Comprehensive Planning for Healthy Eating and Active Living in Wisconsin

By

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DATA, CODE, AND MATERIALS AVAILABILITY STATEMENT

All data collected for the research presented in this dissertation, materials used for data collection, and code used for analysis are openly available at the following links:

- Chapters 2, 3, and 5 (analysis of comprehensive plans): https://osf.io/h48qk/
- Chapter 4 (scoping review): https://osf.io/m3k5p/

ABSTRACT

Healthy eating and active living (HEAL) are key targets for public health. However, most U.S. adults and children do not eat a healthy diet or get enough physical activity. New systems models of HEAL are bringing to light the need to address systems-wide drivers of HEAL behaviors. Comprehensive plans may be particularly suited to meet this challenge.

Using the Healthy Living and Active Design Scorecard, I evaluated a stratified sample of 116 municipal comprehensive plans from Wisconsin for goals, objectives, and policies related to HEAL. I found that municipalities plan for HEAL to a moderate degree, with the highest scores for parks & recreation and health care access and the lowest scores for healthy food access and an explicit health-focused vision and strategy. However, even in high-scoring areas, goals and objectives often lack specific, actionable recommendations.

Using regression analyses, I found that the year the comprehensive plan was adopted, the primary plan author being a consultant, municipal-level Democratic voting percentage, and having housing and transit identified as a local health priority are consistently associated with better incorporation of HEAL-related components. Using Welch t-tests, I also found that when an item in the Scorecard is mandated by state statute, it is more likely to be included in local plans.

I conducted a scoping review to identify interconnections between planning for HEAL and the UN's Sustainable Development Goals (SDGs). I found interconnections between planning for HEAL and all 17 SDGs. I then used multivariate regression analyses to investigate the relationship between comprehensive planning for HEAL and local-level indicators for six SDG targets. I found that higher planning for HEAL scores are associated with greater walkability (target 11.2), park accessibility (target 11.7), and food accessibility (target 2.1), and lower bicycle and pedestrian danger (target 3.6).

My results show that there is room for progress in planning for HEAL in Wisconsin. Such progress could be facilitated by stronger state-level policies, the use of consultants, and greater collaboration between planning and public health. Comprehensive planning for HEAL shows promise as a *localized synergy driver*, or a concrete, local-level initiative to drive progress on the SDGs.

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Chapter 1: Background information

1.1 Healthy eating and active living: key targets for public health

1.1.1 What are healthy eating and active living?

Healthy eating and active living, commonly referred to as "HEAL," are two of the main factors that form the basis of good health. A healthy diet is rich in vegetables, fruits, legumes, whole grains, nuts and seeds, lean meat and poultry, seafood, unsaturated vegetable oils, and low- or non-fat dairy and limited red and processed meats, sugar-sweetened foods and beverages, and refined grains (USDA, 2020; Willett et al., 2019). The U.S. Departments of Health and Human Services and Agriculture recommend that Americans one year and older consume 2 ½ cups of vegetables, two cups of fruit, six ounces of grains (at least three of them whole grains), three cups of dairy (or fortified soy alternatives), five ounces of protein, and 27 grams of oil per day and limit intake of sugar, sodium, and saturated fat (USDA & USDHHS, 2020).

Physical activity is "any bodily movement produced by skeletal muscle that requires energy expenditure" and can include movement from exercise, sports, recreation, transportation, work, or domestic duties (WHO, 2018, p. 14). The U.S. Department of Health and Human Services and the World Health Organization (WHO) recommend that adults get at least 150 minutes of moderate-to-vigorous physical activity per week and do muscle-strengthening activities twice per week (USDHHS, 2018b; WHO, 2018). Children and adolescents need more physical activity: 60 minutes per day of moderate-to-vigorous physical activity, muscle-strengthening at least three days per week, and bone-strengthening at least three days per week (USDHHS, 2018b; WHO, 2018).

1.1.2 Health impacts of HEAL

Achieving a healthy diet and adequate levels of physical activity have been identified by the WHO as primary objectives in preventing noncommunicable diseases (NCDs), which are the leading cause of death and disability in the United States and worldwide (Kochanek, 2024; O'Toole et al., 2022; WHO, 2013, 2021) (Figure 1.1). HEAL—both separately and in tandem—have been linked to lower risk of heart disease, stroke, type 2 diabetes, dementia, and many types of cancer (Cuenca-García et al., 2014; Elliot & Hamlin, 2018; USDA, 2020; USDHHS, 2018a; WHO, 2004).

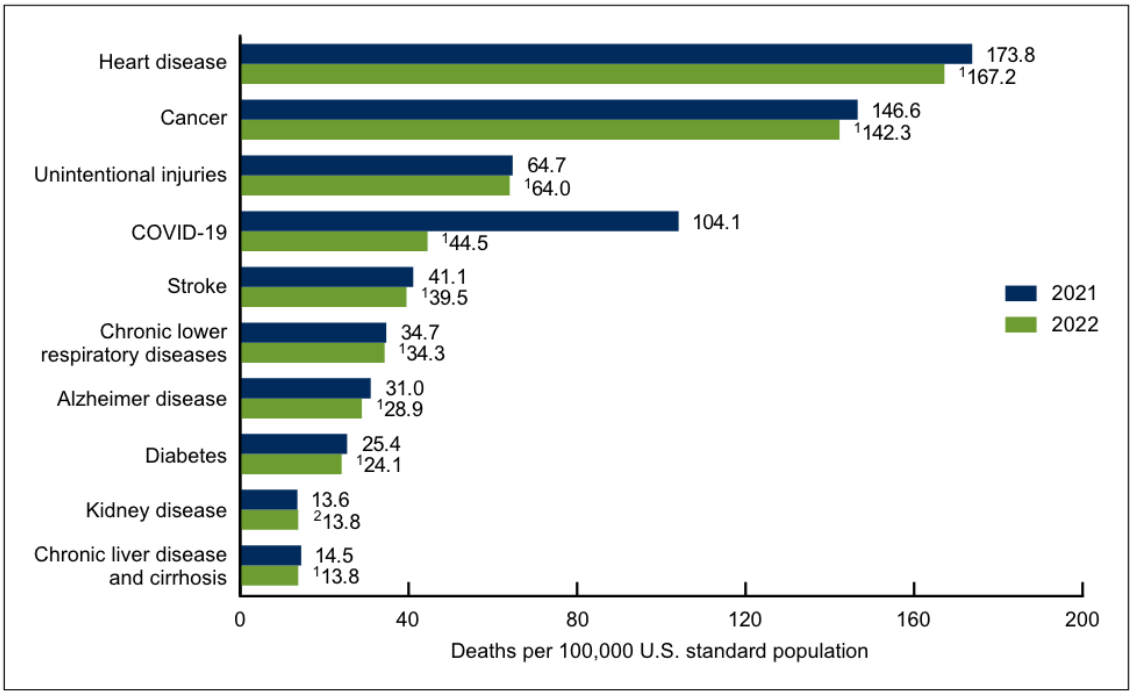

Figure 1.1: Age-adjusted death rate for ten leading causes of death in the United States in 2022 and 2021. Source: (Kochanek, 2024, public domain).

[1] Statistically significant decrease from 2021 to 2022 ($p<0.05$)
[2] Statistically significant increase from 2021 to 2022 ($p<0.05$)
NOTES: A total of 3,279,857 resident deaths were registered in the United States in 2022. The 10 leading causes of death accounted for 72.3% of all U.S. deaths in 2022. Causes of death are ranked according to number of deaths. Rankings for 2021 data are not shown. Data table for Figure 4 includes the number of deaths for leading causes and the percentage of total deaths. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db492-tables.pdf#4. SOURCE: National Center for Health Statistics, National Vital Statistics System, mortality data file.

There are also well-established relationships between physical activity and reduced risk of depression and anxiety as well as alleviation of depression and anxiety symptoms, improved cognitive function, better sleep quality, strong bone development in children, and maintaining independence longer and preventing falls in older adults (USDHHS, 2018a). There is good evidence that a healthy diet promotes bone health (USDA, 2020), with emerging evidence linking healthy dietary patterns to lower risk of depression and anxiety, improved overall mental health throughout the lifespan, improved cognitive performance, and better sleep quality (Collins et al., 2022; Godos et al., 2021; Khalid et al., 2016; Klimova et al., 2020; Li et al., 2017). HEAL also protects individuals from infectious diseases, including COVID-19 (Chastin et al., 2021; R. Sallis et al., 2021; Solomons, 2007).

Physical activity and nutrition are so essential to the health of individuals and communities, they have been identified by the United Nations as basic human rights that should be upheld by all governments (UNESCO, 2015; United Nations Office of the High Commissioner for Human Rights, 2010).

1.1.3 Low levels of HEAL mean high health burden

The vast majority of the world—and the U.S.—population does not meet guidelines for HEAL. Globally, consumption of fruits and vegetables is 48% lower and consumption of whole grains is 61% lower than recommended while consumption of red and processed meat is 377% higher than recommended (Development Initiatives, 2021; Willett et al., 2019). In 2013-2016, 90% of the U.S. population did not meet recommendations for overall vegetable intake, 80% did not meet recommendations for overall fruit intake, and 98% did not meet recommendations for whole grain intake (USDA & USDHHS, 2020). Meanwhile, about one-third of U.S. children ages one to five years old eat fruit less than once per day, one-half eat vegetables less than once

per day, and almost 60% drink sugar-sweetened beverages at least once per week (Hamner et al., 2023). In order to achieve healthier diets, most Americans—and indeed, most of global population—need to eat more quantity and variety of vegetables; more fruits; fewer refined grains and more whole grains; more protein from nuts, seeds, legumes, soy products, and seafood; and fewer processed and red meats, poultry, and eggs (USDA & USDHHS, 2020; Willett et al., 2019).

These unhealthy dietary patterns lead to malnutrition, including underweight, overweight, and nutrient deficiencies, often in the same populations (Swinburn et al., 2019). Globally, over 450 million people (8-9%) are underweight while 2.2 billion (40%) are overweight, with about 772 million having obesity (Development Initiatives, 2021). Meanwhile, 22% of children have stunting (low height-for-age), 7% of children have wasting (low weight-for-age), 15% of newborns are underweight, and 30% of women and girls are anemic (Development Initiatives, 2021). It is estimated that about 20% of premature mortality, or 11-12 million deaths per year, could be avoided if everyone on the planet was able to eat a healthy diet, and this percentage is even higher in high-income countries (Development Initiatives, 2021; Willett et al., 2019)

Globally, about 28% of adults do not achieve adequate physical activity levels, with 36.8% of people in high-income countries and 16.2% of people in low-income countries not meeting recommendations (WHO, 2022). In total, this amounts to about 1.4 billion people who are not physically active enough for their health (WHO, 2022). The situation is even worse in the United States, with over three-quarters of all adults and children failing to meet recommendations for physical activity (Elgaddal et al., 2022; Physical Activity Alliance, 2022). It is estimated that 7-8% of deaths globally and in the United States can be attributed to physical inactivity (Carlson, 2018; Katzmarzyk et al., 2022). If global physical inactivity levels remain

high, it could result in about 500 million new cases of NCDs from 2020-2030, with a direct health care cost of over U.S. $300 billion (Santos et al., 2023). Even small increases in physical activity levels can have large consequences for health across populations. A recent study showed that increases of just ten minutes of physical activity per day could prevent over 100,000 deaths per year in the United States (Saint-Maurice et al., 2022).

1.2 Models for understanding HEAL behavior

1.2.1 Socioecological models and the social determinants of HEAL

Early interventions to increase HEAL behaviors were based on conceptual frameworks that emphasized individual and interpersonal factors (e.g. individual knowledge, awareness, and motivation; social pressure) driving decisions to be active and eat healthfully, such as the Knowledge-Attitude-Behavior Model, Health Belief Model, Theory of Planned Behavior, Social Cognitive Theory, and Transtheoretical Model (Baranowski et al., 2003). However, these models and interventions had limited success in shifting population-levels of HEAL (Egger & Swinburn, 1997; J. F. Sallis et al., 2006).

This is probably because HEAL behaviors are not only the result of individual and social factors, but also factors at the institutional, community, policy, and society level. For example, even if someone knows that they should eat vegetables every day and has the motivation to do so, there might not be anywhere they can buy fresh vegetables at an affordable price in their neighborhood. Similarly, someone might know that they and their kids should be active and want to go play with them in a park, but there might not be a safe, inviting place for them to do so in their neighborhood. These are just two examples of barriers in the neighborhood environment to

HEAL, but broader economic and societal forces have also forced HEAL behaviors out of the everyday lives of most people in developed countries (Swinburn et al., 2019).

The public health field has developed several models to better understand and intervene on the broader determinants of HEAL. First, the socioecological models of HEAL were developed to show the multilevel influences on individual choices to be active and eat a healthy diet (J. F. Sallis et al., 2006; Story et al., 2008) (Figure 1.2 and Figure 1.3). These socioecological models make it clear that many factors at the individual/intrapersonal, social/interpersonal, community/environmental, and societal/policy levels interact to produce HEAL behaviors (or lack thereof).

The socioecological models of HEAL helped shift some of the focus of HEAL researchers to the social determinants of HEAL and of health more broadly. The social determinants of health include the conditions in which people live, work, play, grow, and age on a daily basis as well as the policies, systems, and environments that determine those conditions (Marmot et al., 2008; Payne et al., 2015). They are represented by the institutional/community/settings and society/policy levels of the socioecological model. Interventions at these levels have the potential to create change for whole communities, regions, or even nations of people at once, so that even small individual-level changes scale up to large population-level differences in HEAL behaviors and health outcomes. Examples of interventions at these levels include changes to school lunch programs or recess requirements, building new parks or community gardens in neighborhoods that lack them, creating workplace wellness programs, and changing state or federal policies for agricultural subsidies or transportation funding.

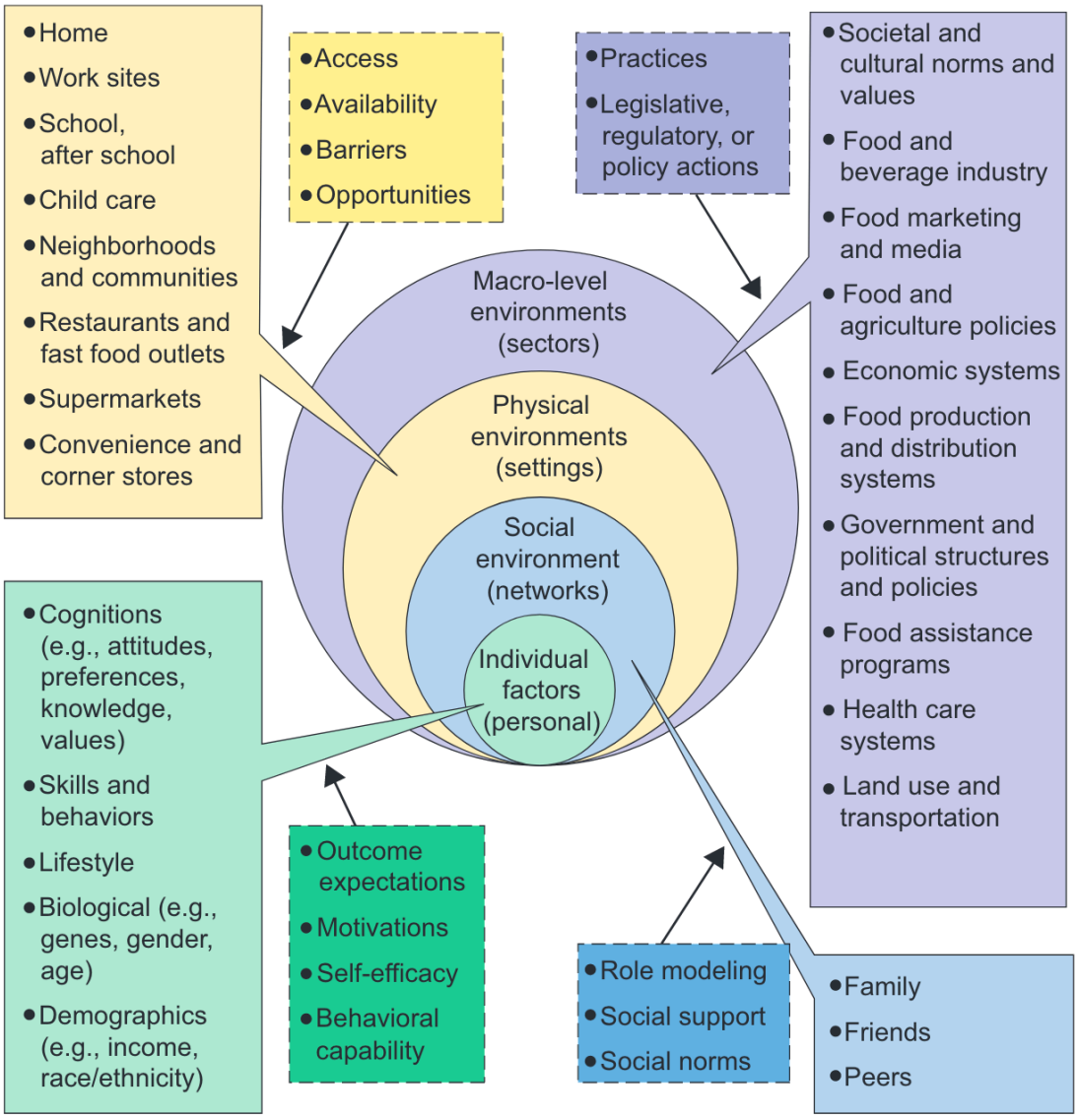

Figure 1.2: Socioecological model of healthy eating. Source: (Story et al., 2008, reproduced with permission)

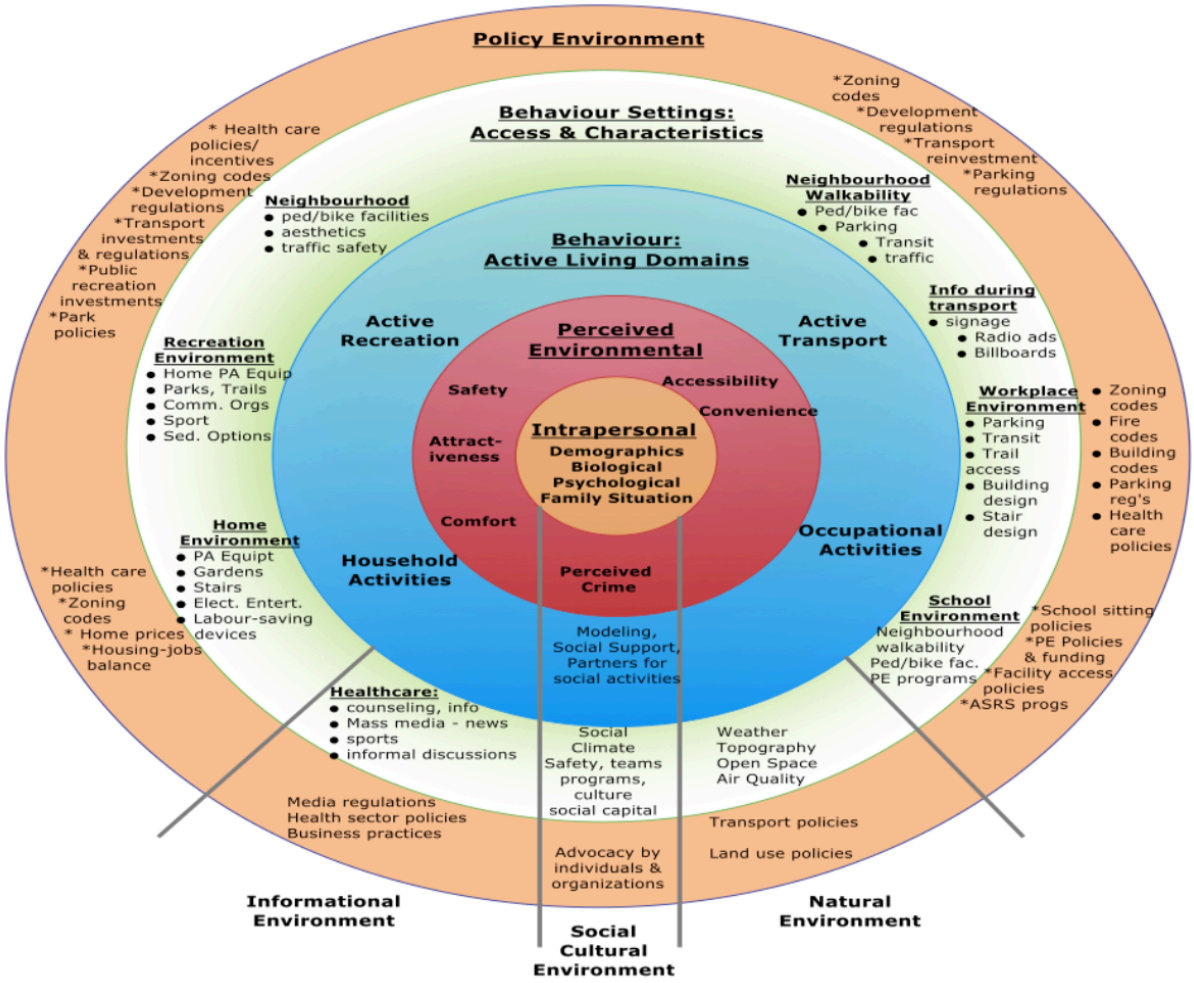

Figure 1.3: Socioecological model of active living. Source: (Christensen, 2019, adapted from Sallis et al., 2006, reproduced with permission)

1.2.2 Systems models of HEAL

More recently, systems thinking approaches have been used to explain how physical inactivity and poor diets are the results of complex and interconnected forces within our societies (Cavill et al., 2020; Friel et al., 2017; Lee et al., 2017; Rutter et al., 2019; Swinburn et al., 2019). Examples of systems models of HEAL can be seen in Figure 1.4 and Figure 1.5. Systems approaches view problems through the lens of interconnected sets of dynamically related elements, that often include reinforcing feedback loops. Importantly for research on HEAL behaviors, and indeed

planning for HEAL as a sub-domain, systems models emphasize studying the entire system rather pieces in isolation.

When applied to problems such as physical inactivity and unhealthy diets, systems models may be more helpful than socioecological models because they make clear the complex and multisectoral nature of the problem and make interactions across levels and elements of the socioecological model more explicit (Cavill et al., 2020; Friel et al., 2017; Rutter et al., 2019). Furthermore, while socioecological models show the multiple levels of influence that may facilitate (or hinder) HEAL, they still place the individual at the center of the model. Therefore, individual and lifestyle factors are still (at least visually) emphasized. This may interfere with seeing HEAL as a population- or community-wide problem with systems-level solutions rather than an individual problem with individual-level solutions (Pineo, 2022a). In other words, while the socioecological model may be helpful in understanding the many reasons an individual participates (or does not participate) in HEAL behaviors, system models may be more helpful in understanding why entire populations do not or cannot eat healthfully or get enough physical activity (Swinburn et al., 2019). Lastly, systems models provide helpful visual tools for expanding the definition of a problem; showcasing the variety of sectors and actors needed to address it; and identifying key areas for intervention (Rutter et al., 2019).

1.2.3 Beyond systems models

Most systems models, however, seek to understand one problem via the interconnected, dynamic elements that drive it. In reality, those systems are often the very same ones that drive other important health and non-health problems. Therefore, some scholars have started to use systems approaches to model the shared, systems-wide drivers of large, entrenched, global issues.

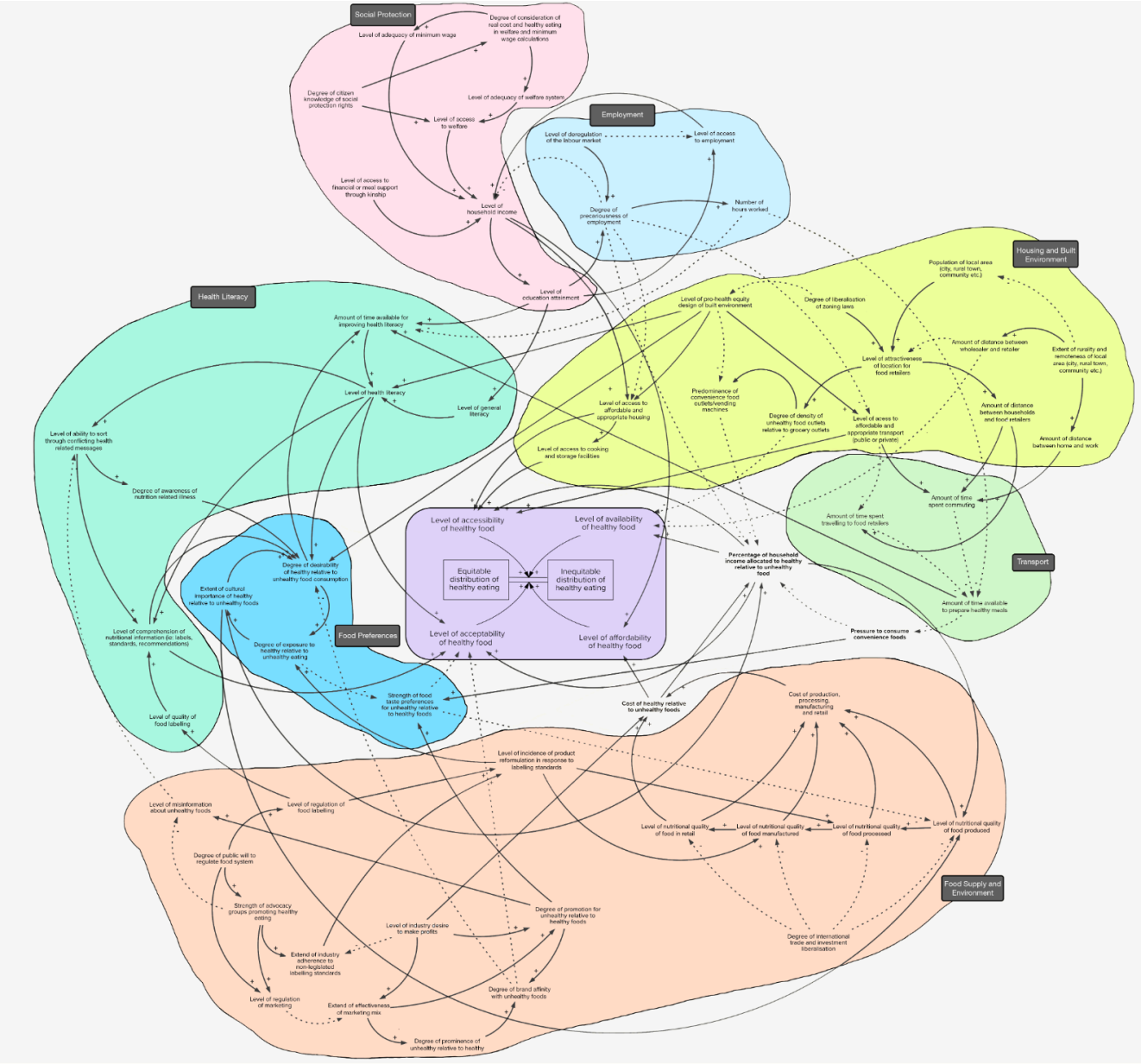

Figure 1.4: A systems model of inequities in healthy eating. Source: (Friel et al., 2017, reproduced under terms of CC BY 4.0 DEED license)

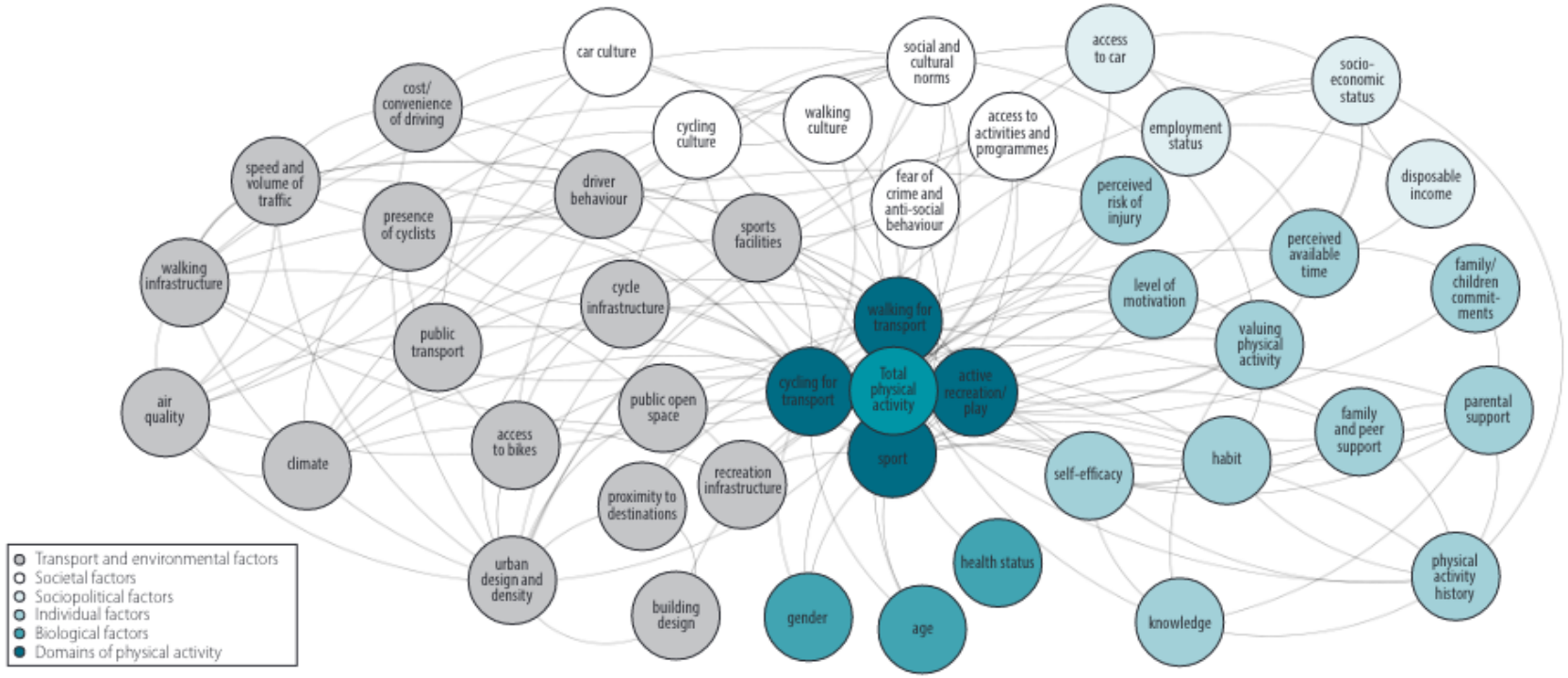

Figure 1.5: A systems model of physical activity. Source: (Rutter et al., 2019, reproduced under terms of CC BY-NC-SA 3.0 IGO DEED license)

For example, The Lancet Commission on Obesity modeled and discussed the shared drivers of global obesity, undernutrition, and climate change, labeling these interconnected and thorny issues “The Global Syndemic” (Swinburn et al., 2019) (Figure 1.6). Macmillan et al. used a systems model to show the interconnections between active transportation and the United Nation’s Sustainable Development Goals (2020) (Figure 1.7). Even more sweepingly, Pineo used both the concentric circles of the socioecological model

and the dynamic and interconnected elements of systems modeling, along with considerations from ecosocial epidemiology and "just sustainabilities," to produce the overarching THRIVES model of healthy urbanism (2022a).

These types of models are incredibly important in a world that faces a seemingly unending array of deeply entrenched, difficult-to-solve, "wicked" problems (Rittel & Webber, 1973). They show not only how one problem arises from an interconnected system of dynamically-linked elements, but how multiple important problems arise from these same systems. These new types of systems models have the potential to focus attention on the scale and urgency of combined challenges and highlight the need for common solutions or, at least, solutions that produce co-benefits across sets of problems (Swinburn et al., 2019). In this way, they can join up the actions of diverse sectors and actors who have varying (yet related) focus areas (e.g. NCDs, food insecurity, climate change). Moreover, from a scientific perspective, these models are probably more realistic about the way that problems exist in the world and in peoples' lives—not in isolation, but interconnected.

The research in this dissertation is influenced by socioecological models and systems models of HEAL, and in particular by shared-issue systems models. Planning for HEAL addresses shared drivers of many of the "wicked" challenges that we currently face, foremost among them malnutrition and climate change (e.g. see "Macro Systems" in Figure 1.6, pane B). It is with this in mind that I have studied the state of planning for HEAL in Wisconsin, its connection to broader global development challenges, and its impact on community-level indicators in Wisconsin.

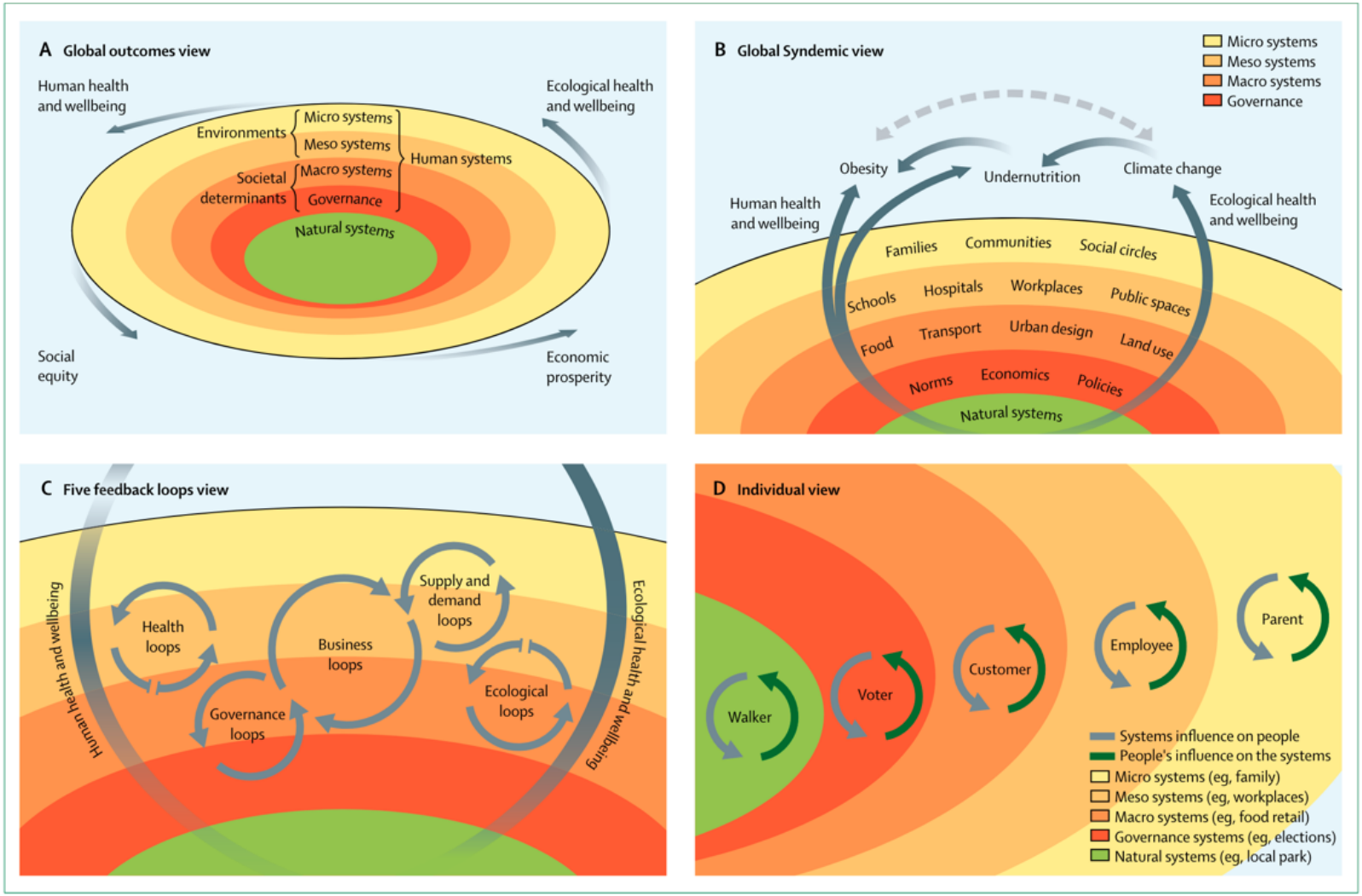

Figure 1.6: Systems model of "The Global Syndemic" of obesity, undernutrition, and climate change. Source: (Swinburn et al., 2019, reproduced with permission)

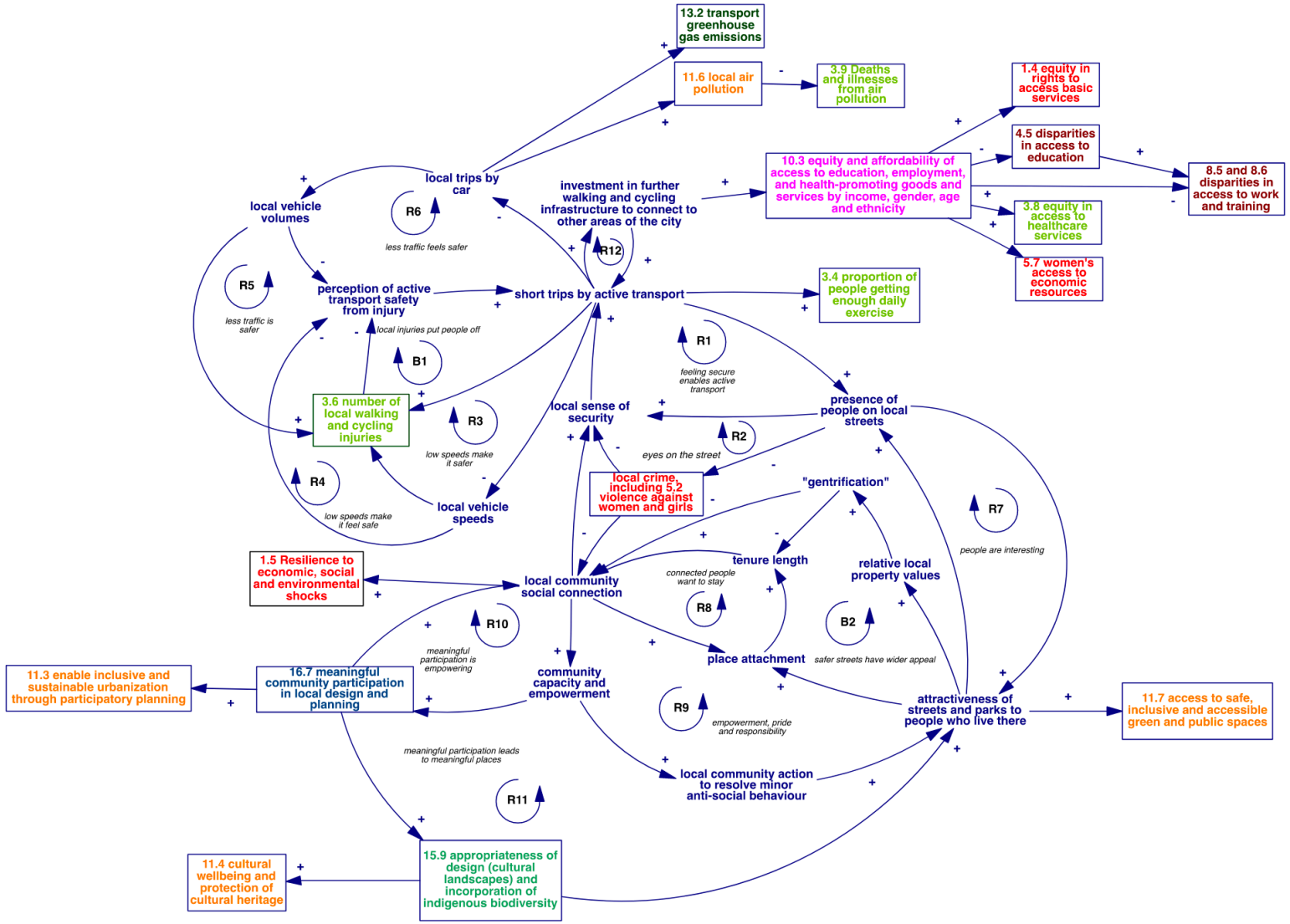

Figure 1.7: A systems model of active transportation, including interconnections to Sustainable Development Goal targets. Source: (Macmillan et al., 2020, reproduced with permission)

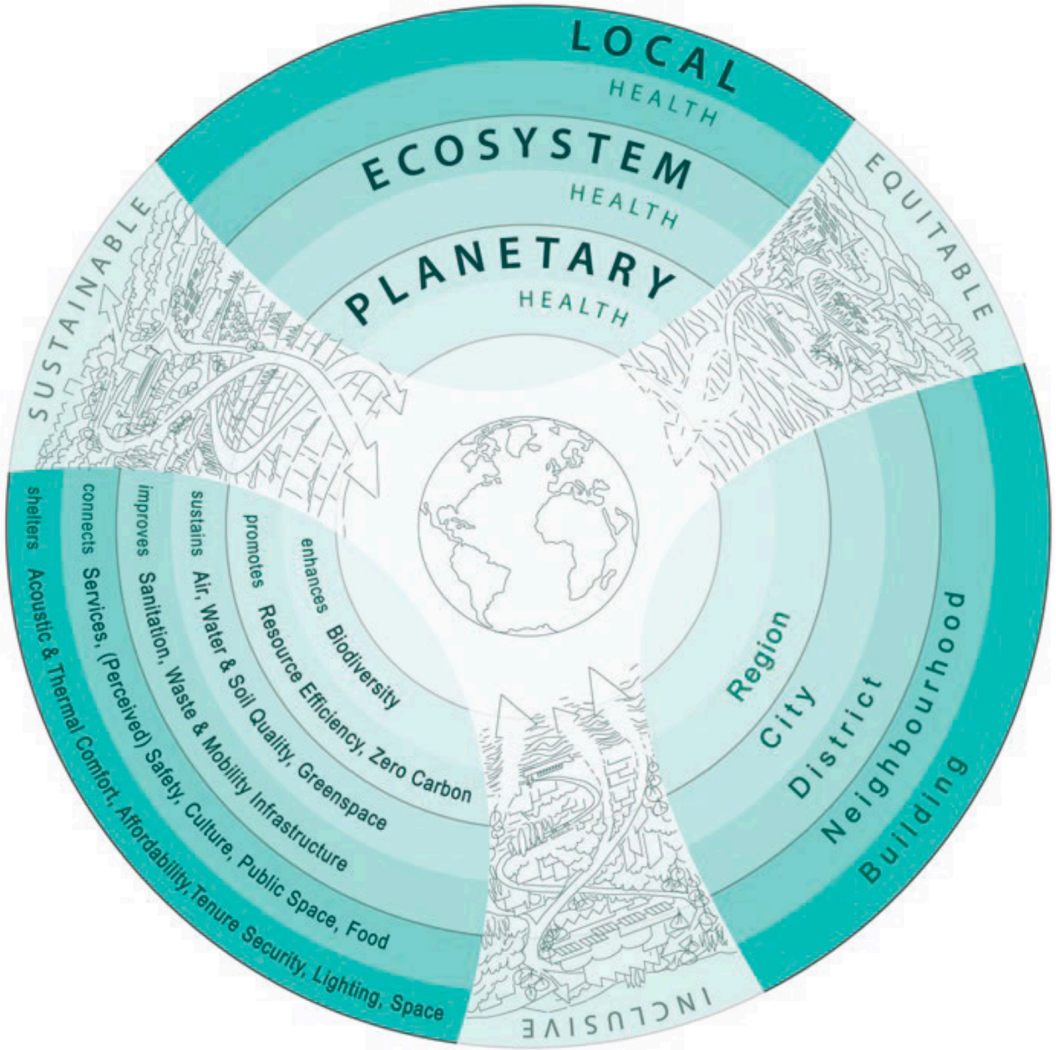

Figure 1.8: THRIVE model of healthy urbanism. Source: (Pineo, 2022b, reproduced under terms of CC BY license)

1.3 HEAL AND THE BUILT ENVIRONMENT

One layer or element that features strongly in each of these models of HEAL behavior is the built and natural environment where people live, work, and play. The link between the built environment and physical activity—including leisure time, transportation, and overall physical activity as well as specific behaviors like walking and biking—is now well established in the epidemiological literature. Recent systematic reviews of this literature find consistently positive associations between physical activity and mixed land uses, infrastructure for walking and biking, residential and destination density, park and recreation resources, pedestrian-oriented streetscape design, street connectivity, and availability of public transportation (Barnett et al., 2017; Christian et al., 2011; Guide to Community Preventive Services, 2016; Kärmeniemi et al., 2018; Smith et al., 2017; Stankov et al., 2020; Stearns et al., 2023; Tcymbal et al., 2020).

The evidence linking the built environment and healthy eating is more mixed, potentially because of the large variety of study designs, measures, and outcomes used; the need for more rigorous studies; and because the body of literature is relatively newer than that linking the built environment and active living (Audate et al., 2019; Bowen et al., 2015; Burt et al., 2021; Caspi et al., 2012; Garcia et al., 2018; Hume et al., 2022; MacMillan et al., 2018; Rahmanian et al., 2014; Woodruff et al., 2018). However, there is some evidence for a link between a healthy diet and the accessibility of farmers' markets, community gardens, and other urban agriculture; supermarkets; and healthy food retail options; as well as a low concentration of convenience stores and fast food outlets (Audate et al., 2019; Bowen et al., 2015; Burt et al., 2021; Garcia et al., 2018; Hume et al., 2022; Rahmanian et al., 2014; Woodruff et al., 2018). In addition, a recent review of qualitative research found that overall walkability of the neighborhood, neighborhood

safety near food stores, and transportation options to food stores might be determinants of a healthy diet (Pitt et al., 2017).

Many early built environment and HEAL studies focused on singular aspects of the built environment—how access to parks or grocery stores, sidewalk infrastructure, or population density, for instance, is associated with HEAL behaviors. More recent research has shown that there is stronger evidence for an association between *composite indices* of the built environment and HEAL behaviors (Casey et al., 2014; Mackenbach et al., 2014; McCormack & Shiell, 2011; J. F. Sallis et al., 2020; Xu et al., 2017). This evidence supports holistic conceptualizations and research about the linkages between the built environment and HEAL, such as the use of the systems models described in the previous section.

All of this mounting evidence is reflected experts' and organizations' calls for built environment approaches to promote HEAL. In the United States, the Institute of Medicine, Centers for Disease Control and Prevention, American Heart Association, and the Community Preventative Services Task Force have all called for land use, urban design, transportation, parks and recreation, and healthy food environment interventions (CDC DNPAO, 2014; Guide to Community Preventive Services, 2016; Institute of Medicine, 2012; Pearson Thomas A. et al., 2013; Schmid et al., 2021). Meanwhile, creating active, healthy communities feature as primary strategies in the WHO's Global Action Plan on the Prevention and Control of Noncommunicable Diseases and Global Action Plan on Physical Activity (WHO, 2013, 2018).

1.3.1 Some co-benefits of built environment approaches to promoting HEAL

In the same vein as the systems models of multiple issues (discussed in section 1.2.3), many HEAL researchers have studied the co-benefits of built environment approaches to promoting HEAL in the last 15 years. Co-benefits research highlights that several (or many) positive

outcomes along multiple dimensions can be achieved through a single policy (Dreyfus, 2015). Like systems models that highlight the shared drivers of multiple issues, co-benefits can make research more relevant to policymakers and stakeholders. Acknowledging the many non-health benefits of built environment approaches to HEAL can make the case to policymakers with many competing priorities, bring together stakeholders with diverse interests, and make efficient use of ever-sparse local resources by tackling several issues with one solution (Giles-Corti et al., 2010; Lawrence, 2022; Mayrhofer & Gupta, 2016; Oliveira et al., 2015). While a systems model of shared drivers may seem too conceptual and abstract at times, discussion of co-benefits can help build a less reductive, more systems-oriented view of HEAL based on concrete examples (Oliveira et al., 2015).

Most co-benefits studies have focused on how promoting HEAL through urban governance and design can mitigate climate change and promote environmental sustainability (or vice versa: how policies to mitigate climate change and promote environmental sustainability can promote HEAL). These studies generally emphasize two pathways through which climate change mitigation and planning for HEAL produce synchronous benefits. Firstly, planning for active transportation is framed as both a public health and an environmental sustainability intervention. When travel mode shifts from private motor vehicles to biking, walking, or public transit—even for short trips—there is a reduction in air pollution and greenhouse gas emissions (Brand et al., 2021; Chang et al., 2017; M. L. Grabow et al., 2012). For example, one modeling study found that switching 50% of short car trips in midwestern urban areas to bicycling or walking could avoid more than 3.9 billion pounds of carbon dioxide emissions and reduce annual PM2.5 concentrations by 1-2% (M. L. Grabow et al., 2012).

Secondly, healthier diets—especially those with fewer animal products and more plant-based foods—have been shown to be more environmentally sustainable, producing fewer greenhouse gas emissions; using less land, water, and energy; and potentially preventing biodiversity loss and waterway eutrophication (Chang et al., 2017; Fresán & Sabaté, 2019; Willett et al., 2019). According to one review of comparative studies, vegetarian diets produce about 35% fewer greenhouse gases and use about 42% less land than standard, Western, omnivorous diets, with even greater reductions for vegan diets (Fresán & Sabaté, 2019). These studies highlight that the global food system is one of the largest contributors to global environmental change, accounting for about one-third of global greenhouse gas emissions, and, at the same time, fails to provide healthy diets for over three billion people (Development Initiatives, 2021, 2022; Swinburn et al., 2019; Willett et al., 2019).

While the environmental co-benefits of active transportation and healthy diets are the most well-researched, others have been noted as well. For example, building parks, recreation spaces, and urban agriculture infrastructure can protect and promote urban biodiversity, help absorb stormwater runoff during large rainstorms, and cool the environment, thus leading to less need for air conditioning in nearby buildings (Artmann & Sartison, 2018; Ferreira et al., 2018; Konijnendijk et al., 2013; Nowak & Heisler, 2010; US EPA, 2017). Building active, connected communities and strong local food systems can also make communities more resilient to shocks, such as those from extreme weather-related disasters or pandemics. Local food systems—and the social connections and partnerships that they entail—can more easily provide food security for local residents than food that arrives via a long, complex, and dispersed supply chain, as was documented during the early stages of the COVID-19 pandemic (Blay-Palmer et al., 2021; Ferreira et al., 2018; Zerbian et al., 2022). Meanwhile, when infrastructure is disturbed due to a

disaster, accessibility may be more easily maintained in compact, connected communities than in ones where destinations are far apart and require more miles of roadway. Furthermore, biking and walking may remain viable options for transportation even when infrastructure for driving is non-functional (Macmillan et al., 2020).

Social and economic benefits accrue in communities where the streets, parks, and public spaces are activated, with people out and about walking, biking, recreating, exercising, and growing food. These neighborhoods have higher levels of social trust and cohesion, increased participation in local governance, greater connection to place and longer tenancies of residents, and better support for local businesses (Credit & Mack, 2019; Ilieva et al., 2022; Macmillan et al., 2020; Said et al., 2020; Stroope, 2021; Zhu et al., 2014). Lastly, active communities can increase perceived and actual safety from both crime and traffic (Elvik & Bjørnskau, 2017; Foster et al., 2010; Macmillan et al., 2020; Webb Jamme et al., 2018).

In addition, building an environment in which driving is a choice rather than a necessity (i.e. where shops, services, and amenities—including food—are accessible via other transport modes) can free up household income that would otherwise need to be spent on a private automobile (Makarewicz et al., 2020). This also has equity ramifications. When designed with consideration and access for diverse users, such a community environment can allow those who cannot afford an automobile or cannot drive for another reason (e.g. cognitive decline, low vision, mobility impairment) greater independence, mobility, and access (Kerr et al., 2012; Levine & Karner, 2023; Macmillan et al., 2020; Sustainable Mobility for All, 2017).

1.3.2 Built environment policies to promote HEAL

A variety of local urban planning policies (e.g. zoning codes, unified development codes, subdivision codes) govern the development of the built environment, all with the potential to

facilitate or create barriers to HEAL. Therefore, there have been many calls to connect the fields of urban and regional planning and public health (Giles-Corti et al., 2016; Swinburn et al., 2019). Several approaches have been developed to facilitate coherence between urban and regional planning policies and public health aims.

The Health in All Policies approach, which includes a framework for governments to institutionalize health into all non-health policies, has gained popularity among local governments since it was formally introduced to the United States in 2010 (ASTHO, 2013; Ware & Kerner, 2021). Another approach is the Health Impact Assessment, which follows the example of and expands upon Environmental Impact Assessments. In 2019, the Health Impact Project reported that over 400 Health Impact Assessments had been conducted across the United States, the vast majority of which focused on planning and zoning, housing, or transportation decisions as they relate to HEAL and related chronic diseases (Health Impact Project, 2019). Lastly, much attention has been paid to the potential for comprehensive plans to promote health in a holistic and connected way (Ricklin et al., 2012; Ricklin & Kushner, 2012; Rouse & Piro, 2022; Shah & Wong, 2020).

1.4 Comprehensive Plans: A Potentially Powerful Lever for Building HEAL-Friendly Communities

Comprehensive plans have been identified as important documents for promoting HEAL-friendly environments (Charron et al., 2021; Ricklin et al., 2012; Ricklin & Kushner, 2012; Rouse, 2022; Shah & Wong, 2020). While they are not binding ordinances or policies, communities across the United States use comprehensive plans to guide the development of their local built, social, and economic environment (Rouse & Piro, 2022). The American Planning Association (APA) has developed several resources for incorporating health into comprehensive

plans (Ricklin et al., 2012; Ricklin & Kushner, 2012; Shah & Wong, 2020), with a recent toolkit describing comprehensive plans as a "foundational policy document for local governments that set the direction for future planning activities, and thus…important to addressing health and health equity" (Shah & Wong, 2020, p. 4).

1.4.1 What is a comprehensive plan?

A comprehensive plans is a long range, holistic plan for the physical, social, and economic development of a community. Comprehensive plans are written by local planners, hired consultants, volunteer plan commissions, or regional planning bodies and incorporate the input of a variety of stakeholders, including elected officials, residents, local businesses, and advocacy organizations. A variety of factors may influence the content of a comprehensive plan, including jurisdiction type, local social and economic factors, population growth patterns, planning capacity (e.g. number of planners on staff, expertise and skill of planners), resources available for planning, salience of different local issues, community and political awareness and will, type of plan author (e.g. planning consultant vs. municipal planning department), and state planning mandates (P. R. Berke & French, 1994; Brody et al., 2006; Bunnell & Jepson, 2011; Burby & Dalton, 1994; Kim & Tran, 2018; Lyles et al., 2014; Manta Conroy & Berke, 2004; Stevens, 2013; Tang, 2008; Tang et al., 2009).

Comprehensive plans are *holistic* and they integrate both *long- and short-term perspectives*. As holistic policy documents, they bridge siloed departmental purviews and coordinate policies, programs, and projects across organizational divides (Godschalk & Anderson, 2012). Most comprehensive plans cover economic development, housing, transportation, parks and recreation, and land use, among other topics. Comprehensive plans also

integrate long-term goals for a community's well-being with shorter-term policies, programs, and actions to achieve those goals (Godschalk & Anderson, 2012).

Many types or definitions of comprehensive plans have been identified in planning theory, and all have ramifications for how the comprehensive plan is translated into on-the-ground community impacts (e.g. see Baer, 1997). I highlight three of the most common definitions of the comprehensive plan and how they relate to plan implementation and/or impact. Comprehensive plans entail a lengthy *process* through which planners synthesize information, facilitate stakeholder and public engagement activities, and build consensus about community goals; they contain a shared *vision* for the development of a community; and they lay out a *blueprint* of policies, programs, and strategies for achieving that vision; (Godschalk & Anderson, 2012; S. H. Grabow et al., 2001; Norton, 2008; Ricklin & Kushner, 2012).

1.4.1.1 The comprehensive plan as a process

The comprehensive planning process offers an opportunity for community members, planners, government officials, and other stakeholders to communicate; share knowledge, identify concerns, preferences, and interests; advocate for historically marginalized groups; connect broad issues to specific, concrete policies; and identify innovative solutions (Davidoff, 1965; Godschalk et al., 2003; Innes & Booher, 2004; Lane, 2005; Lieske et al., 2009; Mastop & Faludi, 1997). Some level of participatory process is required by state mandate for the development of local comprehensive plans in 41 states (Charron et al., 2023). Planners use a variety of tools to facilitate this process, including charettes, workshops, mediation, "what if" scenarios, visualizations, opinion surveys, and online games (Godschalk & Anderson, 2012; S. H. Grabow et al., 2001; Iwaniec & Wiek, 2014; Lieske et al., 2009; Poplin, 2012). Ideally, this process leads to shared knowledge and meaning; resolution of conflicts and consensus building; development

of new partnerships, networks, and collaborations; and building of social capital (Godschalk et al., 2003; Healey, 1996; Innes & Booher, 2010; Lane, 2005; Mastop & Faludi, 1997; Ricklin et al., 2012).

Through a good comprehensive planning process, a comprehensive plan can be developed that reflects the concerns of the community, including those who are often overlooked or marginalized (S. H. Grabow et al., 2001; Lane, 2005; Lieske et al., 2009). It also incorporates the full range of local knowledge available in the community, crowdsources fact-finding and correction of errors, and assures the best possibility of developing innovative solutions through incorporation of diverse perspectives (Innes & Booher, 2004). In this way, a high-quality comprehensive planning process can ensure that comprehensive plan content is factually correct, reflects the community, and proposes solutions likely to work; thus improving the likelihood of positive impact.

In addition to elevating the actual content of the comprehensive plan, a good comprehensive planning process also builds community ownership of and support for the comprehensive plan, which can create better political will for its adoption and implementation (S. H. Grabow et al., 2001; Innes & Booher, 2010; Lieske et al., 2009). Lastly, the learning and consensus building aspects of the comprehensive planning process build community empowerment and institutional capacity (Innes & Booher, 2004, 2010). In the words of Innes and Booher, the process works towards creating "an adaptive, self-organizing polity capable of addressing wicked problems in an informed and effective way" (2004, p. 423). In this way, a comprehensive plan can "work before it exists" (or, outside of the implementation of the plan contents) to create community impact, because of the process it entails (Lieske et al., 2009, p. 297).

1.4.1.2 The comprehensive plan as a vision

Comprehensive plans as visions provide a broad idea of what the community wants for the future, without getting into operational details of how to make that vision happen (Baer, 1997; Norton, 2008). The vision should reflect the community's values and concerns, as developed through the comprehensive planning process. It communicates to all layers of government what the community cares about and how it wants to develop.

The comprehensive plan as a vision creates community impact through its influence[1], or its ability to guide decisionmakers' decisions outside the realm of specific actions recommended by the plan (Godschalk & Anderson, 2012; Lyles et al., 2016; Rouse & Piro, 2022). For instance, staff planners and commissions that guide anything from bicycle planning to farmland preservation can refer to the plan to ensure that their decisions are consistent with its findings and recommendations. In addition, the comprehensive plan may be referenced when more specific plans—like redevelopment; transportation; parks and open space; and corridor, neighborhood, or downtown development plans—are developed. These plans can serve as more operational, specific planning guides. It can also guide funding and resource allocation, facilitate alignment across departments and sectors, and communicate community priorities to private developers (Godschalk & Anderson, 2012; Rouse & Piro, 2022).

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[1] I use Lyles et al.'s definition of plan "influence" here (2016). This same concept has been called plan "performance" by other scholars. I find Lyles et al.'s formulation more intuitive: "influence" defined as whether a plan plays a part in local decision making and "performance" defined as plan impacts or outcomes (2016, p. 384).

1.4.1.3 The comprehensive plan as a blueprint

Lastly, comprehensive plans as blueprints determine the specific steps that a jurisdiction will take in order to fulfill its stated development objectives (Connell & Daoust-Filiatrault, 2018; Lyles et al., 2016; Rudolf & Grădinaru, 2019). This may include policies or regulations to be enacted, programs or initiatives to implement, projects to develop, investments, incentives, and further detailed planning and technical analysis (Lyles et al., 2016; Rouse & Piro, 2022).

The plan as a blueprint creates community impact through conformance of the jurisdiction's actions to the specific recommendations in the plan. In 34 out of 50 states, zoning is required to be consistent with a locally adopted comprehensive plan (American Planning Association, 2019) and in many states—including Wisconsin—other built environmental policies must also be consistent (Wis. Stat. § 66.1001). Examples of policies that might be recommended by a plan include Complete Streets policies and impact fee policies. Examples of programs that might be recommended include creating a Farm-to-School program, participating in the national Main Street Program, and encouraging developers and residents to use LEED certification in new buildings, as well as future analyses and planning like parking studies or the development of a Safe Routes to School plan. Examples of projects that a plan might recommend include the expansion of biking trails or the redevelopment of an industrial site.

1.4.1.4 The great potential of the comprehensive plan

The five facets of comprehensive plans discussed above—*holistic, long- and short-ran*ge *processes, visions, and blueprints*—make them potentially powerful tools for addressing unwieldly, systemic issues such as the promotion of HEAL behaviors. Because they are holistic, they can address the many dynamically-linked elements—across land use, transportation, and other domains—that make a community a place where HEAL behaviors are either easy or

difficult. Because they integrate long- and short-range timelines, they can connect long-range goals (e.g. improved community health) and shorter-range outcomes (e.g. increased bicycle mode share). Because they are processes, they can build community capacity and shared understanding, and highlight the interconnections between multiple aims and stakeholder interests (e.g. environmental sustainability, economic development, public health). Because they are visions, they can have powerful communicative and inspirational capabilities about how people want to live. Because they are blueprints, they include practical roadmaps for action that (in many cases) must, by state law, be followed.

1.4.2 Comprehensive plan evaluation

However, there is a gap between the theoretical potential of the comprehensive plan to address systemic issues and what is actually achieved by comprehensive plans in reality. An entire field of comprehensive plan evaluation research exists to explore why. Planning researchers have evaluated comprehensive plans for how they address issues such as hazard mitigation and resilience (P. R. Berke et al., 1996; Brody, 2003; Burby & Dalton, 1994; Fu & Tang, 2013; Stevens, 2013), environmental sustainability and climate change (P. Berke & Conroy, 2000; P. R. Berke et al., 1999; Brody & Highfield, 2005; Kim & Tran, 2018; Manta Conroy & Berke, 2004; Olshansky, 1996; Tang et al., 2009, 2010; Tang & Brody, 2009), smart growth (Brody et al., 2006; Edwards & Haines, 2007; Norton, 2008), and social equity (Loh & Kim, 2021). Such plan quality evaluation provides baseline estimates of planning practice; identifies strengths and weaknesses in planning within specific domains; and aids in the development of planning theory by providing data necessary to analyze factors associated with plan quality, implementation, and outcomes (Lyles & Stevens, 2014). It answers questions about what is contained in

comprehensive plans and why, how comprehensive plans are implemented, and what impact they have on their communities.

1.4.2.1 Evaluation of HEAL in comprehensive plans

Perhaps the first to evaluate the incorporation of HEAL in comprehensive plans was Semra Aytur, as part of her doctoral research at the University of North Carolina-Chapel Hill. Aytur et al. used a 2000-2003 survey of 67 planning directors in North Carolina to determine if county land use plans included several active living components: non-motorized transportation improvements, mixed land use classification, and a suite of implementation tools to guide land development (2007). They found that 37% of plans included provisions for non-motorized transportation infrastructure and 40% had mixed land uses classifications; active living components were more likely in faster-growing metro areas with higher median incomes; and composite indices of active living components were associated with more leisure and transportation physical activity (Aytur et al., 2007, 2008).

In 2010, the APA initiated a multiphase study to identify local-level comprehensive planning responses to health concerns and to explore promising strategies for incorporating health into the comprehensive planning process (Ricklin et al., 2012). This project included a nationwide survey of almost 900 planning departments; a systematic assessment of 18 comprehensive plans and four sustainability plans for health goals, objectives, policies, and recommendations; and seven case studies of planning departments incorporating health into their work (Hodgson, 2011; Ricklin et al., 2012; Ricklin & Kushner, 2012). The survey found that 57% of plans addressed active living, 9% addressed food and nutrition, and 7% addressed NCDs (Hodgson, 2011). In the systematic evaluation of 22 plans (which were limited to plans that were already identified as incorporating health in some way), the APA found that many plans included

active living goals and policies and few included healthy foods goals or policies or discussed an explicit connection between planning and public health (Ricklin et al., 2012).

The APA conducted a similar study focused more specifically on the incorporation of food systems planning in comprehensive and sustainability plans (Hodgson, 2012). This survey found that 9% of comprehensive plans and 18% of sustainability plans contained goals, objectives, or policies explicitly related to the local or regional food system, while 46% of plans addressed farmers' markets, 13% addressed community gardens, and 13% addressed grocery store access (Hodgson, 2012).

In addition, in developing the Healthy Living and Active Design Scorecard for Comprehensive Plans, a research team at Nemours Children's Health System in Delaware used their scorecard to evaluate 42 land use plans and development codes (Maiden et al., 2017). Comprehensive plans in their study had overall comprehensiveness scores of 10-39 (out of 50) and overall strength scores of 13-69 (out of 100), but descriptive statistics for subsections of the scorecard (e.g. active transportation, parks and recreation) were not reported (Maiden et al., 2017).

Most recently, a team at the CDC analyzed data from the nationally-representative Community-Based Policy and Environmental Supports for Healthy Eating and Active Living (CBS HEAL) survey to assess the presence of three activity-promoting components in local comprehensive, land use, transportation, and bicycle/pedestrian plans (Peterson et al., 2018). They found that 37% of plans had Complete Streets polices, 54% had street connectivity objectives, and 67% had mixed land use development objectives, and that having these components in a local plan was associated with more active-living design standards (e.g.

requirements for bicycle/pedestrian infrastructure, short block sizes, traffic calming features) (Peterson et al., 2018, 2019).

Another research project examined the influence of active-living-oriented zoning on physical activity and health outcomes in over 4,000 jurisdictions in 48 states (Chriqui, Leider, et al., 2016). The study found that active-living zoning measures were associated with increased rates of active travel to work and public transportation use (Chriqui, Leider, et al., 2016; Thrun et al., 2016), increased leisure time physical activity (Chriqui, Nicholson, et al., 2016), reduced rates of no leisure time physical activity (Leider et al., 2017), reduced income and poverty disparities in active travel to work and public transportation use (Chriqui et al., 2017; Serrano et al., 2023), and reduced cancer incidence (Nicholson et al., 2017). However, the study found little evidence of a relationship between pedestrian-oriented zoning and body mass index, hyperlipidemia, or hypertension (Zenk et al., 2022). While these researchers did not study comprehensive plans, their works show the potential for built environment policies to impact downstream health behaviors and outcomes.

While several studies have investigated the presence of HEAL-promoting components in comprehensive plans, as well as other plans and built environment policies, the field of research is still underdeveloped. Most of the studies were based on surveys to planning directors or other municipal staff. Therefore, they may be subject to social desirability bias (i.e. respondents report answers they think the researcher wants to see) or simple mistakes. The few studies that used content analysis methods had small sample sizes, did not use random samples (i.e. they selected plans that they knew contained some amount of public health content), were for the purpose of psychometrically testing an assessment tool and thus did not report descriptive or other statistics for their analysis, or they assessed a small number of active-living-promoting components (e.g.

Complete Streets, mixed use development) instead of a comprehensive set of goals, objectives, and policies meant to promote HEAL.

Therefore, there is still much we do not know about a) the extent to which comprehensive plans include goals, objectives, policies, and recommendations likely to promote HEAL; b) municipal- and state-level factors that support the incorporation of HEAL-promotion into comprehensive plans; and c) the health, social, economic, and sustainability impact of incorporating HEAL-promotion into comprehensive plans.

1.5 About this dissertation

This dissertation seeks to advance our understanding of comprehensive planning for HEAL. It consists of four closely-aligned research projects, measuring different components of the conceptual model in Figure 1.9.

The primary data collection was a systematic evaluation of 116 local comprehensive plans in Wisconsin. Chapter 2 contains detailed methods for this data collection project, descriptive statistics about the extent to which Wisconsin municipalities incorporate HEAL into their local comprehensive plans, and an analysis of municipal-level correlates of planning for HEAL (Local-level factors influencing comprehensive plan, purple box, Figure 1.9). Chapter 3 contains an analysis of state-level mandates for Wisconsin municipalities to include HEAL-related items in their local comprehensive plans and whether the presence of such mandates it associated with those items being included in local plans at higher rates (State mandates, purple box, Figure 1.9). Chapter 4 describes results of a scoping review of interconnections between planning for HEAL and the United Nations' 17 Sustainable Development Goals (SDGs). Chapter 5 investigates if planning for HEAL is associated with six different SDG-related outcomes, as identified in Chapter 4 (aspects of green, yellow, and orange boxes, Figure 1.9).

My research questions were as follows:

1. To what extent and with what variation do urban and suburban municipalities in Wisconsin incorporate HEAL-supportive goals, objectives, and strategies in their comprehensive plans?
    a. To what extent and with what variation do the comprehensive plans incorporate goals, objectives, and strategies specific to the domains of Vision & Strategy, Active Transportation, Parks & Recreation, Healthy Food Access, Health Care Access, and Community Design?
    b. What local, contextual factors are associated with incorporating HEAL-supportive goals, objectives, and strategies in comprehensive plans
2. Are HEAL-related items more likely to be included in local comprehensive plans if they are mandated by the Wisconsin state comprehensive planning statute?
3. What conceptual interconnections have been proposed between planning for HEAL and the United Nations' Sustainable Development Goals?
    a. What is the direction for each proposed interconnection (HEAL to SDG or SDG to HEAL)?
    b. What is the type for each proposed interconnection (indivisible, reinforcing, enabling, co-benefits, trade-offs, and/or intertwined considerations)?
4. How can comprehensive planning for HEAL help Wisconsin communities achieve the SDGs?
    a. To what extent, if any, is comprehensive planning for HEAL associated with:
        i. better local-level park accessibility?
        ii. better local-level food accessibility?
        iii. better local-level walkability?
        iv. higher local-level active commuting rates?
        v. lower local-level bicycle and pedestrian danger?
        vi. lower local-level obesity rates?

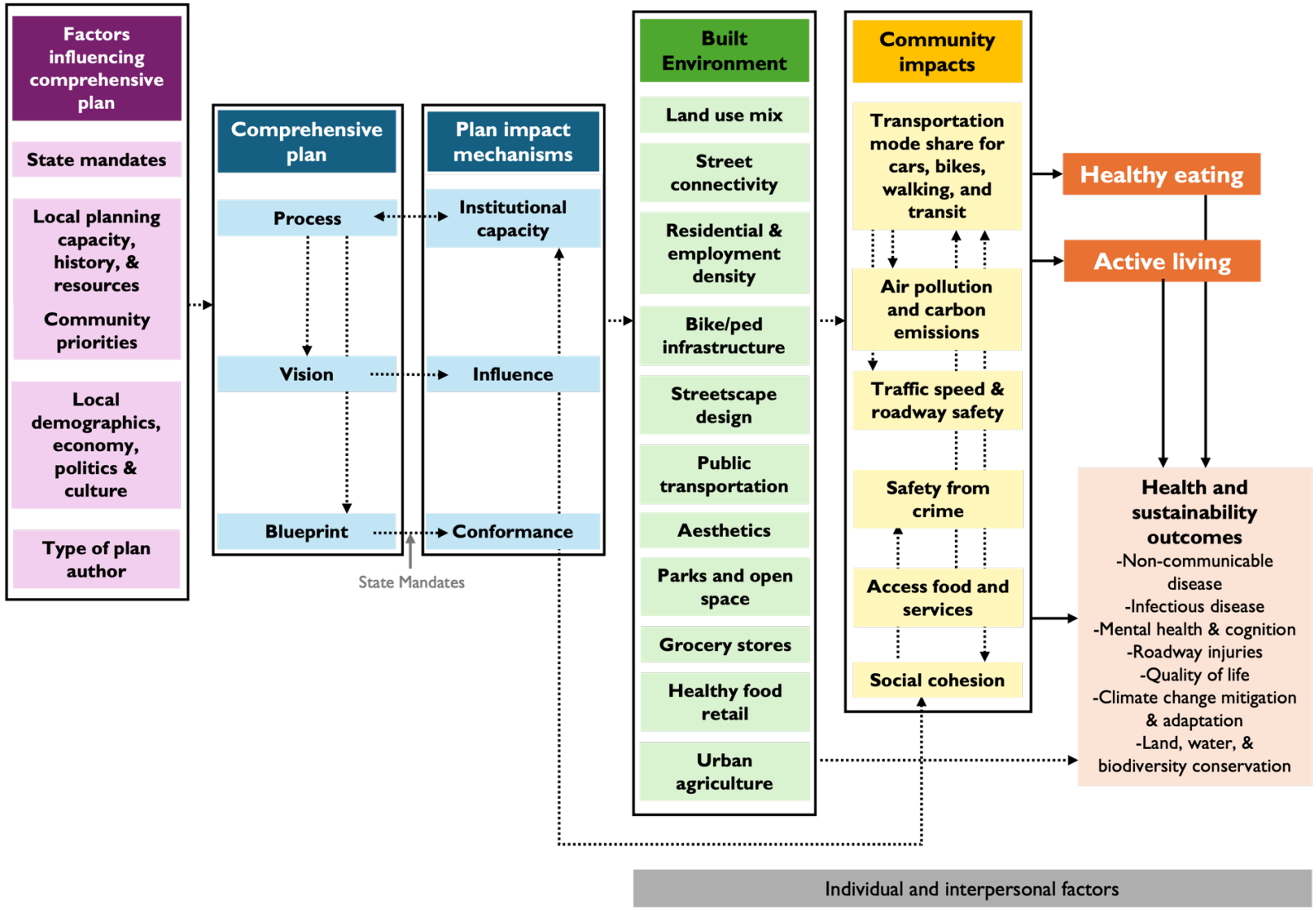

Figure 1.9: Conceptual model of how comprehensive plans come to include HEAL-promoting items and how those items translate to built environment, community, behavioral, and health and sustainability impacts.

1.6 REFERENCES

American Planning Association. (2019). *Survey of State Land Use and Natural Hazard Laws* (p. 26). American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Survey-of-State-Land-Use-and-Natural-Hazards-Planning-Laws.pdf

Artmann, M., & Sartison, K. (2018). The role of urban agriculture as a nature-based solution: A review for developing a systemic assessment framework. *Sustainability*, *10*(6), Article 6. https://doi.org/10.3390/su10061937

ASTHO. (2013). *Health in All Policies: Strategies to Promote Innovative Leadership*. Association of State and Territorial Health Officials. http://www.astho.org/Programs/Prevention/Implementing-the-National-Prevention-Strategy/HiAP-Toolkit/

Audate, P. P., Fernandez, M. A., Cloutier, G., & Lebel, A. (2019). Scoping review of the impacts of urban agriculture on the determinants of health. *BMC Public Health*, *19*(1), 672. https://doi.org/10.1186/s12889-019-6885-z

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2007). Promoting active community environments through land use and transportation planning. *American Journal of Health Promotion*, *21*(4_suppl), 397–407. https://doi.org/10.4278/0890-1171-21.4s.397

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2008). The sociodemographics of land use planning: Relationships to physical activity, accessibility, and equity. *Health & Place*, *14*(3), 367–385. https://doi.org/10.1016/j.healthplace.2007.08.004

Baer, W. C. (1997). General plan evaluation criteria: An approach to making better plans. *Journal of the American Planning Association*, *63*(3), 329–344. https://doi.org/10.1080/01944369708975926

Baranowski, T., Cullen, K. W., Nicklas, T., Thompson, D., & Baranowski, J. (2003). Are current health behavioral change models helpful in guiding prevention of weight gain efforts? *Obesity Research*, *11*(S10), 23S-43S. https://doi.org/10.1038/oby.2003.222

Barnett, D. W., Barnett, A., Nathan, A., Van Cauwenberg, J., Cerin, E., & on behalf of the Council on Environment and Physical Activity (CEPA) – Older Adults working group. (2017). Built environmental correlates of older adults' total physical activity and walking: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 103. https://doi.org/10.1186/s12966-017-0558-z

Berke, P., & Conroy, M. M. (2000). Are we planning for sustainable development? *Journal of the American Planning Association*, *66*(1), 21–33. https://doi.org/10.1080/01944360008976081

Berke, P. R., Crawford, J., Dixon, J., & Ericksen, N. (1999). Do cooperative environmental planning mandates produce good plans? Empirical results from the New Zealand experience.

Environment and Planning B: Planning and Design, *26*(5), 643–664. https://doi.org/10.1068/b260643

Berke, P. R., & French, S. P. (1994). The influence of state planning mandates on local plan quality. *Journal of Planning Education and Research*, *13*(4), 237–250. https://doi.org/10.1177/0739456X9401300401

Berke, P. R., Roenigk, D., J. Kaiser, E., & Burby, R. (1996). Enhancing plan quality: Evaluating the role of state planning mandates for natural hazard mitigation. *Journal of Environmental Planning and Management*, *39*. https://doi.org/10.1080/09640569612688

Blay-Palmer, A., Santini, G., Halliday, J., Malec, R., Carey, J., Keller, L., Ni, J., Taguchi, M., & van Veenhuizen, R. (2021). City region food systems: Building resilience to COVID-19 and other shocks. *Sustainability*, *13*(3), Article 3. https://doi.org/10.3390/su13031325

Bowen, D. J., Barrington, W. E., & Beresford, S. A. A. (2015). Identifying the effects of environmental and policy change interventions on healthy eating. *Annual Review of Public Health*, *36*(1), 289–306. https://doi.org/10.1146/annurev-publhealth-032013-182516

Brand, C., Dons, E., Anaya-Boig, E., Avila-Palencia, I., Clark, A., de Nazelle, A., Gascon, M., Gaupp-Berghausen, M., Gerike, R., Götschi, T., Iacorossi, F., Kahlmeier, S., Laeremans, M., Nieuwenhuijsen, M. J., Pablo Orjuela, J., Racioppi, F., Raser, E., Rojas-Rueda, D., Standaert, A., … Int Panis, L. (2021). The climate change mitigation effects of daily active travel in cities. *Transportation Research Part D: Transport and Environment*, *93*, 102764. https://doi.org/10.1016/j.trd.2021.102764

Brody, S. D. (2003). Are we learning to make better plans?: A longitudinal analysis of plan quality associated with natural hazards. *Journal of Planning Education and Research*, *23*(2), 191–201. https://doi.org/10.1177/0739456X03258635

Brody, S. D., Carrasco, V., & Highfield, W. E. (2006). Measuring the adoption of local sprawl reduction planning policies in Florida. *Journal of Planning Education and Research*, *25*(3), 294–310. https://doi.org/10.1177/0739456X05280546

Brody, S. D., & Highfield, W. E. (2005). Does planning work?: Testing the implementation of local environmental planning in Florida. *Journal of the American Planning Association*, *71*(2), 159–175. https://doi.org/10.1080/01944360508976690

Bunnell, G., & Jepson, E. J. (2011). The effect of mandated planning on plan quality. *Journal of the American Planning Association*, *77*(4), 338–353. https://doi.org/10.1080/01944363.2011.619951

Burby, R. J., & Dalton, L. C. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review*, *54*(3), 229–238. https://doi.org/10.2307/976725

Burt, K. G., Mayer, G., & Paul, R. (2021). A systematic, mixed studies review of the outcomes of community garden participation related to food justice. *Local Environment*, *26*(1), 17–42. https://doi.org/10.1080/13549839.2020.1861589

Carlson, S. A. (2018). Percentage of deaths associated with inadequate physical activity in the United States. *Preventing Chronic Disease*, *15*. https://doi.org/10.5888/pcd18.170354

Casey, R., Oppert, J.-M., Weber, C., Charreire, H., Salze, P., Badariotti, D., Banos, A., Fischler, C., Hernandez, C. G., Chaix, B., & Simon, C. (2014). Determinants of childhood obesity: What can we learn from built environment studies? *Food Quality and Preference*, *31*, 164–172. https://doi.org/10.1016/j.foodqual.2011.06.003

Caspi, C. E., Sorensen, G., Subramanian, S. V., & Kawachi, I. (2012). The local food environment and diet: A systematic review. *Health & Place*, *18*(5), 1172–1187. https://doi.org/10.1016/j.healthplace.2012.05.006

Cavill, N., Richardson, D., Faghy, M., Bussell, C., & Rutter, H. (2020). Using system mapping to help plan and implement city-wide action to promote physical activity. *Journal of Public Health Research*, *9*(3). https://doi.org/10.4081/jphr.2020.1759

CDC DNPAO. (2014). *Healthier Food Retail: An Action Guide for Public Health Practitioners* (p. 160). U.S. Department of Health and Human Services. https://www.cdc.gov/nccdphp/dnpao/state-local-programs/pdf/Healthier-Food-Retail-guide-full.pdf

Chang, K. M., Hess, J. J., Balbus, J. M., Buonocore, J. J., Cleveland, D. A., Grabow, M. L., Neff, R., Saari, R. K., Tessum, C. W., Wilkinson, P., Woodward, A., & Ebi, K. L. (2017). Ancillary health effects of climate mitigation scenarios as drivers of policy uptake: A review of air quality, transportation and diet co-benefits modeling studies. *Environmental Research Letters*, *12*(11), 113001. https://doi.org/10.1088/1748-9326/aa8f7b

Charron, L. M., Milstein, C., Chriqui, J., Abildso, C., & Moyers, S. I. (2023). *PAPREN State Comprehensive Planning Statutes Dataset* [dataset]. OSF. https://doi.org/10.17605/OSF.IO/XFV5C

Charron, L. M., Milstein, C., Moyers, S. I., Abildso, C. G., & Chriqui, J. F. (2021). Do state comprehensive planning statutes address physical activity?: Implications for rural communities. *International Journal of Environmental Research and Public Health*, *18*(22), Article 22. https://doi.org/10.3390/ijerph182212190

Chastin, S. F. M., Abaraogu, U., Bourgois, J. G., Dall, P. M., Darnborough, J., Duncan, E., Dumortier, J., Pavón, D. J., McParland, J., Roberts, N. J., & Hamer, M. (2021). Effects of regular physical activity on the immune system, vaccination and risk of community-acquired infectious disease in the general population: Systematic review and meta-analysis. *Sports Medicine*, *51*(8), 1673–1686. https://doi.org/10.1007/s40279-021-01466-1

Chriqui, J. F., Leider, J., Thrun, E., Nicholson, L. M., & Slater, S. (2016). Communities on the move: Pedestrian-oriented zoning as a facilitator of adult active travel to work in the United States. *Frontiers in Public Health*, *4*. https://doi.org/10.3389/fpubh.2016.00071

Chriqui, J. F., Leider, J., Thrun, E., Nicholson, L. M., & Slater, S. J. (2017). Pedestrian-oriented zoning is associated with reduced income and poverty disparities in adult active travel to work, United States. *Preventive Medicine*, *95*, S126–S133. https://doi.org/10.1016/j.ypmed.2016.10.003

Chriqui, J. F., Nicholson, L. M., Thrun, E., Leider, J., & Slater, S. J. (2016). More active living-oriented county and municipal zoning is associated with increased adult leisure time physical activity—United States, 2011. *Environment and Behavior*, *48*(1), 111–130. https://doi.org/10.1177/0013916515611175

Christensen, A. (2019). *Activity space, perceived neighbourhoods and buffers: Exploring spatial definitions in adolescents* [Doctor of Philosophy, Leeds Beckett University]. https://www.researchgate.net/publication/351096793_Activity_space_perceived_neighbourhoods_and_buffers_exploring_spatial_definitions_in_adolescents

Christian, H., Giles-Corti, B., Knuiman, M., Timperio, A., & Foster, S. (2011). The influence of the built environment, social environment and health behaviors on body mass index. Results from RESIDE. *Preventive Medicine*, *53*(1–2), 57–60. https://doi.org/10.1016/j.ypmed.2011.05.004

Collins, S., Dash, S., Allender, S., Jacka, F., & Hoare, E. (2022). Diet and mental health during emerging adulthood: A systematic review. *Emerging Adulthood*, *10*(3), 645–659. https://doi.org/10.1177/2167696820943028

Connell, D. J., & Daoust-Filiatrault, L.-A. (2018). Better than good: Three dimensions of plan quality. *Journal of Planning Education and Research*, *38*(3), 265–272. https://doi.org/10.1177/0739456X17709501

Credit, K., & Mack, E. (2019). Place-making and performance: The impact of walkable built environments on business performance in Phoenix and Boston. *Environment and Planning B: Urban Analytics and City Science*, *46*(2), 264–285. https://doi.org/10.1177/2399808317710466

Cuenca-García, M., Ortega, F. B., Ruiz, J. R., González-Gross, M., Labayen, I., Jago, R., Martínez-Gómez, D., Dallongeville, J., Bel-Serrat, S., Marcos, A., Manios, Y., Breidenassel, C., Widhalm, K., Gottrand, F., Ferrari, M., Kafatos, A., Molnár, D., Moreno, L. A., De Henauw, S., … HELENA Study Group. (2014). Combined influence of healthy diet and active lifestyle on cardiovascular disease risk factors in adolescents. *Scandinavian Journal of Medicine & Science in Sports*, *24*(3), 553–562. https://doi.org/10.1111/sms.12022

Davidoff, P. (1965). Advocacy and pluralism in planning. *Journal of the American Institute of Planners*, *31*(4).

Development Initiatives. (2021). *2021 Global Nutrition Report: The State of Global Nutrition*. Development Initiatives. https://globalnutritionreport.org/reports/2021-global-nutrition-report/

Development Initiatives. (2022). *2022 Global Nutrition Report: Stronger Commitments for Greater Action*. Development Initiatives. https://globalnutritionreport.org/reports/2022-global-nutrition-report/

Dreyfus, M. (2015). *The Co-Benefits Approach at the Local Level: Legal Perspectives* (Policy Brief 3; p. 4). United Nations University, Institute for the Advanced Study of Sustainability. https://i.unu.edu/media/ias.unu.edu-en/news/11145/UNU-IAS-Policy-Brief-No.-3-2015.pdf

Edwards, M. M., & Haines, A. (2007). Evaluating smart growth: Implications for small communities. *Journal of Planning Education and Research*, *27*(1), 49–64. https://doi.org/10.1177/0739456X07305792

Egger, G., & Swinburn, B. (1997). An "ecological" approach to the obesity pandemic. *BMJ : British Medical Journal*, *315*(7106), 477–480. https://doi.org/10.1136/bmj.315.7106.477

Elgaddal, N., Kramarow, E. A., & Reuben, C. (2022). *Physical Activity Among Adults Aged 18 and Over: United States, 2020* (NCHS Data Brief 443). Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/data/databriefs/db443.pdf

Elliot, C. A., & Hamlin, M. J. (2018). Combined diet and physical activity is better than diet or physical activity alone at improving health outcomes for patients in New Zealand's primary care intervention. *BMC Public Health*, *18*(1), 230. https://doi.org/10.1186/s12889-018-5152-z

Elvik, R., & Bjørnskau, T. (2017). Safety-in-numbers: A systematic review and meta-analysis of evidence. *Safety Science*, *92*, 274–282. https://doi.org/10.1016/j.ssci.2015.07.017

Ferreira, A. J. D., Guilherme, R. I. M. M., Ferreira, C. S. S., & Oliveira, M. de F. M. L. de. (2018). Urban agriculture, a tool towards more resilient urban communities? *Current Opinion in Environmental Science & Health*, *5*, 93–97. https://doi.org/10.1016/j.coesh.2018.06.004

Foster, S., Giles-Corti, B., & Knuiman, M. (2010). Neighbourhood design and fear of crime: A social-ecological examination of the correlates of residents' fear in new suburban housing developments. *Health & Place*, *16*(6), 1156–1165. https://doi.org/10.1016/j.healthplace.2010.07.007

Fresán, U., & Sabaté, J. (2019). Vegetarian diets: Planetary health and its alignment with human health. *Advances in Nutrition*, *10*(Supplement_4), S380–S388. https://doi.org/10.1093/advances/nmz019

Friel, S., Pescud, M., Malbon, E., Lee, A., Carter, R., Greenfield, J., Cobcroft, M., Potter, J., Rychetnik, L., & Meertens, B. (2017). Using systems science to understand the determinants of inequities in healthy eating. *PLOS ONE*, *12*(11), e0188872. https://doi.org/10.1371/journal.pone.0188872

Fu, X., & Tang, Z. (2013). Planning for drought-resilient communities: An evaluation of local comprehensive plans in the fastest growing counties in the US. *Cities*, *32*, 60–69. https://doi.org/10.1016/j.cities.2013.03.001

Garcia, M. T., Ribeiro, S. M., Germani, A. C. C. G., & Bógus, C. M. (2018). The impact of urban gardens on adequate and healthy food: A systematic review. *Public Health Nutrition*, *21*(2), 416–425. https://doi.org/10.1017/S1368980017002944

Giles-Corti, B., Foster, S., Shilton, T., Falconer, R., Giles-Corti, B., Foster, S., Shilton, T., & Falconer, R. (2010). The co-benefits for health of investing in active transportation. *New South Wales Public Health Bulletin*, *21*(6), 122–127. https://doi.org/10.1071/NB10027

Giles-Corti, B., Vernez-Moudon, A., Reis, R., Turrell, G., Dannenberg, A. L., Badland, H., Foster, S., Lowe, M., Sallis, J. F., Stevenson, M., & Owen, N. (2016). City planning and population health: A global challenge. *The Lancet*, *388*(10062), 2912–2924. https://doi.org/10.1016/S0140-6736(16)30066-6

Godos, J., Grosso, G., Castellano, S., Galvano, F., Caraci, F., & Ferri, R. (2021). Association between diet and sleep quality: A systematic review. *Sleep Medicine Reviews*, *57*, 101430. https://doi.org/10.1016/j.smrv.2021.101430

Godschalk, D., & Anderson, W. (2012). *Sustaining Places: The Role of the Comprehensive Plan* (PAS Report 567; p. 108). American Planning Association. https://www.planning.org/publications/report/9026891/

Godschalk, D., Brody, S., & Burby, R. (2003). Public participation in natural hazard mitigation policy formation: Challenges for comprehensive planning. *Journal of Environmental Planning and Management*, *46*(5), 733–754. https://doi.org/10.1080/0964056032000138463

Grabow, M. L., Spak, S. N., Holloway, T., Stone, B., Mednick, A. C., & Patz, J. A. (2012). Air quality and exercise-related health benefits from reduced car travel in the Midwestern United States. *Environmental Health Perspectives*, *120*(1), 68–76. https://doi.org/10.1289/ehp.1103440

Grabow, S. H., Hilliker, M., & Moskal, J. (2001). *Comprehensive Planning and Citizen Participation* (G3810; p. 76). UW Extension. https://cdn.shopify.com/s/files/1/0145/8808/4272/files/G3810.pdf

Guide to Community Preventive Services. (2016). *Physical Activity: Built Environment Approaches Combining Transportation System Interventions with Land Use and Environmental Design*. https://www.thecommunityguide.org/findings/physical-activity-built-environment-approaches

Hamner, H. C., Dooyema, C., Blanck, H. M., Flores-Ayala, R., Jones, J. R., Ghandour, R. M., & Petersen, R. (2023). Fruit, vegetable, and sugar-sweetened beverage intake among young children, by state—United States, 2021. *MMWR. Morbidity and Mortality Weekly Report*, *72*. https://doi.org/10.15585/mmwr.mm7207a1

Healey, P. (1996). The communicative turn in planning theory and its implications for spatial strategy formation. *Environment and Planning B: Planning and Design*, *23*(2), 217–234. https://doi.org/10.1068/b230217

Health Impact Project. (2019, October 31). *HIAs and other resources to advance health-informed decisions: A toolkit to promote healthier communities through cross-sector collaboration*. Pew Charitable Trusts. http://bit.ly/1F13PKL

Hodgson, K. (2011). *Comprehensive Planning for Public Health: Results of the Planning and Community Health Research Center Study*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/research/publichealth/pdf/surveyreport.pdf

Hodgson, K. (2012). *Planning for Food Access and Community-Based Food Systems: A National Scan and Evaluation of Local Comprehensive and Sustainability Plans*. American Planning Association. https://planning.org/publications/document/9148238/

Hume, C., Grieger, J. A., Kalamkarian, A., D'Onise, K., & Smithers, L. G. (2022). Community gardens and their effects on diet, health, psychosocial and community outcomes: A systematic review. *BMC Public Health*, *22*(1), 1247. https://doi.org/10.1186/s12889-022-13591-1

Ilieva, R. T., Cohen, N., Israel, M., Specht, K., Fox-Kämper, R., Fargue-Lelièvre, A., Poniży, L., Schoen, V., Caputo, S., Kirby, C. K., Goldstein, B., Newell, J. P., & Blythe, C. (2022). The socio-cultural benefits of urban agriculture: A review of the literature. *Land*, *11*(5), Article 5. https://doi.org/10.3390/land11050622

Innes, J. E., & Booher, D. E. (2004). Reframing public participation: Strategies for the 21st century. *Planning Theory & Practice*, *5*(4), 419–436. https://doi.org/10.1080/1464935042000293170

Innes, J. E., & Booher, D. E. (2010). *Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy*. Routledge.

Institute of Medicine. (2012). *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. The National Academies Press. https://doi.org/10.17226/13275

Iwaniec, D., & Wiek, A. (2014). Advancing sustainability visioning practice in planning—The general plan update in Phoenix, Arizona. *Planning Practice & Research*, *29*(5), 543–568. https://doi.org/10.1080/02697459.2014.977004

Kärmeniemi, M., Lankila, T., Ikäheimo, T., Koivumaa-Honkanen, H., & Korpelainen, R. (2018). The built environment as a determinant of physical activity: A systematic review of longitudinal studies and natural experiments. *Annals of Behavioral Medicine*, *52*(3), 239–251. https://doi.org/10.1093/abm/kax043

Katzmarzyk, P. T., Friedenreich, C., Shiroma, E. J., & Lee, I.-M. (2022). Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. *British Journal of Sports Medicine*, *56*(2), 101–106. https://doi.org/10.1136/bjsports-2020-103640

Kerr, J., Rosenberg, D., & Frank, L. (2012). The role of the built environment in healthy aging: Community design, physical activity, and health among older adults. *Journal of Planning Literature*, *27*(1), 43–60. https://doi.org/10.1177/0885412211415283

Khalid, S., Williams, C. M., & Reynolds, S. A. (2016). Is there an association between diet and depression in children and adolescents? A systematic review. *British Journal of Nutrition*, *116*(12), 2097–2108. https://doi.org/10.1017/S0007114516004359

Kim, H., & Tran, T. (2018). An evaluation of local comprehensive plans toward sustainable green infrastructure in US. *Sustainability*, *10*(11), 4143. https://doi.org/10.3390/su10114143

Klimova, B., Dziuba, S., & Cierniak-Emerych, A. (2020). The effect of healthy diet on cognitive performance among healthy seniors – A mini review. *Frontiers in Human Neuroscience*, *14*. https://www.frontiersin.org/articles/10.3389/fnhum.2020.00325

Kochanek, K. D. (2024). *Mortality in the United States, 2022* (Data Brief 492). National Center for Health Statistics. https://www.cdc.gov/nchs/products/databriefs/db492.htm#section_4

Konijnendijk, C. C., Annerstedt, M., Busse Nielsen, A., & Maruthaveeran, S. (2013). *Benefits of Urban Parks: A Systematic Review*. International Federation of Parks and Recreation Administration. http://www.worldurbanparks.org/images/Members_Login_Area/IfpraBenefitsOfUrbanParks.pdf

Lane, M. B. (2005). Public participation in planning: An intellectual history. *Australian Geographer*, *36*(3), 283–299. https://doi.org/10.1080/00049180500325694

Lawrence, R. J. (2022). Co-benefits of transdisciplinary planning for healthy cities. *Urban Planning*, *7*(4), 61–74. https://doi.org/10.17645/up.v7i4.5674

Lee, B. Y., Bartsch, S. M., Mui, Y., Haidari, L. A., Spiker, M. L., & Gittelsohn, J. (2017). A systems approach to obesity. *Nutrition Reviews*, *75*(suppl_1), 94–106. https://doi.org/10.1093/nutrit/nuw049

Leider, J., Chriqui, J. F., & Thrun, E. (2017). Associations between active living-oriented zoning and no adult leisure-time physical activity in the U.S. *Preventive Medicine*, *95*, S120–S125. https://doi.org/10.1016/j.ypmed.2016.06.029

Levine, K., & Karner, A. (2023). Approaching accessibility: Four opportunities to address the needs of disabled people in transportation planning in the United States. *Transport Policy*, *131*, 66–74. https://doi.org/10.1016/j.tranpol.2022.12.012

Li, Y., Lv, M.-R., Wei, Y.-J., Sun, L., Zhang, J.-X., Zhang, H.-G., & Li, B. (2017). Dietary patterns and depression risk: A meta-analysis. *Psychiatry Research*, *253*, 373–382. https://doi.org/10.1016/j.psychres.2017.04.020

Lieske, S. N., Mullen, S., & Hamerlinck, J. D. (2009). Enhancing Comprehensive Planning with Public Engagement and Planning Support Integration. In S. Geertman & J. Stillwell (Eds.), *Planning Support Systems Best Practice and New Methods* (Vol. 95, pp. 295–315). Springer Netherlands. https://doi.org/10.1007/978-1-4020-8952-7_15

Loh, C. G., & Kim, R. (2021). Are we planning for equity? *Journal of the American Planning Association*, *87*(2), 181–196. https://doi.org/10.1080/01944363.2020.1829498

Lyles, W., Berke, P., & Smith, G. (2014). A comparison of local hazard mitigation plan quality in six states, USA. *Landscape and Urban Planning*, *122*, 89–99. https://doi.org/10.1016/j.landurbplan.2013.11.010

Lyles, W., Berke, P., & Smith, G. (2016). Local plan implementation: Assessing conformance and influence of local plans in the United States. *Environment and Planning B: Planning and Design*, *43*(2), 381–400. https://doi.org/10.1177/0265813515604071

Lyles, W., & Stevens, M. (2014). Plan quality evaluation 1994–2012: Growth and contributions, limitations, and new directions. *Journal of Planning Education and Research*, *34*(4), 433–450. https://doi.org/10.1177/0739456X14549752

Mackenbach, J. D., Rutter, H., Compernolle, S., Glonti, K., Oppert, J.-M., Charreire, H., De Bourdeaudhuij, I., Brug, J., Nijpels, G., & Lakerveld, J. (2014). Obesogenic environments: A systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project. *BMC Public Health*, *14*(1), 233. https://doi.org/10.1186/1471-2458-14-233

Macmillan, A., Smith, M., Witten, K., Woodward, A., Hosking, J., Wild, K., & Field, A. (2020). Suburb-level changes for active transport to meet the SDGs: Causal theory and a New Zealand case study. *Science of the Total Environment*, *714*, 136678. https://doi.org/10.1016/j.scitotenv.2020.136678

MacMillan, F., George, E. S., Feng, X., Merom, D., Bennie, A., Cook, A., Sanders, T., Dwyer, G., Pang, B., Guagliano, J. M., Kolt, G. S., & Astell-Burt, T. (2018). Do natural experiments of changes in neighborhood built environment impact physical activity and diet? A systematic review. *International Journal of Environmental Research and Public Health*, *15*(2), Article 2. https://doi.org/10.3390/ijerph15020217

Maiden, K. M., Kaplan, M., Walling, L. A., Miller, P. P., & Crist, G. (2017). A comprehensive scoring system to measure healthy community design in land use plans and regulations. *Preventive Medicine*, *95*, S141–S147. https://doi.org/10.1016/j.ypmed.2016.09.031

Makarewicz, C., Dantzler, P., & Adkins, A. (2020). Another look at location affordability: Understanding the detailed effects of income and urban form on housing and transportation expenditures. *Housing Policy Debate*, *30*(6), 1033–1055. https://doi.org/10.1080/10511482.2020.1792528

Manta Conroy, M., & Berke, P. R. (2004). What makes a good sustainable development plan? An analysis of factors that influence principles of sustainable development. *Environment and Planning A: Economy and Space*, *36*(8), 1381–1396. https://doi.org/10.1068/a367

Marmot, M., Friel, S., Bell, R., Houweling, T. A., & Taylor, S. (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. *The Lancet*, *372*(9650), 1661–1669. https://doi.org/10.1016/S0140-6736(08)61690-6

Mastop, H., & Faludi, A. (1997). Evaluation of strategic plans: The performance principle. *Environment and Planning B: Planning and Design*, *24*(6), 815–832. https://doi.org/10.1068/b240815

Mayrhofer, J. P., & Gupta, J. (2016). The science and politics of co-benefits in climate policy. *Environmental Science & Policy*, *57*, 22–30. https://doi.org/10.1016/j.envsci.2015.11.005

McCormack, G. R., & Shiell, A. (2011). In search of causality: A systematic review of the relationship between the built environment and physical activity among adults. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 125. https://doi.org/10.1186/1479-5868-8-125

Nicholson, L. M., Leider, J., & Chriqui, J. F. (2017). Exploring the linkage between activity-friendly zoning, inactivity, and cancer incidence in the United States. *Cancer Epidemiology Biomarkers & Prevention*, *26*(4), 578–586. https://doi.org/10.1158/1055-9965.EPI-16-0331

Norton, R. K. (2008). Using content analysis to evaluate local master plans and zoning codes. *Land Use Policy*, *25*(3), 432–454. https://doi.org/10.1016/j.landusepol.2007.10.006

Nowak, D. J., & Heisler, G. M. (2010). *Air Quality Effects of Urban Trees and Parks* (Research Series). National Recreation and Park Association. https://www.fs.usda.gov/research/treesearch/52881

Oliveira, J. A. P. de, Doll, C. N. H., Siri, J., Dreyfus, M., Farzaneh, H., Capon, A., Oliveira, J. A. P. de, Doll, C. N. H., Siri, J., Dreyfus, M., Farzaneh, H., & Capon, A. (2015). Urban governance and the systems approaches to health-environment co-benefits in cities. *Cadernos de Saúde Pública*, *31*, 25–38. https://doi.org/10.1590/0102-311X00010015

Olshansky, R. B. (1996). The California Environmental Quality Act and local planning. *Journal of the American Planning Association*, *62*(3), 313–330. https://doi.org/10.1080/01944369608975697

O'Toole, T. P., Blanck, H. M., Flores-Ayala, R., Rose, K., Galuska, D. A., Gunn, J., O'Connor, A., Petersen, R., & Hacker, K. (2022). Five priority public health actions to reduce chronic disease through improved nutrition and physical activity. *Health Promotion Practice*, *23*(1_suppl), 5S-11S. https://doi.org/10.1177/15248399221120507

Payne, G. H., James, S. D., Hawley, L., Corrigan, B., Kramer, R. E., Overton, S. N., Farris, R. P., & Wasilewski, Y. (2015). CDC's Health Equity Resource Toolkit: Disseminating guidance for state practitioners to address obesity disparities. *Health Promotion Practice*, *16*(1), 84–90. https://doi.org/10.1177/1524839914538967

Pearson Thomas A., Palaniappan Latha P., Artinian Nancy T., Carnethon Mercedes R., Criqui Michael H., Daniels Stephen R., Fonarow Gregg C., Fortmann Stephen P., Franklin Barry A., Galloway James M., Goff David C., Heath Gregory W., Frank Ariel T. Holland, Kris-Etherton Penny M., Labarthe Darwin R., Murabito Joanne M., Sacco Ralph L., Sasson Comilla, & Turner Melanie B. (2013). American Heart Association guide for improving cardiovascular health at the

community level, 2013 update. *Circulation*, *127*(16), 1730–1753. https://doi.org/10.1161/CIR.0b013e31828f8a94

Peterson, E. L., Carlson, S. A., Schmid, T. L., & Brown, D. R. (2018). Prevalence of master plans supportive of active living in US municipalities. *Preventive Medicine*, *115*, 39–46. https://doi.org/10.1016/j.ypmed.2018.08.004

Peterson, E. L., Carlson, S. A., Schmid, T. L., Brown, D. R., & Galuska, D. A. (2019). Supporting active living through community plans: The association of planning documents with design standards and features. *American Journal of Health Promotion*, *33*(2), 191–198. https://doi.org/10.1177/0890117118779011

Physical Activity Alliance. (2022). *The 2022 United States Report Card on Physical Activity for Children and Youth*. Physical Activity Alliance.

Pineo, H. (2022a). *Healthy Urbanism: Designing and Planning Equitable, Sustainable and Inclusive Places*. Springer Nature Singapore. https://doi.org/10.1007/978-981-16-9647-3

Pineo, H. (2022b). Towards healthy urbanism: Inclusive, equitable and sustainable (THRIVES) – an urban design and planning framework from theory to praxis. *Cities & Health*, *6*(5), 974–992. https://doi.org/10.1080/23748834.2020.1769527

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environments on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Poplin, A. (2012). Playful public participation in urban planning: A case study for online serious games. *Computers, Environment and Urban Systems*, *36*(3), 195–206. https://doi.org/10.1016/j.compenvurbsys.2011.10.003

Rahmanian, E., Gasevic, D., Vukmirovich, I., & Lear, S. A. (2014). The association between the built environment and dietary intake-a systematic review. *Asia Pacific Journal of Clinical Nutrition*, *23*(2), 183–196. https://doi.org/10.6133/apjcn.2014.23.2.08

Ricklin, A., Klein, W., & Musiol, E. (2012). *Healthy Planning: An Evaluation of Comprehensive and Sustainability Plans Addressing Public Health*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Healthy-Planning.pdf

Ricklin, A., & Kushner, N. (2012). *Healthy Plan Making: Integrating Health into the Comprehensive Planning Process: An Analysis of Seven Case Studies and Recommendations for Change*. American Planning Association. https://planning.org/publications/document/9148247/

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Rouse, D. (2022). The future of the comprehensive plan. *Journal of Comparative Urban Law and Policy*, *5*(1), 299–326. https://doi.org/10.4324/9781003024170

Rouse, D., & Piro, R. (2022). *The Comprehensive Plan: Sustainable, Resilient, and Equitable Communities for the 21st Century*. Routledge.

Rudolf, S. C., & Grădinaru, S. R. (2019). The quality and implementation of local plans: An integrated evaluation. *Environment and Planning B: Urban Analytics and City Science*, *46*(5), 880–896. https://doi.org/10.1177/2399808317737070

Rutter, H., Cavill, N., Bauman, A., & Bull, F. (2019). Systems approaches to global and national physical activity plans. *Bulletin of the World Health Organization*, *97*(2), 162–165. https://doi.org/10.2471/BLT.18.220533

Said, M., Geha, G., & Abou-Zeid, M. (2020). Natural experiment to assess the impacts of street-level urban design interventions on walkability and business activity. *Transportation Research Record*, *2674*(7), 258–271. https://doi.org/10.1177/0361198120921849

Saint-Maurice, P. F., Graubard, B. I., Troiano, R. P., Berrigan, D., Galuska, D. A., Fulton, J. E., & Matthews, C. E. (2022). Estimated number of deaths prevented through increased physical activity among US adults. *JAMA Internal Medicine*. https://doi.org/10.1001/jamainternmed.2021.7755

Sallis, J. F., Cerin, E., Kerr, J., Adams, M. A., Sugiyama, T., Christiansen, L. B., Schipperijn, J., Davey, R., Salvo, D., Frank, L. D., De Bourdeaudhuij, I., & Owen, N. (2020). Built environment, physical activity, and obesity: Findings from the International Physical Activity and Environment Network (IPEN) adult study. *Annual Review of Public Health*, *41*(1), 119–139. https://doi.org/10.1146/annurev-publhealth-040218-043657

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health*, *27*(1), 297–322. https://doi.org/10.1146/annurev.publhealth.27.021405.102100

Sallis, R., Young, D. R., Tartof, S. Y., Sallis, J. F., Sall, J., Li, Q., Smith, G. N., & Cohen, D. A. (2021). Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: A study in 48 440 adult patients. *British Journal of Sports Medicine*, *55*(19), 1099–1105. https://doi.org/10.1136/bjsports-2021-104080

Santos, A. C., Willumsen, J., Meheus, F., Ilbawi, A., & Bull, F. C. (2023). The cost of inaction on physical inactivity to public health-care systems: A population-attributable fraction analysis. *The Lancet Global Health*, *11*(1), e32–e39. https://doi.org/10.1016/S2214-109X(22)00464-8

Schmid, T. L., Fulton, J. E., McMahon, J. M., Devlin, H. M., Rose, K. M., & Petersen, R. (2021). Delivering physical activity strategies that work: Active People, Healthy NationSM. *Journal of Physical Activity and Health*, *18*(4), 352–356. https://doi.org/10.1123/jpah.2020-0656

Serrano, N., Leider, J., & Chriqui, J. F. (2023). Pedestrian-oriented zoning moderates the relationship between racialized economic segregation and active travel to work, United States. *Preventive Medicine*, *177*, 107788. https://doi.org/10.1016/j.ypmed.2023.107788

Shah, S., & Wong, B. (2020). *Toolkit to Integrate Health and Equity into Comprehensive Plans* (p. 37). American Planning Association. https://www.planning.org/publications/document/9201866/?utm_campaign=2020-08-06+HIP+content+order&utm_medium=email&utm_source=Pew

Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., Baas, P., & Mackie, H. (2017). Systematic literature review of built environment effects on physical activity and active transport – an update and new findings on health equity. *International Journal of Behavioral Nutrition and Physical Activity*, *14*, 158. https://doi.org/10.1186/s12966-017-0613-9

Solomons, N. W. (2007). Malnutrition and infection: An update. *British Journal of Nutrition*, *98*(S1), S5–S10. https://doi.org/10.1017/S0007114507832879

Stankov, I., Garcia, L. M. T., Mascolli, M. A., Montes, F., Meisel, J. D., Gouveia, N., Sarmiento, O. L., Rodriguez, D. A., Hammond, R. A., Caiaffa, W. T., & Diez Roux, A. V. (2020). A systematic review of empirical and simulation studies evaluating the health impact of transportation interventions. *Environmental Research*, *186*, 109519. https://doi.org/10.1016/j.envres.2020.109519

Stearns, J. A., Avedzi, H. M., Yim, D., Spence, J. C., Labbaf, F., Lamboglia, C. G., Ko, F., Farmer, C., Lytvyak, E., Kennedy, M., Kim, Y.-B., Ren, H., & Lee, K. K. (2023). An umbrella review of the best and most up-to-date evidence on the built environment and physical activity in older adults ≥60 years. *Public Health Reviews*, *44*, 1605474. https://doi.org/10.3389/phrs.2023.1605474

Stevens, M. R. (2013). Evaluating the quality of official community plans in southern British Columbia. *Journal of Planning Education and Research*, *33*(4), 471–490. https://doi.org/10.1177/0739456X13505649

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, *29*(1), 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Stroope, J. (2021). Active transportation and social capital: The association between walking or biking for transportation and community participation. *Preventive Medicine*, *150*, 106666. https://doi.org/10.1016/j.ypmed.2021.106666

Sustainable Mobility for All. (2017). *Global Mobility Report 2017: Tracking Sector Performance*. Sustainable Mobility for All. https://www.sum4all.org/publications/global-mobility-report-2017

Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., Brinsden, H., Calvillo, A., De Schutter, O., Devarajan, R., Ezzati, M., Friel, S., Goenka, S., Hammond, R. A., Hastings, G., Hawkes, C., Herrero, M., Hovmand, P. S., Howden, M., … Dietz, W. H. (2019). The Global Syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, *393*(10173), 791–846. https://doi.org/10.1016/S0140-6736(18)32822-8

Tang, Z. (2008). Evaluating local coastal zone land use planning capacities in California. *Ocean & Coastal Management*, *51*(7), 544–555. https://doi.org/10.1016/j.ocecoaman.2008.06.001

Tang, Z., Bright, E., & Brody, S. (2009). Evaluating California local land use plan's environmental impact reports. *Environmental Impact Assessment Review*, *29*(2), 96–106. https://doi.org/10.1016/j.eiar.2008.03.002

Tang, Z., & Brody, S. D. (2009). Linking planning theories with factors influencing local environmental-plan quality. *Environment and Planning B: Planning and Design*, *36*(3), 522–537. https://doi.org/10.1068/b34076

Tang, Z., Brody, S. D., Quinn, C., Chang, L., & Wei, T. (2010). Moving from agenda to action: Evaluating local climate change action plans. *Journal of Environmental Planning and Management*, *53*(1), 41–62. https://doi.org/10.1080/09640560903399772

Tcymbal, A., Demetriou, Y., Kelso, A., Wolbring, L., Wunsch, K., Wäsche, H., Woll, A., & Reimers, A. K. (2020). Effects of the built environment on physical activity: A systematic review of longitudinal studies taking sex/gender into account. *Environmental Health and Preventive Medicine*, *25*(1), 75. https://doi.org/10.1186/s12199-020-00915-z

Thrun, E., Leider, J., & Chriqui, J. F. (2016). Exploring the cross-sectional association between transit-oriented development zoning and active travel and transit usage in the United States, 2010–2014. *Frontiers in Public Health*, *4*. https://doi.org/10.3389/fpubh.2016.00113

UNESCO. (2015). *International Charter of Physical Education, Physical Activity and Sport*. United Nations. https://www.unesco.org/en/sport-and-anti-doping/international-charter-sport

United Nations Office of the High Commissioner for Human Rights. (2010). *Fact Sheet No. 34: The Right to Adequate Food*. United Nations. https://www.ohchr.org/en/publications/fact-sheets/fact-sheet-no-34-right-adequate-food

US EPA. (2017). *Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement* (841-R-16–112). US Environmental Protection Agency, Office of Water. https://www.epa.gov/nps/green-infrastructure-parks-guide

USDA. (2020). *Scientific Report of the 2020 Dietary Guidelines Advisory Committee: Advisory Report to the Secretary of Agriculture and Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service. https://doi.org/10.52570/DGAC2020

USDA & USDHHS. (2020). *Dietary Guidelines for Americans, 2020-2025* (9th ed.). U.S. Department of Agriculture and U.S. Department of Health and Human Services.

USDHHS. (2018a). *2018 Physical Activity Guidelines Advisory Committee Scientific Report*. U.S. Department of Health and Human Services. https://health.gov/our-work/nutrition-physical-activity/physical-activity-guidelines/current-guidelines/scientific-report

USDHHS. (2018b). *Physical Activity Guidelines for Americans, 2nd edition* (p. 118). U.S. Department of Health and Human Services. https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf

Ware, A., & Kerner, B. (2021). Moving the field forward: A decade of progress implementing health in all policies in the United States. *Journal of Public Health Management and Practice*, *27*(1), 94–96. https://doi.org/10.1097/PHH.0000000000001280

Webb Jamme, H.-T., Bahl, D., & Banerjee, T. (2018). Between "broken windows" and the "eyes on the street:" Walking to school in inner city San Diego. *Journal of Environmental Psychology*, *55*, 121–138. https://doi.org/10.1016/j.jenvp.2018.01.004

WHO. (2004). *Global Strategy on Diet, Physical Activity, and Health*. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/43035/924?sequence=1

WHO. (2013). *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020*. World Health Organization. https://www.who.int/publications/i/item/9789241506236

WHO. (2018). *More Active People for a Healthier World: Global Action Plan on Physical Activity 2018-2030*. World Health Organization. https://www.who.int/publications/i/item/9789241514187

WHO. (2021). *Development of an Implementation Roadmap 2023–2030 for the Global Action Plan for the Prevention and Control of NCDs 2013–2030* [Discussion Paper]. World Health Organization. https://www.who.int/teams/noncommunicable-diseases/governance/roadmap

WHO. (2022). *Global Status Report on Physical Activity 2022*. World Health Organization. https://www.who.int/publications/i/item/9789240059153

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., Vries, W. D., Sibanda, L. M., … Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Woodruff, R. C., Raskind, I. G., Harris, D. M., Gazmararian, J. A., Kramer, M., Haardörfer, R., & Kegler, M. C. (2018). The dietary impact of introducing new retailers of fruits and vegetables into a community: Results from a systematic review. *Public Health Nutrition*, *21*(5), 981–991. https://doi.org/10.1017/S1368980017003226

Xu, Y., Liu, Y., Chen, T., Shao, W., & Fu, Z. (2017). A longitudinal analysis of environment and risk of obesity in the US. *Journal of Geoscience and Environment Protection*, *05*(09), 204–220. https://doi.org/10.4236/gep.2017.59015

Zenk, S. N., Pugach, O., Chriqui, J. F., Wing, C., Raymond, D., Tarlov, E., Sheridan, B., Jones, K. K., & Slater, S. J. (2022). Active living-oriented zoning codes and cardiometabolic conditions

across the lifespan. *Translational Behavioral Medicine*, *12*(4), 595–600. https://doi.org/10.1093/tbm/ibab157

Zerbian, T., Adams, M., & Wilson, N. (2022). Social Resilience in Local Food Systems: A Foundation for Food Security during a Crisis. In A. I. Ribeiro-Barros, D. S. Tevera, L. F. Goulao, & L. D. Tivana (Eds.), *Food Systems Resilience* (Vol. 1, pp. 101–118). IntechOpen. https://doi.org/10.5772/intechopen.95206

Zhu, X., Yu, C.-Y., Lee, C., Lu, Z., & Mann, G. (2014). A retrospective study on changes in residents' physical activities, social interactions, and neighborhood cohesion after moving to a walkable community. *Preventive Medicine*, *69*, S93–S97. https://doi.org/10.1016/j.ypmed.2014.08.013

Chapter 2: Healthy eating and active living in comprehensive plans: A systematic assessment from Wisconsin

2.1 Introduction

Within the field of planning research, there is a rich history of evaluating comprehensive plans for how they address engrained, systemic, or important issues. For example, comprehensive plans have been evaluated extensively for hazard mitigation and resilience (P. R. Berke et al., 1996; Brody, 2003a; Burby & Dalton, 1994; Fu & Tang, 2013; Stevens, 2013), environmental sustainability and climate change (P. Berke & Conroy, 2000; P. R. Berke et al., 1999; Brody & Highfield, 2005; Kim & Tran, 2018; Manta Conroy & Berke, 2004; Olshansky, 1996; Tang et al., 2009, 2010; Tang & Brody, 2009), smart growth (Brody et al., 2006; Edwards & Haines, 2007; Norton, 2008), and social equity (Loh & Kim, 2021). Plan quality evaluation provides baseline estimates of planning practice; identifies strengths and weaknesses in planning within specific domains; and aids in the development of planning theory by providing data necessary to analyze factors associated with plan quality, implementation, and outcomes (Lyles & Stevens, 2014).

However, while national and international organizations and researchers have called for an alignment of urban planning and public health (Jackson et al., 2013) and comprehensive plans are a main planning tool in the United States, very little systematic research has been conducted regarding the extent to which comprehensive plans incorporate health-promoting goals, objectives, policies, and recommendations.

In an effort to address this gap, the APA initiated a multiphase study in 2010 to identify local-level comprehensive planning responses to health concerns and to explore promising

strategies for incorporating health into the comprehensive planning process (Ricklin et al., 2012). This project included a nationwide survey of planning departments; a systematic assessment of 18 comprehensive plans for health goals, objectives, policies, and recommendations; and seven case studies of planning departments incorporating health into their work (Hodgson, 2011; Ricklin et al., 2012; Ricklin & Kushner, 2012). While this study provided initial evidence of the state of the practice for incorporating health into comprehensive plans, the sample size was small and was selected from survey respondents who had already said that their plan addressed health in some way.

More recently, researchers at APA reviewed 15 local comprehensive plans in order to glean model policy language regarding health equity principles (Shah & Wong, 2020). In addition, in developing the Healthy Living and Active Design Scorecard for Comprehensive Plans, a research team at Nemours Children's Health System in Delaware used their scorecard to evaluate 42 land use plans and development codes (Maiden et al., 2017). Providing baseline estimates of comprehensive planning for health was the goal of neither of these studies, though, so descriptive statistics about the extent to which health was addressed in plans were not reported. Furthermore, several studies have assessed the extent to which comprehensive plans contain policies supportive of active living; however, these studies were all survey-based and only collected information on a few active-living measures (e.g. complete streets, mixed land use) rather than a host of integrated HEAL-supportive goals and policies (Aytur et al., 2007, 2008; Evenson et al., 2011; Peterson et al., 2018).

A systematic content analysis of HEAL-promoting components in municipal comprehensive plans has not yet been conducted. Therefore, I aimed to systematically evaluate a sample of comprehensive plans from Wisconsin. The goals of this evaluation were to:

1. Provide baseline data on the state of the practice of comprehensive planning for HEAL in Wisconsin

2. Determine areas of strength and opportunities for growth in planning for HEAL in Wisconsin

3. Investigate local sociodemographic, political, planning-related, and health priority factors that might be associated with comprehensive planning for HEAL in Wisconsin

2.1.1 Research questions

1. To what extent and with what variation do urban and suburban municipalities in Wisconsin incorporate HEAL-supportive goals, objectives, and strategies in their comprehensive plans?
    - To what extent and with what variation do comprehensive plans include goals, objectives, and strategies specific to the domains of Vision & Strategy, Active Transportation, Parks & Recreation, Healthy Food Access, Health Care Access, and Community Design?

2. What local, contextual factors are associated with incorporating HEAL-supportive goals, objectives, and strategies in comprehensive plans?

2.2 METHODS

2.2.1 Study design

This study design draws on the best practices for comprehensive plan evaluation research proposed by Lyles and Stevens (2014), adapted for efficiency and to align with common methods used in population health and health policy research. Lyles and Stevens propose seven recommendations for plan evaluation researchers, which are summarized in Table 2.1. I have organized the description of our methods according to these recommendations, noting where and why we deviate from the recommended methods.

Table 2.1: Lyles and Stevens' (2014, p. 444) methodological recommendations for plan evaluation research.

Category	Recommendation for plan evaluation research
Sampling	• Explicitly identify the region and sample • Clarify how plans are obtained
Protocol, design, usage, and availability	• When available, use an existing scorecard, especially if it has been tested and the sources of all scoring items are identified
Scoring	• Specifically describe the scoring protocol and its application • Explicitly address weighting scheme when aggregating scores across items (including if all items are weighted equally)
Description of coders and coder training	• Explicitly describe who coded the plans and what type of training they received
Assessing reliability	• Measure inter-rater reliability using Krippendorff's alpha • Report individual item reliability statistics or a range for the items included in the publication
Coding procedures	• Use independent double coding and describe the reconciliation process used to generate final scores
Pretesting	• Pretest scorecards and scoring protocols using plans external to the study sample • Report the reliability measures for pretesting

2.2.1.1 Sampling

2.2.1.1.1 Target population

Our target population was all 209 urban and suburban municipalities (i.e. towns, villages, cities) in Wisconsin.

2.2.1.1.2 Stratifying by urbanicity

Delineating communities into urban, suburban, and rural classifications for research purposes is not straightforward. There are many extant classification systems, developed by various federal offices. These systems determine urbanicity based on *integration*, which links communities

based on economic and social ties, or *separation*, which uses population and population density cut-offs for different urbanicity classes, or sometimes elements of both (Isserman, 2005). Hart et al. (2005) suggest that researchers identify which aspects of urban-rural taxonomies are most relevant to their research and carefully select a classification system that includes those qualities. Integration-based classification methods are appropriate for the analysis of regional access to services, economic connections, and commuting behaviors (Isserman, 2005). Separation-based classification methods are appropriate for studies about the built environment itself because they tend to reflect the place-based qualities that match what we perceive as "urban" or "rural" (Isserman, 2005). While comprehensive plans often address regional economic ties, our study focused more closely on policies guiding the development of HEAL-supportive built environment infrastructure; therefore, we chose a separation-based classification of urbanicity.[2]

We used the Census Bureau's Urban Areas. This classification scheme is available at the census block group level and is based on contiguous areas of sufficient population and population density (U.S. Census Bureau, 2019). Other separation-based classification systems

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[2] I originally tried using a municipal approximation of Rural-Urban Commuting Area (RUCA) codes—an integration-based classification system often used in population health research—to stratify Wisconsin municipalities. I ground-truthed this system by reading several town and village comprehensive plans for each RUCA code. While this was an informal process, it clearly showed that municipalities that were clearly not urban or suburban were being classified as such by the RUCA municipal approximation. For instance, the Town of Vienna in Dane County has a population of 1,482 and the vast majority of the land is used for agriculture. Yet the Town of Vienna is classified as part of an "Urban Core" by the consolidated RUCA municipal approximation, probably because of its proximity to the cities of Madison and DeForest. Moreover, a mapped comparison of the municipal approximation of the RUCA codes versus Census-defined Urban Area shows "urban core" and "suburban" RUCA codes covering many more communities that the Urban Areas classification system. The integration-based system would have increased our sampling frame considerably (because more municipalities would have been considered urban or suburban), but likely would have lowered comprehensive plan scores because primarily rural municipalities would have been evaluated with a tool more appropriate for urban and suburban communities.

were only available at the county level, which does not recognize the significant variation in urbanicity found *within* most counties in the United States (Hall et al., 2006; Hart et al., 2005). Municipalities were considered urban or suburban if at least 50 percent of their land area fell within a Census-defined Urban Area.

The Urban Areas system does not delineate between urban and suburban places, though. Drawing on the research team's knowledge of Wisconsin communities, we identified natural cut points of population and population density to demarcate urban versus suburban municipalities. In the end, municipalities were classified as urban if at least 50 percent of their land area was within an Urban Area and at least one of the two following criteria was true: 1) at least 20,000 total population, or 2) at least 15,000 total population and at least 3,000 people per square mile population density. All those municipalities with at least 50 percent of their land area within an Urban Area that *did not* fulfill the qualifications above were categorized as suburban. This categorization is summarized in Table 2.2.

Table 2.2: Characteristics of urban, suburban, and rural communities according to our classification system.

Category	**Requirements**
Urban	• At least 50 percent land area within Census Bureau's Urbanized Area or Urban Cluster • At least 20,000 population OR a combination of at least 15,000 population and at least 3,000 people per square mile population density
Suburban	• At least 50 percent land area within Census Bureau's Urbanized Area or Urban Cluster • Not categorized as "Urban"
Rural*	• Less than 50 percent land area within Census Bureau's Urbanized Area or Urban Cluster

*Rural communities excluded from our sample.

2.2.1.1.3 Stratifying by regional planning commission

After applying our definition of urban and suburban, we further stratified municipalities by regional planning commission (RPC). In Wisconsin, RPCs conduct research and data analysis, advise local and county governments, coordinate programs and activities across local governments and agencies, and draft comprehensive plans (Wis. Stat. § 66.0309). Wisconsin's RPCs have a long history of guiding regional planning initiatives. The first RPC in Wisconsin—the Northwest Wisconsin RPC—was created in 1959 and by 1973 all nine of the current RPCs had been formed (Lawrence, 2018). While RPCs may draft and adopt regional comprehensive plans, many also contract with local governments to help them write municipal comprehensive plans. In our experience, this practice is very prevalent in some RPC areas and almost non-existent in others. Moreover, different RPCs tend to focus on different issues: some focus on water quality issues, others on business development, and others on land use and transportation planning (Lawrence, 2018). Stratification by RPC was meant to capture the different approaches to planning and salient planning topics within each region—both due to the longstanding influence of the RPCs themselves and because of planning differences borne out of geography and culture across regions.

Eight of the nine RPCs in Wisconsin are comprised of five to ten counties each. One RPC—the Capitol Area RPC—is comprised of only Dane County. Five counties adjacent to Dane County do not belong to any RPC. These counties were grouped into one RPC stratum.

2.2.1.1.4 Sampling frame and sample selection

After stratifying by urbanicity and RPC, the sampling frame consists of 20 clusters (Table 2.3). Due to the small number of urban municipalities in Wisconsin, we included all of them in our analysis ($n_U = 35$). We randomly sampled at least 43% of municipalities within each suburban

stratum, ensuring that we included at least two municipalities in each stratum ($n_S = 81$, range of sampling rates 43.8%-66.7%). Our sampling percentage was derived from variance estimates from a pilot study of 33 coded urban and suburban Wisconsin comprehensive plans and assumed a margin of error of e=0.04. Our final sample size was 116 municipalities (Table 2.4).

Table 2.3: Frequency of urban and suburban Wisconsin municipalities by regional planning commission, based on 2017 data.

RPC	Suburban	Urban	Total
Bay Lake	16	5	21
Capitol Area	17	2	19
East Central	19	5	24
Mississippi River	12	1	13
None	20	3	23
North Central	10	2	12
Northwest	3	0	3
Southeastern	57	16	73
Southwestern	6	0	6
West Central	14	1	15
Total	174	35	209

Table 2.4: Stratified sample of suburban and urban municipalities in Wisconsin.

RPC	Suburban	Urban	Total
Bay Lake	7	5	12
Capitol Area	8	2	10
East Central	9	5	14
Mississippi River	6	1	7
None	9	3	12
North Central	5	2	7
Northwest	2	0	2
Southeastern	25	16	41
Southwestern	3	0	3
West Central	7	1	8
Total	81	35	116

2.2.1.1.5 Acquiring comprehensive plans in sample

For municipalities selected into our sample, we downloaded adopted comprehensive plans in 2017-2018 from municipal, county planning, or RPC websites. We verified that we had the latest update of each comprehensive plan by cross-checking with the Wisconsin Department of Administration (DOA) database of comprehensive plans. If the latest plan could not be found online, the coding team reached out via email to the planning department (or other relevant agency) to acquire an electronic copy of the plan. If the plan was not available electronically, we paid for the plan to be copied and mailed to the University of Wisconsin Population Health Institute. If we did not receive a response to our email request within two weeks, we followed up via phone. If none of these methods yielded a comprehensive plan (and none was listed in the DOA database), then it was assumed that the municipality did not have an adopted comprehensive plan.

2.2.1.2 Protocol, design, usage, and availability

When evaluating comprehensive plans, Lyles and Stevens suggest that researchers use existing assessment protocols and items, when available, in order to facilitate replication (Lyles & Stevens, 2014). We therefore chose the Healthy Living and Active Design Scorecard for Comprehensive Plans to evaluate our sample (from now, the "Scorecard") (Kaplan et al., 2016). The Scorecard was developed by Cedar Creek Sustainable Planning Services based on extensive literature review, key informant interviews, and review by a cross-disciplinary committee of the Delaware Coalition for Healthy Eating and Active Living (Maiden et al., 2017). It includes 50 items in six sections, covering a "gold standard" set of goals, objectives, policies, and

recommendations for comprehensive plans to contribute to HEAL.[3] In our analysis, we renamed the Scorecard sections to make them more applicable to traditional planning topics. Table 2.5 briefly describes the sections in the Scorecard, including the revised section titles. The Scorecard is freely available online at http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf.

Table 2.5: Sections in the Healthy Living and Active Design Scorecard for Comprehensive Plans, including revised sections titles to align with traditional planning domains (Kaplan et al., 2016).

Original section title	Revised section title	# of items	Summary
Overall plan, vision, and strategy	Vision & Strategy	6	Explicit connection between planning, the built environment, land use, and healthy eating and active living related chronic disease outcomes
Healthy living: How we move around	Active Transportation	13	Goals for increasing active transportation mode share; strategies for making active transportation safer, more comfortable, more efficient, and more equitable
How we eat and drink	Healthy Food Access	8	Goals and strategies for promoting the production and consumption of healthy foods
How we play and get our exercise	Parks & Recreation	5	Goals and strategies to ensure the everyone in the community has access to quality parks, open spaces, and recreation opportunities
How we get and stay well	Health Care Access	3	Goals and strategies to ensure access to health care; goals and strategies for aging in place
Active design	Community Design	15	Urban design strategies for promoting active living, from streetscape to land use scales

[3] The Scorecard also includes 29 implementation measures, which were not evaluated in this study due to capacity constraints. This section requires further assessment of zoning codes or codes of ordinances.

2.2.1.3 Scoring

For each item in the Scorecard, a comprehensive plan can score a 0, 1, or 2. The plan scores a 0 if it does not contain the appropriate policy language; a 1 if it contains the appropriate policy language but it is weak, vague, includes loopholes, or is included merely as an aspiration; and a 2 if it contains the appropriate policy language with specific plans or strategies, action-oriented language, and apparent commitment to enacting the policy (Kaplan et al., 2016).

We calculated overall and section comprehensiveness and strength scores based on the guidance in the Scorecard. The equations for these scores, as well as sample calculations for a hypothetical section, can be seen in Table 2.6.

Table 2.6: Equations and sample calculations for comprehensiveness and strength scores.

	Equation	**Score for hypothetical section with scores: 0, 1, 1, 0, 2**
Comprehensiveness score	$\frac{\#\ of\ items\ scored\ 1\ or\ 2}{Total\ \#\ of\ items\ in\ section} * 100$	$\frac{3}{5} * 100 = 60\%$
Strength score	$\frac{Sum\ of\ scores}{Total\ possible\ score\ for\ section} * 100$	$\frac{4}{10} * 100 = 40\%$

This method of score aggregation into comprehensiveness and strength scores gives equal weight to each item in the scorecard (and in each section). However, because the sections vary in the number of items they contain, each section of the Scorecard does not carry equal weight in the calculation of the overall comprehensiveness and strength scores. For example, the topics of Community Design (15 items) and Active Transportation (13 items) are weighted more heavily than Vision & Strategy (6 items), Healthy Food Access (8 items), Parks & Recreation (5 items), and Health Care Access (3 items) in the overall scores.

2.2.1.4 Description of coders and coder training

The coding team was comprised of five students. Two were masters level students in the field of urban and regional planning. Two were advanced undergraduate students in the field of geography. I led all team training, assessed inter-rater reliability, and conducted a smaller portion of the independent coding.

As suggested in Hallgren's tutorial on measuring and reporting inter-rater reliability, the team underwent reliability training and testing for each section of the Scorecard prior to coding plans independently for that section (2012). For each section of the Scorecard, I led a discussion about each item and presented example comprehensive plan language that would merit scoring a 2, 1, and sometimes a 0 (i.e. particular language that would not score). We discussed potential scoring pitfalls and ambiguities and made clarifications to the assessment items via a "Coding Guide" spreadsheet. This Coding Guide was available for coders to reference via a document sharing platform for the entirety of the project.[4] The Coding Guide also contained search methods to be employed for each item (e.g. chapters to read or skim, keyword searches to conduct).

After this discussion, the team started the first reliability training round. For each round of reliability training, the entire coding team (including myself) coded the same 3-6 plans for the appropriate section of the Scorecard. Then, we discussed scoring discrepancies and interpretation of the assessment items, coming to a consensus on the "Master scores" for each plan in the reliability training round. Evolving interpretation of the assessment items was tracked in the

[4] The "Coding Guide" is available, along with other study materials, data, and code, at https://osf.io/h48qk/.

"Coding Guide," and significant changes to the interpretation of assessment items triggered a re-assessment of plans previously coded in the reliability training rounds.

2.2.1.5 Assessing reliability

Testing for reliability was an important part of the training process for the coding team. In this context, reliability is the extent to which coders agreed with the "Master scores" assigned to the comprehensive plans in the reliability rounds (Hallgren, 2012; Stevens et al., 2014). That is, measured reliability tested the extent to which each coder agreed with our approximation of the "true score" for each section. While this is a slightly different interpretation of reliability than many studies use, it has precedent in other health policy studies (Weymouth et al., 2019) and, if anything, is a more stringent measure of reliability than agreement amongst coders.

We used intraclass correlation coefficients (ICCs) to test reliability during the training rounds rather than Krippendorff's alpha, which is recommended by Lyles and Stevens and Stevens et al. (Lyles & Stevens, 2014; Stevens et al., 2014). ICCs were used in the initial psychometric testing of the Scorecard (Maiden et al., 2017), have been used in evaluations of school wellness policies with similar designs to our study (Schwartz et al., 2009; Weymouth et al., 2019), and are a common measure of reliability in health sciences research (Alavi et al., 2022). Like Krippendorff's alpha, ICCs are a "chance-corrected" measure. That is, they account for the certain proportion of agreement between coders that comes about merely by chance (Hallgren, 2012). They also have well-known standards for interpreting acceptable levels of reliability and measure reliability of ratio- (i.e. subsection scores) and ordinal-level (i.e. scores for individual items in the Scorecard) variables. There are also several variations of ICC statistics for different types of study designs. We used two-way, mixed effect, individual ICCs with absolute agreement for each coder for each reliability training round. This type of ICC is

specifically designed to measure a) absolute agreement of scores (rather than consistent agreement); b) reliability for individual coders rather than average reliability across coders; and c) reliability in study designs where only a subset of plans were scored by multiple coders (Hallgren, 2012). This was therefore the best measure of reliability for our study design, in which the goal of measuring reliability was to assess each individual coder's ability to individually code plans before allowing them asses their own independent portion of the sample.

An ICC of 1 indicates perfect agreement, 0 indicates random agreement, and negative ICCs indicate systematic disagreement (Hallgren, 2012). Reliability is considered poor for ICCs below 0.40, fair for ICCs of 0.40-0.59, good for ICCs of 0.60-0.74, and excellent for ICCs of 0.75 or higher (Cicchetti, 1994). While Lyles and Stevens recommend calculating reliability measures for individual items (2014), Hallgren recommends calculating reliability measures for the form of data on which the final data analysis will take place (2012). Therefore, we initially calculated ICCs for the comprehensiveness and strength subsection scores (though, see Chapter 3 for post-hoc reliability testing of individual item scores).

Coders began to score plans independently when they achieved adequate ICCs for the subsection scores under question for two reliability rounds in a row. Adequate ICC levels varied between sections (Table 2.7). Insufficient variation in scoring can artificially lower calculated ICCs (Hallgren, 2012; Stevens et al., 2014). We observed this phenomenon in the Vision & Strategy and Health Care Access sections. The threshold for achieving adequate reliability was therefore lowered for those sections.

Table 2.7: Adequate ICCs to determine reliability of coders for each section.

Section title	Adequate ICC
Vision & Strategy	0.60
Active Transportation	0.75
Healthy Food Access	0.75
Parks & Recreation	0.75
Health Care Access	0.60
Community Design	0.75

2.2.1.6 Coding protocol

Lyles and Stevens recommend using independent dual coding of all plans in the sample, followed by a reconciliation process (2014). However, for the sample size and the number of assessment items in the Scorecard, dual coding all plans would have been out of the scope of the resources available to the project. Therefore, once coders reached adequate reliability levels for a section, they began to independently code plans for that section of the Scorecard. We held weekly meetings during independent coding to discuss language in comprehensive plans for which scoring was not clear. For these items, the team discussed and reached a consensus. In addition to scoring the comprehensive plans in the sample, we also gathered information about the year the plan was adopted and up to two dates it was updated and primary and secondary authors of the plan. In addition, we noted if the plan was multijurisdictional (i.e. if it covered more than just the municipality in question).

2.2.1.7 Pretesting

The team that developed the Scorecard conducted psychometric testing using a sample of 42 comprehensive plans that varied with regard to geographic location, population size covered, and accessibility of their plan documents (Maiden et al., 2017). Each plan was dual-coded and then

ICCs were calculated to measure consistency of agreement[5] between coders on overall and focus area comprehensiveness and strength scores (Maiden et al., 2017). The results of the reliability pretesting, reported in Maiden et al., are presented in Table 2.8 (2017).

Our own reliability training and testing (see sections 2.2.1.4 and 2.2.1.5, above) was, in effect, an iterative testing of not only the Scorecard but also the more detailed Coding Guide we developed on real world comprehensive plans. While Lyles and Stevens recommend pretesting on an external sample of plans (2014), we did include plans coded during the reliability training rounds in the final dataset. This allowed us to use our limited time and resources efficiently to produce information about the greatest number of comprehensive plans.

Table 2.8: Results of reliability pretesting of Scorecard conducted by Maiden et al. (2017).

Section title	**Team 1**		**Team 2**		**Team 3**	
	Compr	Strength	Compr	Strength	Compr	Strength
Vision & strategy	0.719	0.723	0.696	0.716	0.946	0.969
Healthy living*	0.786	0.954	0.938	0.923	0.828	0.813
Community design	0.715	0.805	0.910	0.940	0.886	0.796
Overall	0.703	0.922	0.943	0.968	0.883	0.815

*The "Healthy living" focus area includes the "Active Transportation," "Healthy Food Access," "Parks & Recreation," and "Health Care Access" sections.

2.2.2 Data analysis

Comprehensiveness and strength scores for the comprehensive plans in our sample can range from 0% to 100%. A calculated comprehensiveness score of 100% would indicate that the municipality scored a 1 or 2 for every item in the section (i.e. it did not score any 0s). In other words, municipalities that receive high comprehensiveness scores address a breadth of HEAL-

[5] Note that the ICCs calculated in pretesting measure consistent agreement between coders rather than absolute agreement, which our reliability testing measured.

supportive policies in their comprehensive plans. A strength score of 100%, on the other hand, indicates that a municipality scored a 2 on every item in the section. This indicates that the municipality not only addressed a breadth of HEAL-supportive policies in their comprehensive plan, but also that they did so in a way that was actionable, strategic, and/or precise. Strength scores between 0% and 50% may indicate the presence of many weak policies or a few strong policies in the comprehensive plan. For example, a municipality that scored 2, 2, 0, 0, 0 and a municipality that scored 1, 1, 1, 1, 0 for a five-item section would both receive a section strength score of 40%.

2.2.2.1 Descriptive statistics

We calculated statewide mean comprehensiveness and strength scores for each section and overall, as well as standard errors and 95% confidence intervals. We also report the minimum and maximum comprehensiveness and strength score for each section and overall. All descriptive analysis was conducted using Stata 16.1 (StataCorp, 2019).

All statewide descriptive statistics were calculated taking into account the complex survey design of the sample. Sampling weights were calculated for each stratum (see Table 2.9) based on the inverse of the probability of selection into each stratum (sampling weight = stratum sample size / stratum population size).

Using the Stata's suite of survey commands (i.e. using the svy prefix command), our analysis uses the sampling weights in Table 2.9 and takes into account the stratified nature of the sample (StataCorp LLC, 2021). In addition, we used the finite population correction in all analysis because we sampled without replacement and the sample comprised a large portion (about 56%) of the total target population (Heeringa et al., 2010). Using sampling weights in our analysis produces unbiased population point estimates of statewide scores (Heeringa et al.,

2010). Taking into account the stratified nature of the sample and using the FPC produces unbiased and efficient standard errors and confidence intervals (Heeringa et al., 2010). We used Stata's default Taylor series linearization method of estimating variances.[6] When survey commands were not available, analytical weights or frequency weights were used to produce accurate point estimates, as recommended by Heeringa, West, and Berlund (2010). We evaluated normality of the overall and section scores by visually assessing Q-Q normal plots and histograms.

Table 2.9: Sampling weights for observations in each stratum.

RPC	Suburban	Urban
Bay Lake	2.29	1
Capitol Area	2.13	1
East Central	2.11	1
Mississippi River	2.0	1
None	2.22	1
North Central	2.0	1
Northwest	1.5	n/a
Southeastern	2.28	1
Southwestern	2.0	n/a
West Central	2.0	1

2.2.2.2 Regression analysis

In order to evaluate factors associated with higher section and overall scores, we used a series of weighted least squares, univariate, linear regression models with sampling weights and the finite population correction. Other plan evaluation studies have used correlation, t-tests, or other

[6] Taylor series linearization and the two other forms of variance estimation for survey samples—jackknife repeated replication and balanced repeated replication—have been shown to produce equal results across most sample designs and estimators (Heeringa et al., 2010).

statistical analysis, but about 25% of plan quality studies use regression analysis to understand factors that might lead to better plan scores (Lyles & Stevens, 2014). Using regression analysis allowed us to more easily take advantage of the complex survey design of my sample to produce more efficient estimates. All regression analysis was conducted using StataSE 17.0 (StataCorp, 2021).

The dependent variables in our regression analyses were the overall and section comprehensiveness and strength scores for the comprehensive plans (14 variables). Independent variables were drawn from comprehensive planning theory and evaluation literature and included planning-related factors, municipal sociodemographic and political factors, and local health priority areas (see Table 2.10).

We conducted exploratory analysis of independent variables using histograms and Pearson's correlations to assess overall distributions and potential multicollinearity. For each univariate model, we used scatterplots, residual graphs, Q-Q normal plots, and graphs overlaying the regression line on fitted values to assess model fit, potential outliers, and the normalcy and homoscedasticity of residuals.[7] Based on these assessments, we then explored adjustments to the models to:

a) inspect the impact on the models of potential outliers in the median household income and planning capacity variables;
b) address issues of model fit (potential non-linearity) with the population, population density, and year variables;
c) re-operationalize certain variables for better interpretability and practical applicability.

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[7] Many post-estimation statistics for weighted least squares regression using survey sampling characteristics are either not well-theorized or not readily available in statistical software (Heeringa et al., 2010, p. 196; StataCorp LLC, 2021; Williams, 2021). Therefore, we relied on visual assessment of post-estimation graphs to assess regression assumptions, as advised in Heeringa, West, and Berglund (2010, pp. 194–195).

We prioritized parsimonious models and retaining as much of our data as possible in our final model and variable selection. We did not observe significant improvement in model fit when excluding outliers nor when including non-linear terms. Therefore, we retained all observations and excluded non-linear terms in our final models.

We did, however, re-operationalize several variables. For example, we converted the original planning capacity variable (# of staff planners) into two variables: a) # of staff planners per 10,000 population (this removed impact of an outlier with 29 staff planners) and b) a binary variable indicating the municipality has at least one planner on staff (suggested by Heeringa, West, and Berglund when a large portion of the observations have a value of 0 for a continuous variable (2010, p. 211)). We also standardized the continuous independent variables to near their (unweighted) standard deviation with exact scaling values chosen for interpretability of regression coefficients (Table 2.11).

Table 2.10: Independent variables for regression analysis, drawn from planning theory and evaluation literature.

Independent variable	**Precedent and theoretical justification**
Planning characteristics	
Year plan was adopted	Newer plans are generally found to be of higher quality (Kim & Tran, 2018; Stevens, 2013; Tang et al., 2009; Tang & Brody, 2009). This likely reflects a learning process about "good" planning (Brody, 2003a; Stevens, 2013). For this study, it might reflect greater emphasis in recent years by planning and public health organizations on planning for health, healthy food systems, and active living.
Consultant as plan author	Researchers have found that involving a consultant in the planning process can lead to higher quality plans (Bunnell & Jepson, 2011; Stevens, 2013). Consulting firms may possess more experience with comprehensive planning, greater technical expertise and skills, access to a more multi-disciplinary network, and may be more up to date on current planning trends.
Planning capacity	Planning capacity, usually indicated by number of planners on staff or the number of planners who worked on the comprehensive plan, has been positively associated with plan quality in previous studies (Brody et al., 2006; Burby & Dalton, 1994; Kim & Tran, 2018; Tang et al., 2009).
Municipal characteristics	

Population	Municipalities with larger populations are generally found to have higher-quality plans (Brody, 2003b; Bunnell & Jepson, 2011; Tang et al., 2009; Tang & Brody, 2009), possibly because they have greater resources to devote to comprehensive planning activities.
Population density	Previous studies have found that greater population density was associated with fewer sprawl-mitigation measures (Brody et al., 2006; Burby & Dalton, 1994).
Population change	Researchers have found that higher rates of population growth are associated with the incorporation of sustainability components (Manta Conroy & Berke, 2004) and have hypothesized that they were associated with the inclusion of active living objectives in plans (Peterson et al., 2018). Population change is an indicator of development pressure, which influences the actual pace of change in the built environment, attitudes towards controlling that change with planning policies, and leverage of local governments over developers (Manta Conroy & Berke, 2004).
Median household income	In previous research, higher median income or median home values have been associated with higher plan quality (Burby & Dalton, 1994) and incorporation of fewer sprawl-reduction measures (Brody, 2003b)
Education level	Higher educational attainment has been associated with the incorporation of sustainability (Kim & Tran, 2018) and sprawl-reduction measures (Brody et al., 2006) in comprehensive plans.
Voting patterns	Political activity related to hazard mitigation and environmental issues have been associated with the incorporation of those elements in comprehensive plans (Burby & Dalton, 1994); however, to my knowledge political affiliation or voting patterns have not been studied in relation to local comprehensive plan quality. However, Republicanism and/or conservatism have been empirically or conceptually linked to opposition for bicycling infrastructure (Wilson & Mitra, 2020); smart growth (Lewis, 2015; Slaton, 2012); and policies, systems, and environmental approaches to obesity prevention (Barry et al., 2009; Robles & Kuo, 2017; Welch et al., 2012).
Municipality type	In Wisconsin, the three municipalities types (cities, villages, and towns) have differing governance structures and rules about the services they can or must provide (Brauer, 2018; League of Wisconsin Municipalities, n.d.). Furthermore, cities of certain classes may have additional rules and requirements (Brauer, 2018). These differences may impact the content of their local comprehensive plans. While county versus municipal jurisdiction has been assessed as a potential correlate of plan quality in previous studies (Kim & Tran, 2018; Tang, 2008; Tang et al., 2009), to my knowledge, type of municipal as a potential correlate of plan quality has not.
Local health priority areas	
Diet & exercise as priority area in Community Health Assessment	The seriousness of environmental and hazard-related issues has been associated with plan quality within those domains (Burby & Dalton, 1994; Tang, 2008). Theoretically, obesity, diet, and exercise as recognized priorities by local governments should translate to greater incorporation of HEAL components in comprehensive plans.
Housing & transit as a priority area in a	The seriousness of environmental and hazard-related issues has been associated with plan quality within those domains (Burby & Dalton, 1994; Tang, 2008). Theoretically, urban planning and built environment issues as

Community Health Assessment	recognized health priorities by local governments should translate to greater incorporation of HEAL components in comprehensive plans.

Table 2.11: Final operationalization and data sources for independent variables.

Independent variable	**Operationalization in models**	**Data source**
Planning variables		
Year	Year the plan was adopted. Centered at 2000, scaled to 4 years	Gathered from comprehensive plans
Planning capacity	# of staff planners per 10,000 population	Gathered from municipal websites and communication with municipal staff; 2022†
	Has at least one staff planner	Gathered from municipal websites and communication with municipal staff; 2022†
Consultant	Consultant as the primary author of plan	Gathered from comprehensive plans
Municipal variables		
Population	Natural log	2010 Census
Population density	People per square mile; scaled to 1,000*	2010 Census
Population change	Average annual population change 2000-2020, as a percentage of 2000 population; scaled to 0.25 percentage points*	2000 and 2020 Census
Income	Median household income; scaled to $25,000*	2008-2012 American Community Survey 5-year estimates
Education	% of population with Bachelor's degree or higher; scaled to 15 percentage points*	2008-2012 American Community Survey 5-year estimates
Democratic voting	% Democratic vote in 2008 presidential election; scaled to 10 percentage points*	Wisconsin Elections Commission
Municipality type	Indicator variable: 0=city, 1=village/town	Wisconsin Department of Administration, 2017
Local health priority (LHP) variables		
Diet & exercise LHP	Diet & exercise as LHP in a county or municipal health department Community Health Assessment	2021 data gathered by the University of Wisconsin Population Health Institute†
Housing & transit LHP	Housing & transit as a LHP in a county or municipal health department Community Health Assessment	2021 data gathered by the University of Wisconsin Population Health Institute†

*Variables scaled to near their (unweighted) standard deviation, exact scaling values chosen for interpretability.

†Archival data was not available for earlier years corresponding to the timeframe when the comprehensive plans were adopted.

We ran a univariate regression model for each combination of independent variable and score (12 independent variables x 14 dependent variables = 168 models). Then, we ran each of these models again with municipal population as a covariate (11 independent variables x 14 dependent variables = 154 models) because a) the population variable was overwhelmingly the most strongly associated with comprehensiveness and strength scores across sections; b) many of the other independent variables were correlated with population. In total, this analysis is comprised of 322 regression models.

2.3 Results

2.3.1 Results of reliability testing

According to Lyles and Stevens, protocols used to asses plan quality should have mutually exclusive scoring options, employ objective criteria, and be clearly written with specific rules for scoring (Lyles & Stevens, 2014). While the Scorecard does include specific guidance for scoring a 1 and 2 for each item, we found that significant extra guidance was required for coders to apply the Scorecard consistently across real comprehensive plans. In particular, many clarifications had to be made about what plan content exactly would count to score a 1 or 2 for each item. As noted in the Methods section, we created a Coding Guide to gather all of this extra guidance.[8]

Depending on the section in the Scorecard, coders took between three and nine training rounds to achieve eligibility for independent coding. Certain coders could not achieve adequate reliability levels for certain sections. In these cases, coders dual coded plans or simply left coding those sections to other members of the team who had achieved adequate reliability

[8] The Coding Guide is freely available in the OSF repository for the project, https://osf.io/h48qk/.

independently. For example, only one coder reached adequate reliability for the Health Care Access section, and so they coded every plan for that section.[9]

Across coders and sections of the Scorecard, initial (first-round) ICCs averaged 0.79 but ranged from 0.15 to 0.99. Final ICCs averaged 0.89 and ranged from 0.65 to 1.00. The mean final ICCs across coders, the final ICC ranges across coders, the mean rounds to reach adequate reliability, and the range of rounds to reach reliability, as well as the number of coders that eventually reached adequate reliability for each section are displayed in Table 2.12.

Table 2.12: Summary statistics of reliability training and testing.

Section	Comprehensiveness scores		Strength scores		Rounds to adequate reliability		# of coders who reached adequate reliability*
	Mean ICC**	**ICC range****	**Mean ICC****	**ICC range****	**Mean rounds**	**Rounds range**	
Vision & Strategy	0.82	0.75, 0.88	0.77	0.65, 0.90	7.7	5, 9	3
Active Transportation	0.85	0.80, 0.96	0.88	0.80, 0.92	3.7	3, 4	3
Healthy Food Access	0.95	0.90, 1.00	0.94	0.88, 0.98	4.3	4, 5	3
Parks & Recreation	0.93	0.78, 1.00	0.93	0.80, 1.00	3.0	3, 3	4
Health Care Access	0.86	0.85, 0.87	0.89	0.87, 0.90	5.0	5, 5	1
Community Design	0.95	0.89, 0.99	0.93	0.78, 0.99	3.3	3, 4	4

*This is based on (a) how coders performed in reliability testing and (b) turnover in the coding team. Some coders were only trained to code certain sections of the Scorecard because they either left the project early or were hired after the start of the project.
**Mean and range across coders for the final ICCs, or the two rounds of reliability testing that counted towards independent coding eligibility.

[9] The Health Care Access section was the smallest section, with only three items. This could have contributed to the difficulty several coders faced in reaching adequate reliability. The limited number of items meant that there was simply less room for error in coding this section.

2.3.2 Results of acquiring comprehensive plans

All but two of the 116 municipalities selected into the sample had adopted comprehensive plans (98.3%). Both municipalities missing comprehensive plans were villages in the Southeastern RPC. Both were listed as partners in multijurisdictional, county-level comprehensive plans; however, we found no record of the two villages officially adopting those multijurisdictional plans as their municipal-level comprehensive plans. Municipalities without comprehensive plans were given scores of 0 for each item in the Scorecard for the purpose of analysis. We conducted all analysis with and without these datapoints, and the results were similar both ways.

2.3.3 Results of descriptive analysis

Comprehensiveness scores in Table 2.13 represent the statewide mean percentage of items that scored a 1 or 2 in each section while strength scores represent the statewide mean percentage of points scored in each section. Wisconsin municipalities are comprehensive planning for HEAL with overall moderate comprehensiveness and low strength. On average, they include just under half of the items on the Scorecard in their comprehensive plans and achieve about 37 out of 100 possible points.

The range of scores is quite wide. Some municipalities in Wisconsin are not including any HEAL-promoting goals or policies in their comprehensive plans. On the other hand, the highest overall comprehensiveness score in our sample was 92%, meaning that at least one municipality scored 0s on as few as 4 out of 50 items in the Scorecard. The highest overall strength score was 79%, meaning that at least one municipality scored as many as 79 out of a possible 100 points. The histograms in Figure 2.1 show that the overall scores are relatively normally distributed, meaning that within the wide range of scores, there is a concentration of

municipalities around the mean with a relatively equal number of low- and high-scoring municipalities.

Table 2.13: Estimated statewide mean comprehensiveness and strength scores for each section and overall.

	Comprehensiveness score (%)			Strength score (%)			St. to Co.*
Section	**Mean**	**95% CI**	**Range**	**Mean**	**95% CI**	**Range**	
Vision & Strategy	31.2	29.0, 33.3	0, 100	26.6	24.6, 28.6	0, 75.0	0.9
Active Transportation	56.2	53.1, 59.3	0, 100	43.2	40.6, 45.8	0, 96.2	0.8
Healthy Food Access	27.0	24.5, 29.5	0, 87.5	21.5	19.3, 23.7	0, 87.5	0.8
Parks & Recreation	65.3	62.2, 68.4	0, 100	45.8	43.4, 48.2	0, 90.0	0.7
Health Care Access	61.2	57.3, 65.0	0, 100	40.2	37.2, 43.3	0, 100	0.7
Community Design	51.5	48.6, 54.4	0, 100	41.7	39.4, 44.0	0, 86.7	0.8
Overall	*48.3*	*46.0, 50.6*	*0, 92.0*	*37.4*	*35.5, 39.2*	*0, 79.0*	*0.8*

CI: confidence interval
Mean and confidence interval calculated using sampling weights and finite population correction.
*St. to. Co. is the mean strength score as a proportion of the mean comprehensiveness score. It is a way to quantify and compare the discrepancy between the strength and comprehensiveness scores in each section.

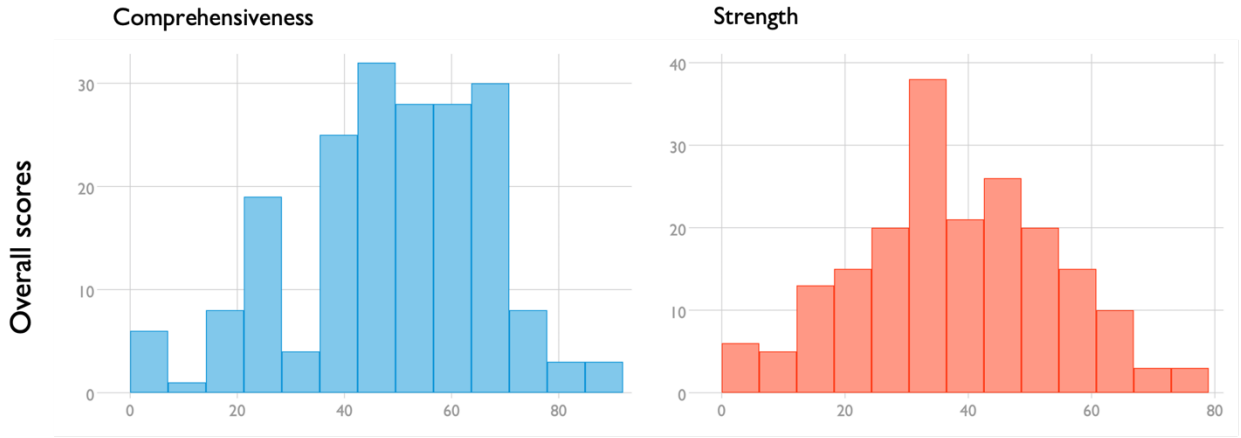

Figure 2.1: Histograms of overall comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

As can be seen in Table 2.13, the wide range of overall comprehensiveness and strength scores is mirrored in the section scores. However, there are marked differences in the mean scores across sections. Mean scores are highest in the Parks & Recreation section, followed by the Health Care Access section. They are moderate in Active Transportation and Community

Design sections. On average, municipalities score lowest, by far, in the Vision & Strategy and Healthy Food Access sections. The section scores, including the shape of their distributions, are discussed in more depth in sections 2.3.3.1 through 2.3.3.6 below.

2.3.3.1 Vision & Strategy scores

The Vision & Strategy section (Figure 2.2) is comprised of six items concerning the explicit connection between public health and urban planning, the built environment, and land use. On average, urban and suburban municipalities in Wisconsin include just under one-third of the items in the Vision & Strategy section in their comprehensive plans and score about 3 out of a possible 12 points in this section. This makes the Vision & Strategy section the second-lowest scoring section among Wisconsin municipalities. However, it has the highest ratio of strength-to-comprehensive score (rightmost column in Table 2.13).

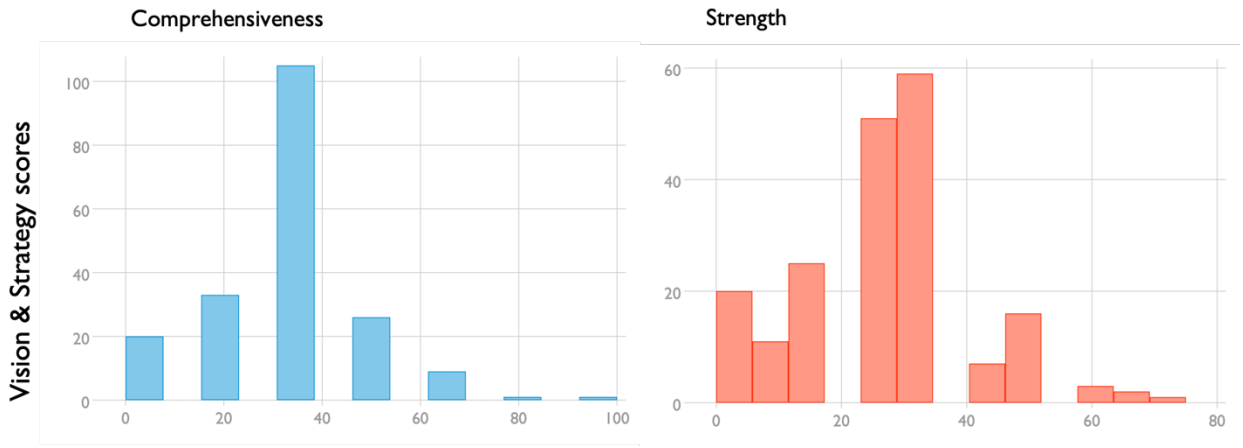

Figure 2.2: Histograms of Vision & Strategy comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

Furthermore, the comprehensiveness and strength scores in this section have a concentration around 30%, which leads to a somewhat leptokurtic distribution. Otherwise, the distributions are approximately normal with slight evidence of right skew. Combined with the high strength-to-comprehensiveness ratio, this indicates that the majority of Wisconsin

municipalities explicitly connect planning, urban design, and the built environment to health outcomes to a low degree in their comprehensive plans. However, the few municipalities that do, do so in a specific and actionable way.

2.3.3.2 Active Transportation scores

The Active Transportation section (Figure 2.3) is comprised of 13 items covering goals and strategies for increasing the safety, convenience, and comfort with which residents bike, walk, and take public transit. On average, municipalities include just over half of the items in this section in their comprehensive plans and score around 11 out of a possible 26 points. This makes the Active Transportation section middle-of-the-pack when comparing across sections of the Scorecard. The strength-to-comprehensiveness ratio is similarly moderate, at 0.8. The distribution of comprehensiveness scores is somewhat left skewed, while the strength scores are relatively normally distributed. While many Wisconsin municipalities are including a breadth of active transportation related goals and objectives in their comprehensive plans, fewer are doing so with specific recommended actions or policies.

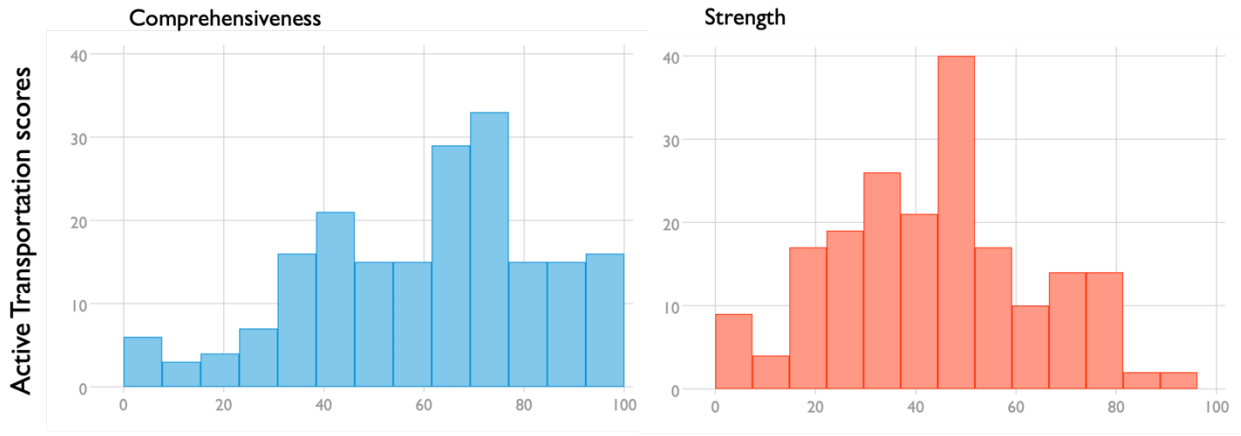

Figure 2.3: Histograms of Active Transportation comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

2.3.3.3 Healthy Food Access scores

The Healthy Food Access section (Figure 2.4) is comprised of 8 items that address strategies for making healthy foods more accessible. On average, municipalities include just over one-quarter of items in this section in their comprehensive plans and scored around 3.5 out of a possible 16 points. This section is the lowest scoring section among Wisconsin municipalities and has a moderate strength-to-comprehensiveness ratio. Both comprehensiveness and strength scores exhibit right skew, meaning that the bulk of municipalities score poorly in this section with a few high-scoring deviants.

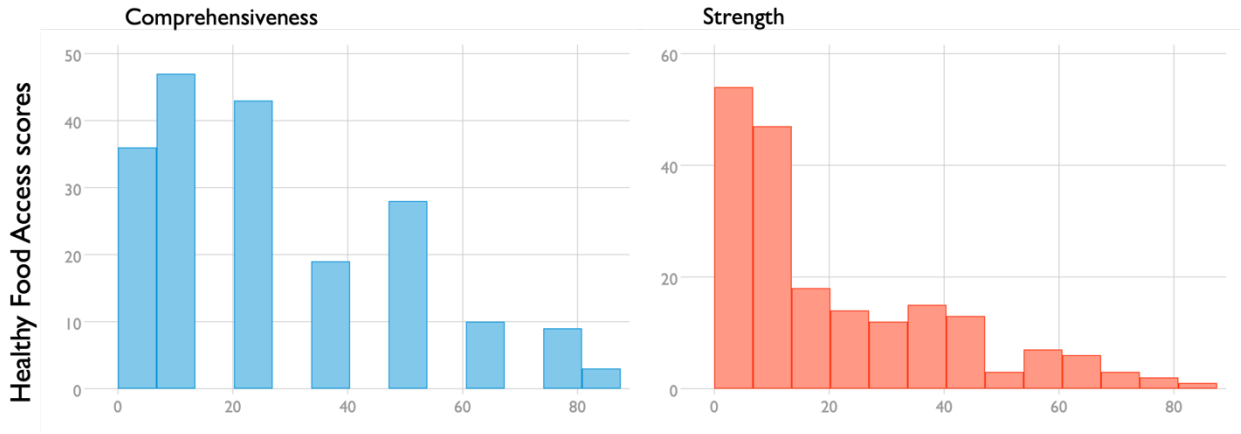

Figure 2.4: Histograms of Healthy Food Access comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

2.3.3.4 Parks & Recreation scores

The Parks & Recreation section (Figure 2.5) is comprised of five items concerning the provision of quality parks, open spaces, and opportunities to recreate. On average, municipalities include just under two-thirds of items in this section in their comprehensive plans and score around 4.5 out of a possible 10 points in this section. This makes Parks & Recreation the highest scoring section among Wisconsin municipalities.

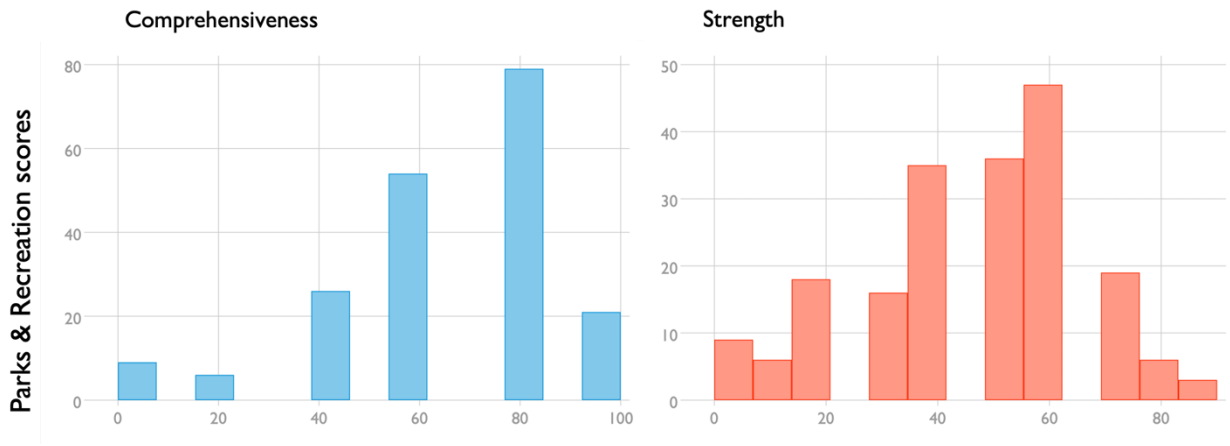

Figure 2.5: Histograms of Parks & Recreation comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

The comprehensiveness scores for this section are left-skewed. The majority of municipalities achieve a comprehensiveness score in this section of at least 60%, with many achieving a score of at least 80%. This indicates that most Wisconsin communities are incorporating most of the Parks & Recreation goals and objectives identified in the scorecard, while a small number of communities are incorporating only a few (or none at all). The strength scores, on the other hand, are approximately normal. In addition, the strength-to-comprehensiveness ratio is one of the lowest across sections, at 0.7. This means that, while most municipalities include many Parks & Recreation goals, objectives, and policies in their comprehensive plans, the specificity and actionability of these components is more limited.

2.3.3.5 Health Care Access scores

The Health Care Access section (Figure 2.6) is the shortest section with only three items. These items cover access to health services and maintaining access to services for seniors. On average, municipalities include just under two-thirds of items in this section in their comprehensive plans and they score around 2.5 out of a possible 6. This is the second-highest scoring section among Wisconsin municipalities. However, like the Parks & Recreation section, this section has one of

the lowest strength-to-comprehensiveness ratios. The distribution of comprehensiveness and strength scores show a similar pattern to the Parks & Recreation section as well. The comprehensiveness scores are also left-skewed, though less pronounced than in the Parks & Recreation section. The strength scores are relatively normally distributed. Therefore, as with the Parks & Recreation section, most municipalities incorporate most of the goals, objectives, and policies related to health care access into their comprehensive plans, the actionability and specificity is somewhat lacking.

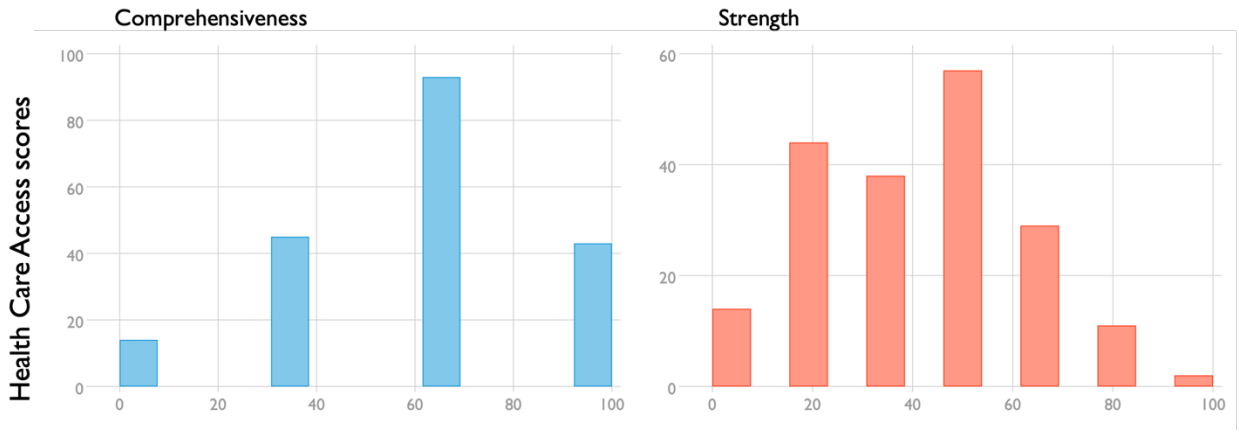

Figure 2.6: Histograms of Health Care Access comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

2.3.3.6 Community Design scores

The Community Design section (Figure 2.7) is the longest section with 15 items. These items cover aspects of urban design, from land use to streetscape scale. On average, municipalities include about half of the items in this section in their comprehensive plans and score around 6.5 out of a possible 30 points in this section. When compared to the other sections in the Scorecard, Community Design is moderately-scoring, as is the strength-to-comprehensiveness ratio. The histograms for the Community Design comprehensiveness and strength scores show approximately normal distributions. While the bulk of urban and suburban municipalities in

Wisconsin plan for active community design to a moderate degree, the number of municipalities who are thoroughly and strongly planning for active community design versus minimally engaging with these planning practices is pretty even.

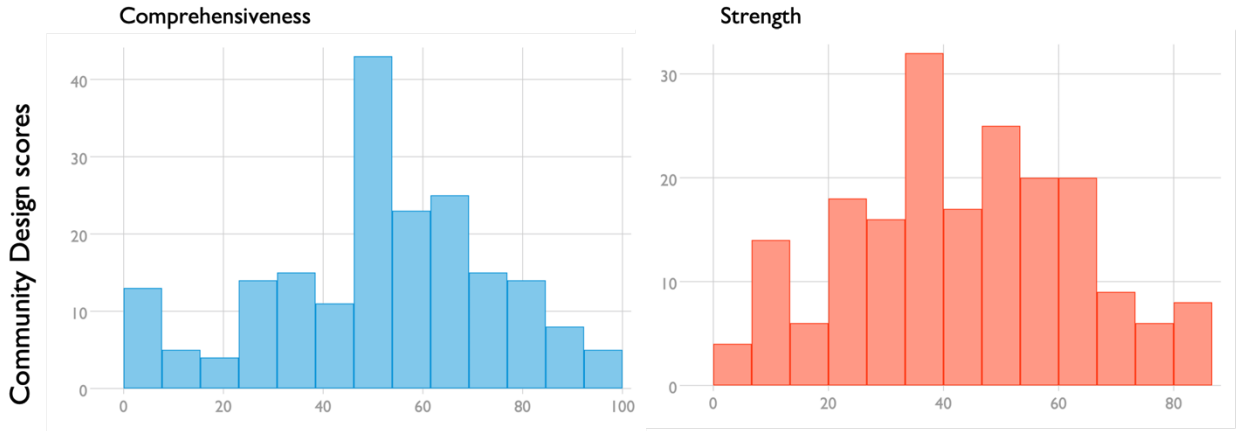

Figure 2.7: Histograms of Community Design comprehensiveness and strength scores (produced using sampling weights to estimate distribution of scores in suburban and urban municipalities statewide).

2.3.4 Results of regression analyses

Figure 2.8 and Figure 2.9 show that, when not controlled for municipal population, most of the independent variables show statistically significant, positive relationships with plan scores across many of the Scorecard sections. Municipal population is the most consistent and strongest correlate of plan scores in the unadjusted models. When adjusted for municipal population, most of the relationships we observed in the unadjusted models are attenuated—many to the point of no longer being statistically significant. In these models, Democratic voting, the year the plan is adopted, consultant as the primary plan author, and housing and transit as a local health priority consistently correlate with HEAL promotion in comprehensive plans, across most sections. Surprisingly, income, education, and planning capacity display mostly non-significant, but sometimes negative, correlations with plan quality. In sections 2.3.4.1 through 2.3.4.3, below, I discuss each independent variable in turn.

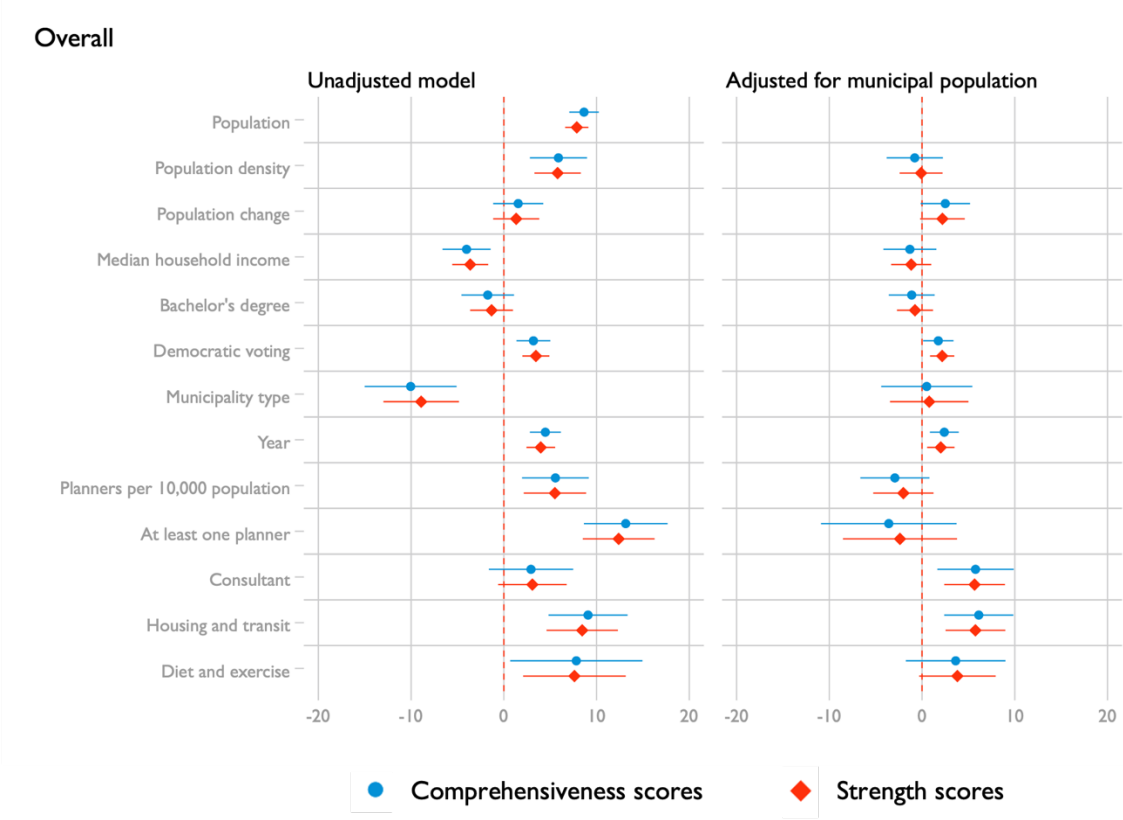

Figure 2.8: Percentage point differences in overall scores associated with a one-unit change in each independent variable, with 95% confidence intervals. See Table 2.11 for scaling information for each independent variable.

2.3.4.1 Municipal correlates

2.3.4.1.1 Population

In the unadjusted models, the natural log of population is the strongest, most consistent correlate of comprehensiveness and strength scores, across subsections. The p-value for the coefficient is 0.000 in all sections and overall. Because of the log transformation of the variable, the regression coefficients can be interpreted as the percentage point change in score per percent increase in population. I used the formula $\beta * \ln(2.0)$ to calculate the change in scores per each doubling (or 100% increase) in municipal population. The results of these calculations can be seen in Appendix 4.

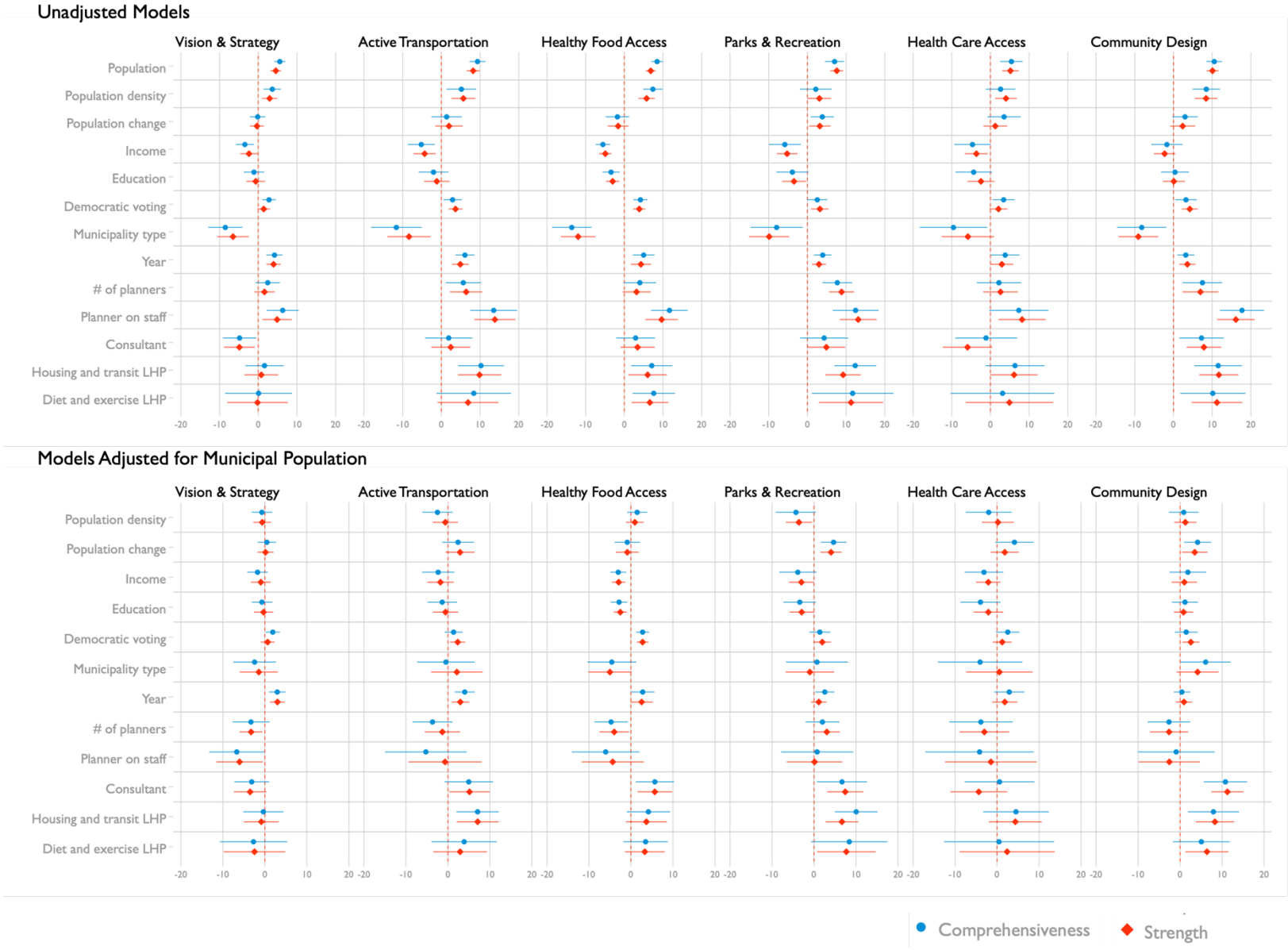

Figure 2.9: Percentage point differences in section scores associated with a one-unit change in each independent variable, with 95% confidence intervals. See Table 2.11 for scaling information for each variable. Appendix 2 contains tables of point estimates, confidence intervals, and p-values for each regression coefficient for each model.

Each doubling of municipal population is associated with a 6.0 percentage point increase (95% CI: 4.9,7.1) in comprehensiveness score and a 5.5 percentage point increase (95% CI: 4.6,6.3) in strength score across the entire Scorecard. The correlation coefficients for the sections range from 3.1 (Vision & Strategy, strength) to 7.3 (Community Design, comprehensiveness) percentage point differences for each doubling of population.

2.3.4.1.2 Population density

Population density is a statistically significant, positive correlate of comprehensiveness and strength scores for most sections (the exception being comprehensiveness scores for the Parks & Recreation and Health Care Access sections) in the unadjusted models. It is also associated with higher overall comprehensiveness and strength scores. Many of these associations, including that for overall scores, are significant at the 0.001 confidence level. However, almost all of these associations are statistically insignificant when I control for population. This is not unexpected, as population density tends to increase as municipal population does (Pearson correlation = 0.66), so many of the observed relationships between population density and plan scores can be explained by population instead of population density.

When I control for municipal population, population density has a negative, statistically significant relationship with Parks & Recreation strength scores. This means that, when comparing municipalities of similar population sizes, those with higher population densities have lower Parks & Recreation strength scores, or they have a similar breadth of Parks & Recreation policies, but the strength of those policies is lacking. Each 1,000 people per square mile is associated with 3.5 percentage point (95% CI: -6.7,-0.5) lower Parks & Recreation strength score.

2.3.4.1.3 Population change

The annual population change rate is only associated with Parks & Recreation scores in the unadjusted models. When I control for population, however, it is significantly, positively associated with higher Parks & Recreation scores and higher Community Design scores. This means that, for municipalities with comparable population sizes, those with higher population change rates include both more and stronger goals, objectives, and policies related to parks access and quality and active urban design features and land use. An increase of 0.25 percentage points of population change is associated with an increase in these scores of about 3.5-4.5 percentage points.

2.3.4.1.4 Municipality type

In the unadjusted models, municipality type is significantly associated with comprehensiveness and strength scores across most sections, with villages/towns being associated with lower scores than cities (the one exception being strength scores in the Health Care Access section, which showed no significant association). The village/town designation is also associated with lower overall comprehensiveness and strength scores. Many of the relationships observed in the unadjusted models are significant to the 0.001 confidence level. However, these relationships almost all become statistically insignificant when I control for population. This is expected. While there are no population-based qualifications for municipalities to be designated as cities in Wisconsin, larger municipalities tend to be designated as cities (Pearson correlation = 0.52).

Once I adjust for population, municipality type is still significantly associated with comprehensiveness scores for the Community Design section. For municipalities of comparable population sizes, villages and towns had more comprehensive goals, objectives, and policies related to active urban design features and land use. When adjusting for population, the

village/town designation is associated with a 6.1 percentage points higher score in this section than the city designation (95% CI: 0.1, 12.1).

2.3.4.1.5 Income and Education

In unadjusted models, median household income shows statistically significant, negative relationships with all section scores except for comprehensiveness and strength scores in the Community Design section. It is also associated with lower overall comprehensiveness and strength scores. Many of these relationships are not apparent, however, when I adjust for municipal population. When controlling for population, higher median household income is still significantly associated with lower Healthy Food Access comprehensiveness and strength scores and lower Parks & Recreation strength scores. This means that, for municipalities of comparable populations, those with higher median incomes include fewer and weaker goals, objectives, and policies related to local, healthy food systems and weaker policies related to providing access to quality parks. Each increase in median household income of $25,000 is associated with a decrease in these scores of about 3 percentage points.

The percent of the population with a Bachelor's degree or higher shows a very similar relationship with plan scores as income. This is expected, as these two independent variables show a strong correlation, despite measuring different constructs (Pearson's correlation coefficient = 0.84). In adjusted models, it also has a statistically significant, negative association with Healthy Food Access comprehensiveness and strength scores and lower Parks & Recreation strength scores (about 2.5-3 percentage point difference per 15 percentage points of the population with a Bachelor's degree or higher). However, unlike the income variable, the education variable is not associated with other section scores in the unadjusted models.

2.3.4.1.6 Voting patterns

In unadjusted models, the percent of Democratic votes in the 2008 presidential election is significantly, positively associated with scores in all sections (though sometimes it is only associated with comprehensiveness *or* strength scores, and not both). It is also associated with higher overall comprehensiveness and strength scores. Many of these relationships are significant at the 0.001 confidence level, including both overall scores.

These relationships are attenuated when I adjust for population. However, among the correlates I tested, Democratic voting percentage remains one of the most consistent correlates of comprehensive plan scores after adjusting for population. It is associated with higher comprehensiveness scores in the Vision & Strategy section; higher strength scores in the Active Transportation and Community Design sections; and higher comprehensiveness and strength scores in the Healthy Food Access section and overall. This means that, for municipalities with comparable populations, those with higher percentages of Democratic voting were more likely to make explicit connections between planning, the built environment, and HEAL; include stronger goals, objectives, and policies related to active urban design, infrastructure, and land use; and more and stronger goals, objectives, and policies related to creating a healthy local food system. For every 10 percentage point increase in Democratic voting, there is an increase in these scores by about 2-3 percentage points.

2.3.4.2 Plan and planning correlates

2.3.4.2.1 Consultant planner

Having a consultant as a primary plan author was one of the most consistent correlates of plan scores that I tested. In unadjusted models, having a consultant as the primary author of the plan is associated with lower Vision & Strategy comprehensiveness and strength scores, higher

Community Design comprehensiveness and strength scores, and higher Parks & Recreation strength scores. When I adjusted for population, the positive relationship between having a consultant as the plan author and plan scores was strengthened and the negative association with Vision & Strategy section scores was no longer significant. When adjusting for population, having a consultant as the primary plan author has a significant, positive association with Healthy Food Access, Parks & Recreation, Community Design, and overall comprehensiveness and strength scores and Active Transportation strength scores. This means that, for municipalities of comparable population sizes, those who had a consultant as their primary plan author had more and stronger goals, objectives, and policies related to promoting local, healthy foods; access to quality parks; and active urban design features and land use, as well as stronger goals, objectives and policies related to promoting walking, biking, and transit use.

In addition to being a consistent correlate of higher plan scores, having a consultant as the plan author is also a strong correlate, with four relationships rising to 0.001 confidence level: Community Design comprehensiveness and strength scores, Parks & Recreation strength scores, and Overall strength scores. This is also reflected in the relatively large correlation coefficients. In the adjusted models, having a consultant as the primary plan author was associated with a difference in plan section scores of about 5-11 percentage points. The largest correlation coefficients were for the Community Design section (10.8 percentage points for comprehensiveness scores and 11.3 percentage points for strength scores).

2.3.4.2.2 Planning capacity

In the unadjusted models, having at least one planner on staff has a statistically significant, positive relationship with comprehensiveness and strength scores in all sections and overall, except for Health Care Access comprehensiveness scores. The relationships in the Active

Transportation, Healthy Food Access, Parks & Recreation, and Community Design sections, as well with overall scores, all rise to the 0.001 confidence level. The magnitude of the coefficients is also quite large. Before adjusting for population, having a planner on staff is associated with about 5-18 percentage point differences in scores. In addition, the number of planners municipalities have on staff per 10,000 population is also associated with higher comprehensiveness and strength scores in the Active Transportation, Parks & Recreation, and Community Design Section, as well as overall in the unadjusted models. In sections where it is statistically significant, each extra planner per 10,000 population is associated with about a 6-9 percentage points difference in scores.

However, adjusting for population negates all of these positive associations and introduces significant negative relationships between planning capacity variables and Vision & Strategy and Healthy Food Access scores. For municipalities of comparable population sizes, those who have a planner on staff include fewer and weaker statements about the explicit connections between planning, the built environment, and HEAL. Having a planner on staff is associated with about a 6-7 percentage point difference in scores in this section. Similarly, for municipalities with comparable population sizes, those with more planners on staff per population include fewer and weaker goals, objectives, and policies related to creating a healthy local food system and weaker statements about the explicit connections between planning, the built environment, and HEAL. For each additional planner per 10,000 population, there is a difference in scores in these sections of about 3-5 percentages points.

2.3.4.2.3 Year the plan is adopted

In the unadjusted models, the year the plan is adopted is associated with higher comprehensiveness and strength scores in all sections and overall. The relationships with Vision

& Strategy, Active Transportation, and overall scores, as well as Healthy Food Access and Parks & Recreation comprehensiveness scores are significant at the 0.001 confidence level. Most of these relationships persist once I control for population, though they are attenuated. When I adjust for population, the year the plan is adopted is associated with higher Vision & Strategy, Active Transportation, and overall scores, as well as Parks & Recreation comprehensiveness scores. For municipalities with comparable population sizes, those that (wrote and) adopted their plan in more recent years include more and stronger statements about the explicit connections between planning, the built environment, and HEAL; more and stronger goals, objectives, and policies to promote biking, walking and using transit; and more goals, objectives, and policies related to improving access to healthy, local foods and quality parks. Every four years more recently the plan was adopted is associated with a difference of about 2-4 percentage points in these section scores.

2.3.4.3 Local health priority correlates

2.3.4.3.1 Diet and exercise as a local health priority

In unadjusted models, diet and exercise as a local health priority is associated with higher Healthy Food Access, Parks & Recreation, and Community Design scores, as well as overall plan scores. However, the only statistically significant relationships that persist when I adjust for population are with Parks & Recreation and Community Design strength scores. This means that, for municipalities with comparable populations, those with diet and exercise identified at a local health priority in a Community Health Assessment include stronger goals, objectives, and policies related to access to quality parks and active urban design features and land use in their comprehensive plan. Having diet and exercise identified as a local health priority is associated with a difference in these scores of about 6-8 percentage points.

2.3.4.3.2 Housing and transit as a local health priority

Having housing and transit identified as a local health priority in a Community Health Assessment is one of the most consistent correlates of plan scores. In unadjusted models, having housing and transit identified as a local health priority is associated with higher scores in every section except the Vision & Strategy section (and only strength scores in the Health Care Access section). It is also associated with higher overall scores. The relationships with Active Transportation, Parks & Recreation, Community Design, and overall scores are significant at the 0.001 level. Even when I adjust for population, housing and transit as a local health priority is associated with higher Active Transportation, Parks & Recreation, Community Design, and overall comprehensiveness and strength scores. This means that, for municipalities with comparable populations, those with housing and transit identified at a local health priority include more and stronger goals, objectives, and policies related to active urban design, infrastructure, and land use, as well as promoting access to quality parks, in their comprehensive plan. The correlation coefficients for this variable are also some of the largest in the project. Having housing and transit identified as a local health priority is associated with about 6-10 percentage point differences in plan scores.

2.4 DISCUSSION

2.4.1 Coding comprehensive plans using the Healthy Living and Active Design Scorecard

The norm in comprehensive plan evaluation research is to dual code plans, conduct minimal reliability training and testing, and to report percent agreement rather than a chance-corrected measure of reliability (Lyles & Stevens, 2014). In order to assess a larger sample efficiently, we tried independent coding paired with an extensive system of reliability training and testing using

intraclass correlation coefficients (ICCs). However, we found that reaching adequate inter-rater reliability levels (as measured by ICCs) took many months of training and discussion, even when using a validated and pre-tested Scorecard. In contrast, in Maiden et al.'s pretesting of the Scorecard, after a short period of training and discussion, dual coder groups achieved ICCs that ranged from 0.70 to 0.97 (2017). This difference in experience could be attributed to the differing experience levels of our coding team (which included undergraduate students, Masters students, and a PhD student) and the Maiden et al. teams (which included scientists and public health specialists with Masters or PhD degrees). Additionally, the ICCs used in the pretesting measured consistent agreement, whereas the ICCs we used measured absolute agreement.

Overall, it is unclear if, in the end, using independent coding was more efficient than dual-coding every plan in our sample. We cautiously advise that future comprehensive plan evaluation efforts use the dual coding method, as recommended by Lyles and Stevens (2014). Furthermore, we recommend that coders are at least Masters-level students with knowledge of urban planning. The members of our team that were at least Masters-level students were able to achieve adequate reliability levels for each section more quickly than the undergraduate members of the team.

2.4.2 The state of comprehensive planning for HEAL in Wisconsin

Wisconsin municipalities are comprehensive planning for HEAL with overall moderate comprehensiveness and low strength. Municipalities score highest in the Parks & Recreation section, followed by the Health Care Access section. They score moderately in Active Transportation and Community Design sections. Municipalities score lowest, by far, in the Vision & Strategy and Healthy Food Access sections.

These findings are consistent with the APA's survey of planning directors and evaluation of 18 comprehensive plans and four sustainability plans (Hodgson, 2011; Ricklin et al., 2012). These studies also found that the topics of parks & recreation and active transportation were addressed consistently and strongly, that most plans did not address healthy food access, and that plans lacked an explicit discussion of the connection between health, the built environment, and planning (Vision & Strategy section in our assessment) (Hodgson, 2011; Ricklin et al., 2012). While explicitly planning for HEAL and healthy food systems planning are relatively new movements in modern urban planning (Vitiello & Brinkley, 2014), community design, transportation planning, planning for community services, and parks and recreation planning have been fundamental components of the planning profession for longer. In addition (and possibly because of this), the four higher-scoring sections are addressed in Wisconsin's comprehensive planning statute while the lower-scoring sections are omitted. It is possible, therefore, that the differences between scores observed across sections is tied to state-level policy governing local-level planning practice.

The range of scores in our sample is wider than a pilot assessment using the same Scorecard, conducted by Maiden et al. on 42 comprehensive plans selected to represent a range of geographies and populations (2017). Their evaluation found overall comprehensiveness scores between 20% and 78% and overall strength scores between 13% and 69% (Maiden et al., 2017). This is surprising, given our sample was likely less diverse (drawn from within the same state and excluding rural and small-town communities). Our larger sample size could have allowed for a greater number of "deviant" comprehensive plans—or those municipalities that planned very well or very poorly for HEAL. Another explanation may be that Wisconsin's urban and suburban municipalities truly do plan for HEAL with greater variation than the nation as a whole.

Strength scores across sections are lower than comprehensiveness scores. The rightmost column in Table 2.13 compares this discrepancy across sections by displaying the mean strength score as a proportion of the mean comprehensiveness score. While the scores may be high in the Parks & Recreation and Health Care Access sections, the discrepancy between the comprehensiveness and strength scores is also the highest. In these sections, municipalities incorporate a breadth of goals and aspirational statements into their comprehensive plans, but they often omit specific, actionable steps to achieve those goals. For example, they may set goals to improve access to parks or health care services for residents without using data to identify the areas most in need of those resources or providing policy options for improving access. The discrepancy is lowest in the Vision & Strategy section. When municipalities include statements about the explicit connection between planning, the built environment, and HEAL, they are more likely to back up these statements with specific plans, analysis, or recommendations.

2.4.3 Contextual factors associated with incorporation of HEAL into comprehensive plans

Figure 2.8 and Figure 2.9 show that, when not controlled for municipal population, most of the independent variables show statistically significant, positive relationships with plan scores across many of the Scorecard sections. When adjusted for municipal population, most of the relationships we observed in the unadjusted models are attenuated—many to the point of no longer being statistically significant. However, the year the plan is adopted, consultant as the primary plan author, Democratic voting, and having housing and transit identified as a local health priority consistently correlate with HEAL promotion in comprehensive plans, across most sections. Below, I discuss how these findings relate to previous studies and what they may mean for future research.

2.4.3.1 Municipal population: A strong correlate of plan quality

Municipal population is the most consistent and strongest correlate of plan scores in the unadjusted models. This finding is unsurprising, as population has been positively correlated with plan quality in many other studies (Brody et al., 2004; Bunnell & Jepson, 2011; Kim & Tran, 2018; Peterson et al., 2018; Tang & Brody, 2009). Municipalities with higher populations are likely to have greater resources and planners on staff with expertise in subjects related to HEAL, such as active transportation, sustainability, or smart growth.

When I include municipal population as a covariate alongside other potential correlates of plan scores, it remains a consistently strong correlate of plan quality. This is a somewhat novel finding among plan evaluation literature. While municipal population has often been found to be a strong correlate of plan quality in the past, in previous studies when it has been included alongside other independent variables, it is usually found to be no longer statistically significant (Kim & Tran, 2018; Tang et al., 2009). This difference in findings could be driven by the logarithmic transformation of the population variable—perhaps when modeled in this way, population becomes a stronger correlate of plan quality. It could also be that planning for HEAL is more strongly linked to population than previously studied topics, such as environmental sustainability.

2.4.3.2 Year and consultant plan author: Confirming previous correlates of plan quality

Our findings that year of plan adoption and consultant plan authorship are correlated with higher plan scores confirms and extends previous findings. Studies have found that newer plans are stronger with regard to natural hazard mitigation (Brody, 2003a), environmental sustainability (Tang et al., 2009; Tang & Brody, 2009), green infrastructure (Kim & Tran, 2018), and social equity (Loh & Kim, 2021). When taken together, this body of findings may indicate that

communities and planners are indeed "learning how to make better plans over time," as Brody suggested (2003a, p. 198). More specifically with regards to planning for HEAL, more recent plans might be influenced by the resurgence of interest in planning for health, including advocacy, education, and resource efforts by the APA, the American Public Health Association, and other organizations.

Meanwhile, studies have found the involvement of a consultant to be associated with higher overall plan quality (Stevens, 2013), better communicative quality (Bunnell & Jepson, 2011), and the inclusion of indigenous rights in local plans (P. R. Berke et al., 2002). Consulting firms may possess more experience with comprehensive planning, greater technical expertise and skills, and access to a more multi-disciplinary network. Consultants may be more up to date on current planning trends, including the move to plan for community health and well-being.

2.4.3.3 Democratic voting and local health priorities: New correlates of plan quality

Democratic voting and local health priorities have not been tested before for associations with comprehensive plan quality. However, political conservatism has been associated with opposition to bicycling infrastructure (Wilson & Mitra, 2020); smart growth (Lewis, 2015; Slaton, 2012); and policies, systems, and environmental approaches to obesity prevention (Barry et al., 2009; Welch et al., 2012). Opposition to these policies might be based on the conservative preference for small government, the free market, and the supremacy of individual property rights (Phillips-Fein, 2011; Schilling & Keyes, 2008). However, drawing on research in social psychology and political behavior, Lewis (2015) argues that such opposition may not be completely based in a rational, cohesive political ideology. Instead, he posits that conservative opposition to mixed-use, dense, transit-oriented development comes from deep-seated moral intuitions that favor single-family, suburban, auto-centric neighborhoods as the "correct" way to

order a community (Lewis, 2015). In any case, our results add to a growing body of research showing that planning policies that promote health can be highly political.

The connection between having housing and transit identified as a local health priority and plan scores is less clear and requires further investigation. It is possible that local health departments in communities with poor housing and transit infrastructure designate this as a local health priority to improve conditions *and* that local planning efforts also independently focus on this area in writing their comprehensive plans, thus earning higher HEAL scores. It is also possible that local health departments that identify housing and transit as a priority area are more likely to work *with* their local planning department to incorporate HEAL promotion into their local comprehensive plan, though previous research shows that such collaboration is not commonplace (Lemon et al., 2015).

2.4.3.4 Income, education, and planning capacity: Surprising findings

When we compare municipalities of the same population size, we find insignificant and, sometimes, negative associations between plan quality and income, education, and planning capacity. This is surprising, as previous studies have found positive relationships between these factors and plan quality.

Previous studies between income, education, and plan quality have usually found either null (Brody, 2003b; Kim & Tran, 2018; Loh & Kim, 2021; Tang & Brody, 2009) or positive associations (Brody et al., 2004; Burby & Dalton, 1994). In fact, studies of active living components in comprehensive plans have found positive associations with income (Aytur et al., 2007) and education (Peterson et al., 2018). Only one other plan evaluation study has found a negative association between wealth and the inclusion of sprawl reducing measures in local comprehensive plans, though they found that education had a positive association (Brody et al.,

2006). Income and education are associated with lower Healthy Food Access and Parks & Recreation scores. In high-income/education municipalities, where food security and park access/quality may already be high, there may be less perceived need for healthy food system or parks and recreation planning.

Previous studies found planning capacity to be a correlate of higher quality plans across topic areas, even after controlling for population (P. R. Berke et al., 2002; Kim & Tran, 2018; Loh & Kim, 2021; Tang & Brody, 2009). Planning capacity is associated with lower Vision & Strategy and Healthy Food Access scores. These are the sections in which Wisconsin municipalities score the lowest and they cover topics that—compared to active transportation or parks & recreation, for example—are less traditional planning topics. It may be that staff planners are "planning what they know," or enhancing plan quality within traditional planning domains at the expense of nontraditional ones. It is also possible that other dimensions of planning capacity—not captured by the variables used in this analysis—would show stronger correlations with the incorporation of HEAL into local plans. For example, Göçmen and LaGro found that Wisconsin planners' knowledge and values about sustainability varied widely across the state and was associated with more local permitting for conservation subdivisions and smart growth developments (2016).

2.4.4 Limitations

This study was cross-sectional, so our results indicate correlations between the independent variables and HEAL-promotion in comprehensive plans, but not causation. Our sample was limited to Wisconsin municipalities, and thus our results are not generalizable outside of the state. Our sample also excluded rural municipalities because the Healthy Living and Active Design Scorecard was not appropriate for assessing small, rural communities in Wisconsin. For

this same reason, we focused on municipal rather than county comprehensive plans. In Wisconsin, county-level plans tend to cover rural areas of the county while urban and suburban municipalities usually have municipal-level plans.

Our study focused on comprehensive plans only, not other plans such as bicycle/pedestrian plans, farmland preservation plans, or sustainability plans. However, the comprehensive plans in our sample often referenced these other plans, so our assessment likely captures some of the goals and policies that would be included in those other plans. Lastly, due to capacity constraints, we did not study the implementation of the comprehensive plans, either in enforceable ordinances or on-the-ground built environment conditions. While a number of land use regulations and ordinances are required to be consistent with a locally-adopted comprehensive plan in Wisconsin, the enforcement of this legislation is entirely based on litigation. Therefore, it is possible that goals, objectives, and policies identified in local comprehensive plans are not always reflected in the local zoning ordinances, development codes, subdivision ordinances, and other land use policies.

2.5 Conclusion

2.5.1 Research implications

Our findings have several implications for future research. Firstly, we showed that, at least in Wisconsin, voting patterns and local health priority areas have relationships with the extent to which local comprehensive plans include HEAL-promoting goals, objectives, and policies. This has important implications for our understanding of the political nature of comprehensive planning and the relationships between local health departments and local planning practice, respectively. Researchers could consider including voting patterns and local health priorities as variables in future studies of plan quality, in particular those related to public health topics.

These two topics could also be further explored using in-depth qualitative research. Studying the connection between local politics and planning for HEAL may reveal strategies for implementing HEAL-supportive built environment policies across the spectrum of political landscapes. Studying the link between housing and transit as an identified local health priority and higher plan scores could tease out the mechanisms behind this relationship and provide actionable information for planners looking to write HEAL-supportive comprehensive plans.

Unlike most other comprehensive plan evaluation studies, we used the log-transformed municipal population as a covariate in our analysis. With this transformation in place, population has a much stronger and more consistent relationship with plan quality than in previous studies. Therefore, future comprehensive plan evaluation research—especially when related to public health—should consider including a log-transformed population variable in the analysis. If nothing else, this allows the researchers to evaluate the correlation of factors such as planning capacity and consultant involvement on plan quality when comparing only communities of similar sizes.

2.5.2 Policy and practice implications

Our results highlight the potential for public health departments and planning consultants to move planning for health forward. Where feasible, municipal planners and decisionmakers should enlist the help of consultants—especially those with expertise in strategies that promote HEAL. States could help with this by providing funding for communities to work with consultants. Planners and local officials involved in comprehensive planning should also develop partnerships with their local public health departments. On the one hand, planners can participate in Community Health Assessments and local priority setting. On the other, planners should include public health officials in the comprehensive planning process. Through these activities,

planners and public health officials could develop shared understanding and public messaging on the connections between HEAL, the built environment, and planning; leverage local health data; and prioritize strategies.

Lastly, our findings may indicate that the APA, American Public Health Association, and other organizations that provide resources and technical assistance on planning for health may be shifting the planning landscape. However, there are still important HEAL-related topics that are often not covered in comprehensive plans. Planning and public health organizations should continue to push for the incorporation of HEAL in comprehensive plans, and potentially target their training and resources towards areas found in this study to need improvement in comprehensive planning for HEAL—healthy food systems, drawing an explicit connection between planning and health, and ensuring HEAL-related goals and policies are strongly-worded and action-oriented.

Local-level governance capacity varies greatly, especially with regard to specific value-laden topical areas. This has been shown to be true for sustainability and smart growth planning in Wisconsin (Göçmen & LaGro, 2016), and is likely true for planning for HEAL as well. The resources these organizations provide have the potential to increase knowledge and values pertaining to planning for HEAL, and thus move the state of the practice forward in Wisconsin and beyond. In addition to the national organizations providing resources to increase planning for HEAL capacity, state or regional organizations such as University of Wisconsin-Extension and RPCs could provide training, technical assistance, and best practice guidelines to Wisconsin planners.

2.5.3 Concluding remarks

Our study shows that municipalities in Wisconsin are starting to incorporate HEAL-promoting components in comprehensive plans, but that more work is needed to ensure that these components cover all important topic areas and are included in an actionable way. Municipalities often include HEAL-promoting aspirations in traditional planning domains like Parks & Recreation, Health Care Access, Active Transportation, and Community Design; however, these goals often lack specific action plans. In addition, municipalities include few components related to Healthy Food Access and or an explicitly health-focused Vision & Strategy. Based on the results of our regression analysis, there is a potentially important role for consultants and for public health departments—as well as national planning and public health organizations—in moving the state of planning for HEAL forward.

2.5.3.1 Author's note

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2.6 References

Alavi, M., Biros, E., & Cleary, M. (2022). A primer of inter-rater reliability in clinical measurement studies: Pros and pitfalls. *Journal of Clinical Nursing*, *31*(23–24), e39–e42. https://doi.org/10.1111/jocn.16514

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2007). Promoting active community environments through land use and transportation planning. *American Journal of Health Promotion*, *21*(4_suppl), 397–407. https://doi.org/10.4278/0890-1171-21.4s.397

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2008). The sociodemographics of land use planning: Relationships to physical activity, accessibility, and equity. *Health & Place*, *14*(3), 367–385. https://doi.org/10.1016/j.healthplace.2007.08.004

Barry, C. L., Brescoll, V. L., Brownell, K. D., & Schlesinger, M. (2009). Obesity metaphors: How beliefs about the causes of obesity affect support for public policy. *The Milbank Quarterly*, *87*(1), 7–47. https://doi.org/10.1111/j.1468-0009.2009.00546.x

Berke, P., & Conroy, M. M. (2000). Are we planning for sustainable development? *Journal of the American Planning Association*, *66*(1), 21–33. https://doi.org/10.1080/01944360008976081

Berke, P. R., Crawford, J., Dixon, J., & Ericksen, N. (1999). Do cooperative environmental planning mandates produce good plans? Empirical results from the New Zealand experience. *Environment and Planning B: Planning and Design*, *26*(5), 643–664. https://doi.org/10.1068/b260643

Berke, P. R., Ericksen, N., Crawford, J., & Dixon, J. (2002). Planning and indigenous people: Human rights and environmental protection in New Zealand. *Journal of Planning Education and Research*, *22*(2), 115–134. https://doi.org/10.1177/0739456X02238442

Berke, P. R., Roenigk, D., J. Kaiser, E., & Burby, R. (1996). Enhancing plan quality: Evaluating the role of state planning mandates for natural hazard mitigation. *Journal of Environmental Planning and Management*, *39*. https://doi.org/10.1080/09640569612688

Brauer, A. (2018). Municipal and County Government. In *Wisconsin Legislator Briefing Book 2019-20*. Wisconsin Legislative Council. https://docs.legis.wisconsin.gov/misc/lc/briefing_book/ch22_municipal.pdf

Brody, S. D. (2003a). Are we learning to make better plans?: A longitudinal analysis of plan quality associated with natural hazards. *Journal of Planning Education and Research*, *23*(2), 191–201. https://doi.org/10.1177/0739456X03258635

Brody, S. D. (2003b). Examining the role of resource-based industries in ecosystem approaches to management: An evaluation of comprehensive plans in Florida. *Society & Natural Resources*, *16*(7), 625–641. https://doi.org/10.1080/08941920309184

Brody, S. D., Carrasco, V., & Highfield, W. E. (2006). Measuring the adoption of local sprawl reduction planning policies in Florida. *Journal of Planning Education and Research*, *25*(3), 294–310. https://doi.org/10.1177/0739456X05280546

Brody, S. D., Highfield, W., & Carrasco, V. (2004). Measuring the collective planning capabilities of local jurisdictions to manage ecological systems in southern Florida. *Landscape and Urban Planning*, *69*(1), 33–50. https://doi.org/10.1016/j.landurbplan.2003.09.002

Brody, S. D., & Highfield, W. E. (2005). Does planning work?: Testing the implementation of local environmental planning in Florida. *Journal of the American Planning Association*, *71*(2), 159–175. https://doi.org/10.1080/01944360508976690

Bunnell, G., & Jepson, E. J. (2011). The effect of mandated planning on plan quality. *Journal of the American Planning Association*, *77*(4), 338–353. https://doi.org/10.1080/01944363.2011.619951

Burby, R. J., & Dalton, L. C. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review*, *54*(3), 229–238. https://doi.org/10.2307/976725

Charron, L. M., Joyner, H. R., LaGro, J., & Gilchrist Walker, J. (2019). Research note: Development of a comprehensive plan scorecard for healthy, active rural communities. *Landscape and Urban Planning*, *190*, 103582. https://doi.org/10.1016/j.landurbplan.2019.05.013

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment*, *6*(4), 284–290. https://doi.org/10.1037/1040-3590.6.4.284

Edwards, M. M., & Haines, A. (2007). Evaluating smart growth: Implications for small communities. *Journal of Planning Education and Research*, *27*(1), 49–64. https://doi.org/10.1177/0739456X07305792

Evenson, K. R., Aytur, S. A., Satinsky, S. B., Kerr, Z. Y., & Rodríguez, D. A. (2011). Planning for pedestrians and bicyclists: Results from a statewide municipal survey. *Journal of Physical Activity and Health*, *8*(s2), S275–S284. https://doi.org/10.1123/jpah.8.s2.s275

Fu, X., & Tang, Z. (2013). Planning for drought-resilient communities: An evaluation of local comprehensive plans in the fastest growing counties in the US. *Cities*, *32*, 60–69. https://doi.org/10.1016/j.cities.2013.03.001

Göçmen, Z. A., & LaGro, J. A. (2016). Assessing local planning capacity to promote environmentally sustainable residential development. *Journal of Environmental Planning and Management*, *59*(8), 1513–1535. https://doi.org/10.1080/09640568.2015.1080673

Hall, S. A., Kaufman, J. S., & Ricketts, T. C. (2006). Defining urban and rural areas in U.S. epidemiologic studies. *Journal of Urban Health*, *83*(2), 162–175. https://doi.org/10.1007/s11524-005-9016-3

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, *8*(1), 23. https://doi.org/10.20982/tqmp.08.1.p023

Hart, L. G., Larson, E. H., & Lishner, D. M. (2005). Rural definitions for health policy and research. *American Journal of Public Health*, *95*(7), 1149–1155. https://doi.org/10.2105/AJPH.2004.042432

Heeringa, S. G., West, B. T., & Berglund, P. A. (2010). *Applied Survey Data Analysis*. Chapman & Hall/CRC.

Hodgson, K. (2011). *Comprehensive Planning for Public Health: Results of the Planning and Community Health Research Center Study*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/research/publichealth/pdf/surveyreport.pdf

Isserman, A. M. (2005). In the national interest: Defining rural and urban correctly in research and public policy. *International Regional Science Review*, *28*(4), 465–499. https://doi.org/10.1177/0160017605279000

Jackson, R. J., Dannenberg, A. L., & Frumkin, H. (2013). Health and the built environment: 10 years after. *American Journal of Public Health*, *103*(9), 1542–1544. https://doi.org/10.2105/AJPH.2013.301482

Kaplan, M., Maiden, K., Miller, P., Celano, G., & Walling, L. A. (2016). *Healthy Living and Active Design: A Scorecard for Comprehensive Plans*. Cedar Creek Sustainable Planning Services & Nemours Children's Health System. http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf

Kim, H., & Tran, T. (2018). An evaluation of local comprehensive plans toward sustainable green infrastructure in US. *Sustainability*, *10*(11), 4143. https://doi.org/10.3390/su10114143

Lawrence, D. (2018, December). Regional planning: Sixty years and still going strong. *Wisconsin Counties*, 16–30.

League of Wisconsin Municipalities. (n.d.). *Distinctions between cities & villages*. League of Wisconsin Municipalities. Retrieved April 7, 2023, from https://www.lwm-info.org/588/Distinctions-Between-Cities-Villages

Lemon, S. C., Goins, K. V., Schneider, K. L., Brownson, R. C., Valko, C. A., Evenson, K. R., Eyler, A. A., Heinrich, K. M., Litt, J., Lyn, R., Reed, H. L., Tompkins, N. O., & Maddock, J. (2015). Municipal officials' participation in built environment policy development in the United States. *American Journal of Health Promotion*, *30*(1), 42–49. https://doi.org/10.4278/ajhp.131021-QUAN-536

Lewis, P. G. (2015). Moral intuitions and smart growth: Why do liberals and conservatives view compact development so differently? *Journal of Urban Affairs*, *37*(2), 87–108. https://doi.org/10.1111/juaf.12172

Loh, C. G., & Kim, R. (2021). Are we planning for equity? *Journal of the American Planning Association*, *87*(2), 181–196. https://doi.org/10.1080/01944363.2020.1829498

Lyles, W., & Stevens, M. (2014). Plan quality evaluation 1994–2012: Growth and contributions, limitations, and new directions. *Journal of Planning Education and Research*, *34*(4), 433–450. https://doi.org/10.1177/0739456X14549752

Maiden, K. M., Kaplan, M., Walling, L. A., Miller, P. P., & Crist, G. (2017). A comprehensive scoring system to measure healthy community design in land use plans and regulations. *Preventive Medicine*, *95*, S141–S147. https://doi.org/10.1016/j.ypmed.2016.09.031

Manta Conroy, M., & Berke, P. R. (2004). What makes a good sustainable development plan? An analysis of factors that influence principles of sustainable development. *Environment and Planning A: Economy and Space*, *36*(8), 1381–1396. https://doi.org/10.1068/a367

Norton, R. K. (2008). Using content analysis to evaluate local master plans and zoning codes. *Land Use Policy*, *25*(3), 432–454. https://doi.org/10.1016/j.landusepol.2007.10.006

Olshansky, R. B. (1996). The California Environmental Quality Act and local planning. *Journal of the American Planning Association*, *62*(3), 313–330. https://doi.org/10.1080/01944369608975697

Peterson, E. L., Carlson, S. A., Schmid, T. L., & Brown, D. R. (2018). Prevalence of master plans supportive of active living in US municipalities. *Preventive Medicine*, *115*, 39–46. https://doi.org/10.1016/j.ypmed.2018.08.004

Phillips-Fein, K. (2011). Conservatism: A state of the field. *Journal of American History*, *98*(3), 723–743. https://doi.org/10.1093/jahist/jar430

Ricklin, A., Klein, W., & Musiol, E. (2012). *Healthy Planning: An Evaluation of Comprehensive and Sustainability Plans Addressing Public Health*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Healthy-Planning.pdf

Ricklin, A., & Kushner, N. (2012). *Healthy Plan Making: Integrating Health into the Comprehensive Planning Process: An Analysis of Seven Case Studies and Recommendations for Change*. American Planning Association. https://planning.org/publications/document/9148247/

Robles, B., & Kuo, T. (2017). Predictors of public support for nutrition-focused policy, systems and environmental change strategies in Los Angeles County, 2013. *BMJ Open*, *7*(1), e012654. https://doi.org/10.1136/bmjopen-2016-012654

Schilling, J., & Keyes, S. D. (2008). The promise of Wisconsin's 1999 comprehensive planning law: Land-use policy reforms to support active living. *Journal of Health Politics, Policy and Law*, *33*(3), 455–496. https://doi.org/10.1215/03616878-2008-005

Schwartz, M. B., Lund, A. E., Grow, H. M., McDonnell, E., Probart, C., Samuelson, A., & Lytle, L. (2009). A comprehensive coding system to measure the quality of school wellness policies. *Journal of the American Dietetic Association*, *109*(7), 1256–1262. https://doi.org/10.1016/j.jada.2009.04.008

Shah, S., & Wong, B. (2020). *Toolkit to Integrate Health and Equity into Comprehensive Plans* (p. 37). American Planning Association. https://www.planning.org/publications/document/9201866/?utm_campaign=2020-08-06+HIP+content+order&utm_medium=email&utm_source=Pew

Slaton, J. E. A. (2012). Navigating the political challenges to sustainable development. *Probate & Property*, *26*(4), 52–56.

StataCorp. (2019). *Stata Statistical Software: Release 16* (16.1) [Computer software]. StataCorp LLC.

StataCorp. (2021). *Stata Statistical Software: Release 17* (17.0) [Computer software]. StataCorp LLC.

StataCorp LLC. (2021). *Stata Survey Data Reference Manual* (17th ed.). Stata Press. https://www.stata.com/manuals/svy.pdf

Stevens, M. R. (2013). Evaluating the quality of official community plans in southern British Columbia. *Journal of Planning Education and Research*, *33*(4), 471–490. https://doi.org/10.1177/0739456X13505649

Stevens, M. R., Lyles, W., & Berke, P. R. (2014). Measuring and reporting intercoder reliability in plan quality evaluation research. *Journal of Planning Education and Research*, *34*(1), 77–93. https://doi.org/10.1177/0739456X13513614

Tang, Z. (2008). Evaluating local coastal zone land use planning capacities in California. *Ocean & Coastal Management*, *51*(7), 544–555. https://doi.org/10.1016/j.ocecoaman.2008.06.001

Tang, Z., Bright, E., & Brody, S. (2009). Evaluating California local land use plan's environmental impact reports. *Environmental Impact Assessment Review*, *29*(2), 96–106. https://doi.org/10.1016/j.eiar.2008.03.002

Tang, Z., & Brody, S. D. (2009). Linking planning theories with factors influencing local environmental-plan quality. *Environment and Planning B: Planning and Design*, *36*(3), 522–537. https://doi.org/10.1068/b34076

Tang, Z., Brody, S. D., Quinn, C., Chang, L., & Wei, T. (2010). Moving from agenda to action: Evaluating local climate change action plans. *Journal of Environmental Planning and Management*, *53*(1), 41–62. https://doi.org/10.1080/09640560903399772

US Census Bureau. (2019, December 2). *2010 Census Urban and Rural Classification and Urban Area Criteria*. United States Census Bureau. https://www.census.gov/geo/reference/ua/urban-rural-2010.html

Vitiello, D., & Brinkley, C. (2014). The hidden history of food system planning. *Journal of Planning History*, *13*(2), 91–112. https://doi.org/10.1177/1538513213507541

Welch, P. J., Dake, J. A., Price, J. H., Thompson, A. J., & Ubokudom, S. E. (2012). State legislators' support for evidence-based obesity reduction policies. *Preventive Medicine*, *55*(5), 427–429. https://doi.org/10.1016/j.ypmed.2012.09.008

Weymouth, L., Joyner, H., Skalitzky, E., Cotter, A., Engstrom, K., & Jorgensen, L. (2019). School wellness in Wisconsin: Evaluating policies for practices to prevent pediatric obesity. *Journal of School Health*, *89*(6), 503–511. https://doi.org/10.1111/josh.12759

Williams, R. (2021). *Analyzing complex survey data: Some key issues to be aware of*. University of Notre Dame. https://www3.nd.edu/~rwilliam/stats3/SvyCautionsX.pdf

Wilson, A., & Mitra, R. (2020). Implementing cycling infrastructure in a politicized space: Lessons from Toronto, Canada. *Journal of Transport Geography*, *86*, 102760. https://doi.org/10.1016/j.jtrangeo.2020.102760

Chapter 3: Wisconsin state comprehensive planning mandates are associated with local planning for healthy eating and active living

3.1 Introduction

The content of a local comprehensive plan is determined by many factors, including local sociodemographic, economic, and political factors; salient community issues and leadership; planning capacity; and the type of planner writing the plan (e.g. municipal vs. consultant planner) (Brody et al., 2006; Burby & Dalton, 1994; Charron et al., forthcoming). However, state comprehensive planning statutes can also influence the content of local comprehensive plans. The Standard City Planning Enabling Act of 1927 and various other model planning laws and regulations have sought to standardize state comprehensive planning statutes (Klein et al., 1996; Meck, 2002). However, there still exists great variation in the state statutes with regards to which jurisdictions can and must plan, what the planning process looks like, and the content that must be included in local plans (Charron et al., 2021).

This second project therefore tests if there is a relationship between mandates in Wisconsin's state comprehensive planning statute and the rate of inclusion of HEAL-promoting components into local comprehensive plans. My research question was: "Are HEAL-related items more likely to be included in local Wisconsin comprehensive plans if they are required by the state comprehensive planning statute?"

3.2 Methods

The sampling and data collection procedures for this project are described in detail in Chapter 2. A team of five coders used the Healthy Living and Active Design Scorecard for Comprehensive Plans (Kaplan et al., 2016) to evaluate 116 urban and suburban municipal comprehensive plans

from Wisconsin. However, while Chapter 2 reports on section and overall comprehensiveness and strength scores, this project analyzed the scores for the 50 individual items in the Scorecard (see Table 3.1 for a summary of the items or Appendix 1 for a full description of the items in the Scorecard.)

Table 3.1: Assessment items in each section of the Healthy Living and Active Design Scorecard.

#	Item name	Item language
	Vision and Strategy	
1	Plan4Health	The plan explicitly recognizes the relationship of the built environment to obesity, chronic disease, and public health in general.
2	Collaboration with PH	The plan demonstrates collaboration with public health officials, public health advocates, relevant institutions, and stakeholder groups.
3	Inequities	The plan addresses health inequities among populations within its jurisdiction.
4	Health Chapter	The plan contains a stand-alone health chapter or element.
5	HIA	The plan refers to Health Impact Assessments (HIAs).
6	Mental/Social Health	The plan establishes a relationship between land use decisions and social cohesion/mental health.
	Active Transportation	
7	Reduce VMT	The plan mentions reducing car dependency as a means of improving public health.
8	Mode Share	The plan includes a goal or objective to increase the number of citizens who walk or bike to work and other daily activities.
9	Complete Streets	The plan references "Complete Streets" principles.
10	Bike/Ped Plan	The plan includes a bicycle/pedestrian plan.
11	Traffic Calming	The plan includes traffic calming goals and measures.
12	Pedestrian Safety	The plan includes references to measures that improve pedestrian mobility and safety.
13	Bike/Ped New Development	The plan requires developers to provide bicycle, pedestrian, and wheelchair access in new communities.

14	Trails	The plan seeks the development or extension of off-road greenways and trails for biking and walking.
15	Parking	The plan recommends reduced parking requirements for developments located near transit stops and/or with bicycle, pedestrian, and wheelchair access.
16	Senior Mobility	The plan identifies access to health care and mobility as issues of special concern to aging populations.
17	Disadvantaged Mobility	The plan identifies access to health care and mobility as issues of special concern to disadvantaged populations.
18	SRTS	The plan supports "Safe Routes to School" for children or other mechanisms that support children walking or riding bikes to schools, including locating schools closer to residential areas.
19	School Hubs	The plan supports the co-location of community services in school buildings.
	Healthy Food Access	
20	Farmland Preservation	The plan supports the preservation of existing working farms.
21	Urban Farms & Local Food	The plan supports the preservation or development of "urban" or specialty farms, which grow products such as vegetables, herbs, honey, eggs, flowers, and plants for local distribution and sale (in addition to or instead of commodity crops such as corn and soybeans).
22	Food Access	The plan cites the need to increase access to healthy food, especially in low-income communities where "food deserts" may exist.
23	Community Gardens	The plan supports the creation and sustainability of community gardens.
24	Farmers' Markets	The plan addresses the creation and sustainability of farmers' markets.
25	Grocery Stores	The plan includes an objective to increase the number of full-service grocery stores in underserved areas.
26	Healthy Retail	The plan supports businesses that provide healthier food and drink options, especially in documented underserved areas.
27	Drinking Water	The plan addresses access to drinking water and/or promotes installation of water fountains.
	Parks & Recreation	
28	Park Access	The plan sets goals for access to open space, parks, and recreational facilities.

29	SCORP	The plan refers to the latest Statewide Comprehensive Outdoor Recreation Plan (SCORP).
30	Park Maintenance	The plan establishes a high level of service for parks – for factors such as lighting, cleanliness, safety.
31	Parks New Development	The plan establishes standards for developer-provided open space within developments.
32	Promote Physical Activity	The plan identifies geographic areas with the greatest need for more physical activity.
	Health Care Access	
33	Health Care Distribution	The plan includes data on the number of health and human service outlets available to populations in need in the jurisdiction.
34	Improving Health Care Access	The plan includes policies to work with relevant state agencies to improve access of all citizens to health care and wellness services.
35	Aging in Place	The plan supports policies that enable aging in place.
	Community Design	
36	Mixed Use	The plan supports walkable, mixed-use development.
37	Pedestrian Streetscape	The plan identifies the need to plan and build connected street networks in mixed-use areas that are pedestrian-friendly.
38	Compact Development	The plan promotes compact development to promote livability, walkability, and transportation efficiency.
39	TOD	The plan addresses transit-oriented design.
40	TND	The plan supports Traditional Neighborhood Development, or village-style development.
41	Infill	The plan supports infill and redevelopment of greyfields in areas already served by public infrastructure.
42	Adaptive Reuse	The plan supports repurposing, adaptation, and reuse of older buildings rather than demolition and new construction on greenfields.
43	Connectivity	The plan supports connectivity between developments.
44	ADUs	The plan supports accessory dwelling units in appropriate locations to create affordable options in existing communities and foster social cohesion for older citizens, young people just starting out, and others who can't afford or don't want to live in a single-family dwelling.
45	Public Spaces	The plan promotes "third places" and public spaces.

46	Street Trees	The plan addresses the use of street trees for shade and to enhance walkability.
47	Natural Surveillance	The plan supports the orientation of buildings to face the street or include windows that face the street (promoting "natural surveillance" and making walking safer).
48	Healthy Building Design	The plan supports recognized third-party standards for healthy building design and operations, such as Leadership in Energy and Environmental Design (LEED).
49	Healthy Community Design	The plan supports recognized third-party standards for sustainable, healthy, mixed-use communities such as STAR Communities or LEED for Neighborhood Development.
50	Intergovernmental Collaboration	The plan supports intergovernmental coordination that ensures mobility and seamless access to services between jurisdictions.

Note: Item names were added by research team for convenience.

3.2.1 Post-hoc individual item reliability testing

I originally conducted reliability testing using section comprehensiveness and strength scores. I did not test for inter-rater reliability of individual item scores. In order to determine the validity of individual item scores to be used in this analysis, I conducted post-hoc reliability testing on the item scores produced by each coder in the reliability training rounds.

I calculated two-way, mixed effect, individual intraclass correlation coefficients (ICCs) with absolute agreement for each coder for each reliability training round, this time using each item's score as the target rather than the section strength and comprehensiveness scores. For each coder, I deemed their reliability for an item "excellent" if they achieved an ICC of at least 0.75 for two consecutive reliability rounds, "good" for ICCs of at least 0.60, "fair" for ICCs of at least 0.40, and "poor" for ICCs less than 0.40. In this way, each coder achieved a rank of excellent, good, fair, or poor for each item. Each item was then given the lowest rating among the coder team. For example, if Coders 1, 2, and 3 achieved excellent reliability for an item, but Coder 4

achieved fair reliability, the item was ranked to have overall fair reliability. All post-hoc reliability testing was completed using Stata/SE 17.0 (StataCorp, 2021).

3.2.1.1 Items with insufficient variation

Several items exhibited such low variation in scoring that ICCs were either artificially low or could not be computed at all. The problem of "insufficient variation" is well-documented in the literature on ICCs and on testing reliability more broadly (Hallgren, 2012; Stevens et al., 2014). Stevens et al. propose two types of items that are likely to produce insufficient variation in scores: baseline items and leading edge items (2014). Baseline items are likely to be present in all or most plans, but are worth including in order to verify their presence and/or identify the small proportion of plans that do not include them (Stevens et al., 2014). Leading edge items are those that are most likely absent from all or most plans, may reflect new advances in planning theory or scientific understandings of the built environment, and are worth including in analyses in order to draw attention to innovative jurisdictions that include the item (Stevens et al., 2014).

My post-hoc reliability testing on individual items in the Scorecard revealed six items with insufficient scoring variation to produce accurate reliability statistics (Table 3.2). I deemed items to have insufficient variation in scoring if at least 90% of the Master scores were identical. This corresponded to items for which three or fewer plans had scores different than the majority of plans. Following the guidance from Stevens et al., I retained these items for analysis (2014).

Five out of the six items with insufficient variation are leading edge items. Items 4 and 5 deal with health being explicitly, systematically, and rigorously included in planning processes, which is an emerging area of interest among planners and public health professionals (Shah & Wong, 2020). Item 22 is about recognizing food access as an overarching goal for planners,

Table 3.2: Items in Scorecard with insufficient variation in scoring to produce accurate ICCs.

#	Item name	Item language	Scoring percentage*	Item type
4	Health Chapter	The plan contains a stand-alone health chapter or element.	100% scored 0	Leading edge item
5	HIA	The plan refers to Health Impact Assessments (HIAs).	97.8% scored 0	Leading edge item
22	Food Access	The plan cites the need to increase access to healthy food, especially in low-income communities where "food deserts" may exist.	90.0% scored 0	Leading edge item
27	Drinking Water	The plan addresses access to drinking water and/or promotes installation of water fountains.	96.7% scored 0	Leading edge item
49	Healthy Community Design	The plan supports recognized third-party standards for sustainable, healthy, mixed-use communities such as STAR Communities or LEED for Neighborhood Development.	94.4% scored 0	Leading edge item
50	Intergovernmental Collaboration	The plan supports intergovernmental coordination that ensures mobility and seamless access to services between jurisdictions.	100% scored 2	Baseline item

*Scoring percentages reflect Master scores from all reliability training rounds.

another area of emerging planning practice (Hodgson, 2012) even if specific strategies to improve food access, such as farmers' markets and community gardens, are more well established. Item 27 is about including access to drinking water in public places, which seems to be an unusual thing to include in comprehensive plans, at least in Wisconsin. Lastly, item 49 concerns third-party standards for healthy neighborhood design, which are not commonly referenced even among scholars focused on incorporating health into urban planning practice.

One item with insufficient variation was identified as a baseline item. Item 50 deals with supporting intergovernmental collaboration in the comprehensive plan. This item is required by Wisconsin's comprehensive planning statute as a standalone element (Wis. Stat. § 66.1001) (to be discussed later in this chapter).

3.2.1.2 Excluded items

The decision to include or exclude items based on the results of reliability testing is always a trade-off between information (including items despite low ICCs) and reliability (excluding items with low ICCs) (Stevens et al., 2014). Some items may be retained in datasets despite low ICCs if excluding scores for those items would diminish the study's ability to answer its research questions (Stevens et al., 2014).

I included items that had at least good (ICC >= 0.60) reliability in my post-hoc reliability testing. Because I calculated ICCs for each coder individually (rather than average ICCs), a tradeoff presented itself between sample size and included items. Certain coders achieved lower reliability scores for items than others; therefore, by excluding *plans* from the final dataset on which certain *coders* had not achieved adequate reliability, I could include more *items* in the final dataset.

I chose to exclude the plans for which two coders (S.G.P. and D.V.) independently coded the Active Transportation and/or Healthy Food Access sections. In this way, I lowered the sample size from 116 plans to 93 plans. By excluding these plans, I also changed the sampling structure of our dataset. All sampling weights were recalculated before analysis.

There were four items for which the remaining coders did not achieve at least "good" reliability; these were items about social inequities (item 3), social and mental health (item 6), reducing vehicle miles traveled (item 7), and accessory dwelling units (item 44). Items 3 and 6

were deemed important enough to the content of the Scorecard that they were retained in the analysis despite coders only achieving fair reliability. However, items 7 and 44 were excluded from the final analysis.

3.2.2 Assessing Wisconsin's state comprehensive planning statute

Samantha I. Moyers-Kinsella, PhD[10] and I independently reviewed Wisconsin's state comprehensive planning statute for language related to each of the 50 items in the Scorecard. Each item in the Scorecard was classified as "mandated with specific language," "mandated with general language," or "not mandated." After independently reviewing the statute, we discussed coding discrepancies and came to a consensus on the codes for each item.

Items were coded as "mandated with specific language" if the state statute required the item (or any score-able part of the item, according to the Coding Guide[11]) to be addressed in local comprehensive plans. Items were coded as "mandated with general language" if a more general topic related to the item was required to be addressed in local comprehensive plans. For example, if planning for walking as a form of transportation was required to be included in comprehensive plans, this would be coded as "mandated with general language" for any items related to walking (e.g. item 8 about increasing active transportation mode share, item 9 about

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[10] Dr. Moyers-Kinsella and I had collaborated in the past on a project evaluating state comprehensive planning statutes. She has an MA Social Responsibility and Sustainable Communities from Western Kentucky University and a PhD in Health Sciences from West Virginia University, as well as three years of planning practice in Alaska. She is currently a Research Associate with the Center for Active West Virginia in the College of Applied Human Sciences at West Virginia University.

[11] The Coding Guide is available at the project repository: https://osf.io/h48qk/.

Complete Streets, item 10 about bicycle/pedestrian plans). More examples of what constituted *specific* and *general* mandates can be found in section 3.3.2 of this chapter.

3.2.3 Descriptive and correlation analysis

For each item in the Scorecard, I used sampling weights to calculate the percentage of urban and suburban municipalities in Wisconsin that include the item with actionable, concrete language (i.e. score a 2); include it with aspirational, vague language (i.e. score a 1), and do not include it (i.e. score a 0) in their local comprehensive plan. The sampling weights produce unbiased population-level estimates for the state of Wisconsin (Heeringa et al., 2010). I also calculated weighted mean scoring percentages and 95% confidence intervals for items within the three state statute mandate categories: mandated with specific language, mandated with general language, and not mandated.

I used one-sided Welch tests to statistically test the relationship between state statute mandates and scoring percentages. The Welch approximation of the difference of means tests is appropriate for this data because, in each test, the two groups being tested have unequal variances and sizes (McDonald, 2009). I tested differences in scoring percentages for items mandated with specific language vs. items not mandated; items mandated with general language vs. items not mandated; and items mandated with specific language vs. items mandated with general language. The Welch tests evaluated the following hypotheses:

a) Items mandated with general language are not included (i.e. score a 0) in local comprehensive plans at lower rates than items not mandated by state statute.
b) Items mandated with general language are included with aspirational language (i.e. score a 1) in local comprehensive plans at higher rates than items not mandated by state statute.

c) Items mandated with general language are included with actionable language (i.e. score a 2) in local comprehensive plans at higher rates than items not mandated by state statute.
d) Items mandated with specific language are not included (i.e. score a 0) in local comprehensive plans at lower rates than items not mandated by state statute.
e) Items mandated with specific language are included with aspirational language (i.e. score a 1) in local comprehensive plans at higher rates than items not mandated by state statute.
f) Items mandated with specific language are included with actionable language (i.e. score a 2) in local comprehensive plans at higher rates than items not mandated by state statute.
g) Items mandated with specific language are not included (i.e. score a 0) in local comprehensive plans at lower rates than items mandated with general language by state statute.
h) Items mandated with specific language are included with aspirational language (i.e. score a 1) in local comprehensive plans at higher rates than items mandated with general language by state statute.
i) Items mandated with specific language are included with actionable language (i.e. score a 2) in local comprehensive plans at higher rates than items mandated with general language by state statute.

3.3 RESULTS

3.3.1 Individual item scores

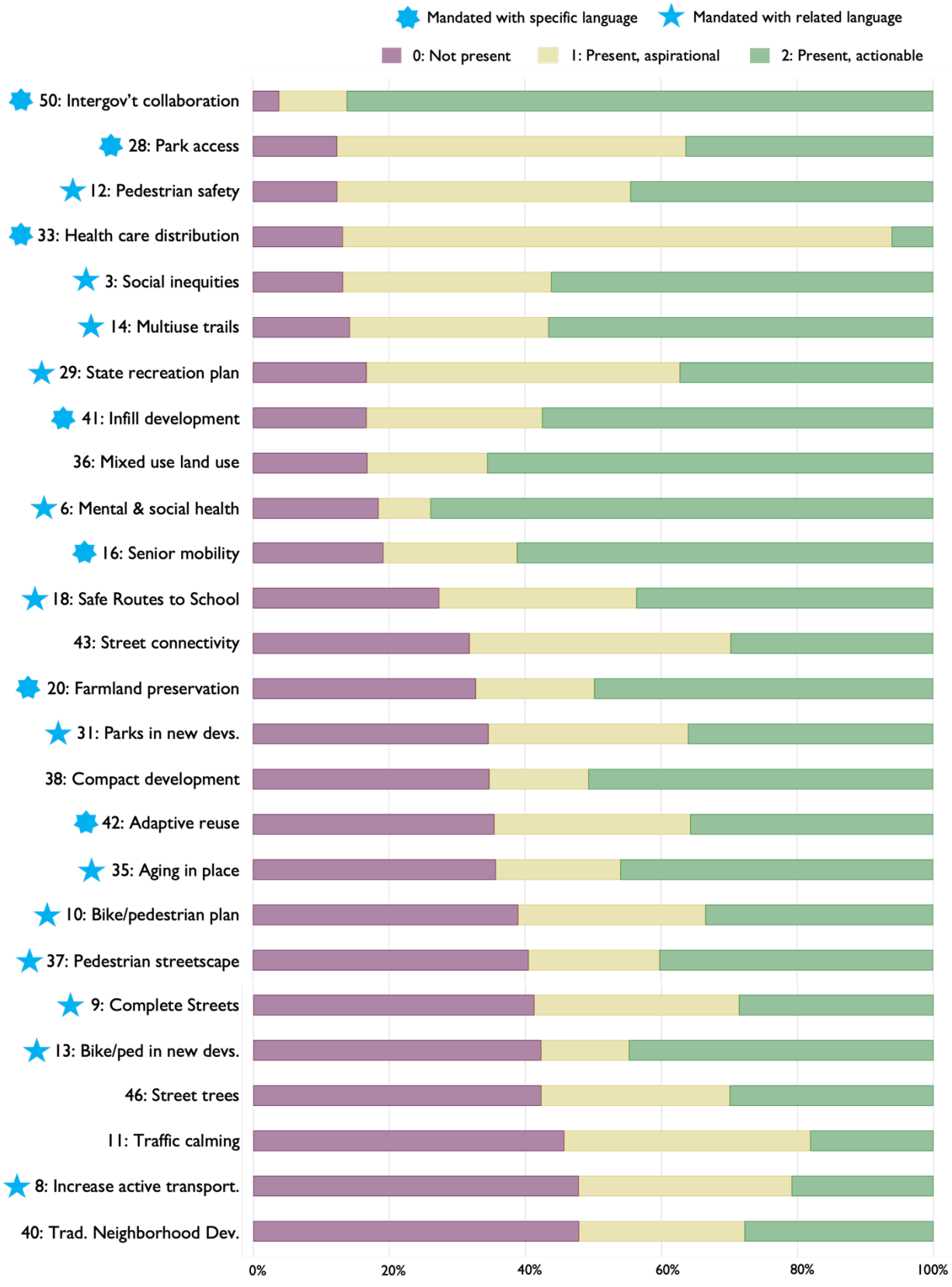
Across items in the Scorecard, there is wide variation in scoring percentages (Figure 3.1). At the high end, 96% of plans address intergovernmental collaboration, with 86% mentioning specific collaborative agreements with neighboring jurisdictions. Ten other items are also included in at

least 80% of comprehensive plans. At the other end of the spectrum, no plans include a standalone health chapter and only 2% of plans mention Health Impact Assessments. In addition to these two items, eight other items are included in less than 20% of plans. Many of these lowest scoring items concern an explicitly health-focused vision and strategy (e.g. public health collaboration; addressing the connection between planning, the built environment, and health) or healthy food access (e.g. healthy food retailers, grocery store access). This mirrors the section scores reported in Chapter 2. In sections 3.3.1.1 to 3.3.1.6, below, I discuss the scoring percentages for items in each section in more detail.

3.3.1.1 Vision & Strategy item scores

Urban and suburban municipalities in Wisconsin are very likely to explicitly discuss inequities or underserved populations (item 3, 87% scoring 1 or 2) and a connection between planning and social cohesion or mental health (item 6, 82% scoring 1 or 2), and to do so in actionable terms. Over half of all urban and suburban municipalities map or use other data to address at least one disparity (item 3, 56% scoring 2). In particular, many of the municipalities in our sample included language in their plans about the provision of housing for people with low incomes and/or special needs. Almost three-quarters of municipalities cited specific examples of how planning for HEAL could directly affect social cohesion and mental health (item 6, 74% score 2).

On the other hand, municipalities are very unlikely to discuss an explicit connection between planning and health (item 1, 11% score 1 or 2), show evidence of collaboration with their local public health department (item 2, 16% score 1 or 2), include a health chapter (item 4,


Mandated with specific language
Mandated with related language
0: Not present
1: Present, aspirational
2: Present, actionable
50: Intergov't collaboration
28: Park access
12: Pedestrian safety
33: Health care distribution
3: Social inequities
14: Multiuse trails
29: State recreation plan
41: Infill development
36: Mixed use land use
6: Mental & social health
16: Senior mobility
18: Safe Routes to School
43: Street connectivity
20: Farmland preservation
31: Parks in new devs.
38: Compact development
42: Adaptive reuse
35: Aging in place
10: Bike/pedestrian plan
37: Pedestrian streetscape
9: Complete Streets
13: Bike/ped in new devs.
46: Street trees
11: Traffic calming
8: Increase active transport.
40: Trad. Neighborhood Dev.
0%
20%
40%
60%
80%
100%

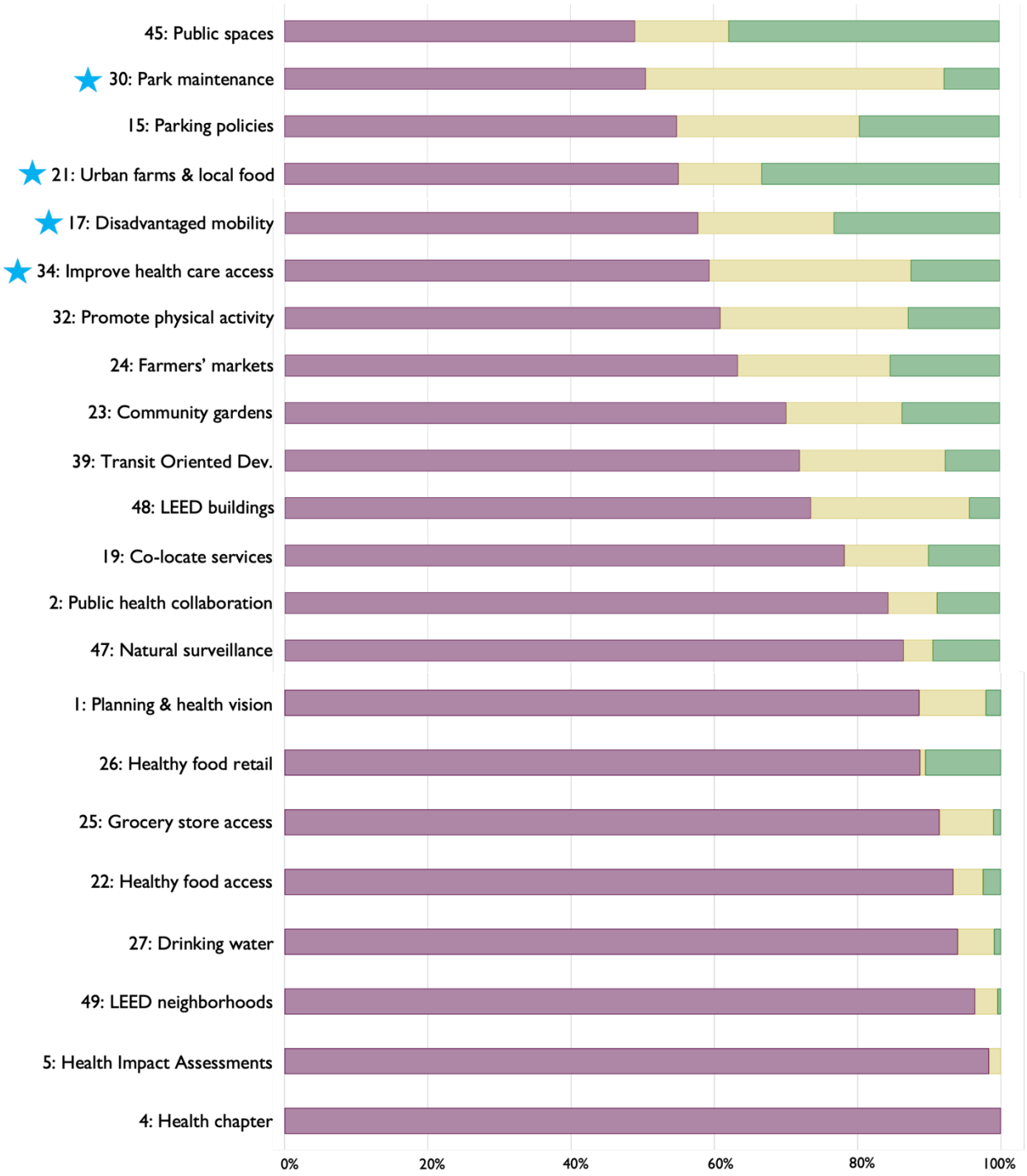


Figure 3.1: Weighted percentage of municipal comprehensive plans that score a 0 (item not present), 1 (item present but vague or aspirational), and 2 (item is present, specific, and actionable) on each item of the Scorecard. Icons indicate items mandated by the state statute with specific language (seven-pointed star) and general language (five-pointed star). Items 7 and 44 excluded due to inadequate inter-rater reliability levels. See Appendix 5 for a table of scoring percentages and state statute mandates for each item.

0%[12] score 1 or 2), or plan for health impact assessments (item 5, 2% scoring 1 or 2) in their comprehensive plans.

3.3.1.2 Active Transportation item scores

Urban and suburban Wisconsin municipalities are most likely to address active transportation in their comprehensive plans by discussing the need for better pedestrian infrastructure (item 12, 88% score 1 or 2), including a goal for more off-road trails for biking and walking (item 14, 86% score 1 or 2), identifying mobility as an issue for the elderly and disabled (item 16, 81% score 1 or 2), or supporting a Safe Routes to School program (item 18, 73% score 1 or 2). All four of these items are more likely to be discussed with concrete, specific plans for improvement rather than aspirational goals.

Compared to the four items above, municipalities in Wisconsin are only moderately likely to include other active transportation topics in their comprehensive plans. Between one-third and two-thirds of municipalities include the following topics in their comprehensive plans: a goal to increase the percentage of people biking or walking (item 8; 52% score 1 or 2), Complete Streets principles or designs (item 9, 59% score 1 or 2), references to a community-wide bicycle and/or pedestrian plan (item 10, 61% score 1 or 2), traffic calming goals or measures (item 11, 54% score 1 or 2), a policy to include bicycle and pedestrian infrastructure in new developments (item 13, 58% score 1 or 2), recommendations to reduce parking

[12] One municipality in our original sample, Eau Claire city, did include a health chapter in their comprehensive plan. However, this municipality was excluded from the final sample after post-hoc reliability testing.

requirements (item 15, 45% score 1 or 2), and discussion of mobility as an issue of special concern for disadvantaged populations (item 17, 42% score 1 or 2).

Most of these moderately-scoring items have a fairly even split between municipalities discussing them in aspirational terms and more concrete, actionable terms. However, there are a few exceptions. Municipalities are about twice as likely to discuss traffic calming in aspirational terms rather than with a concrete plan to install infrastructure (item 11, 36% score 1 vs. 18% score 2). On the other hand, when municipalities discuss the inclusion of pedestrian and bicycle infrastructure in new developments, they are more than three times as likely to identify a specific policy and/or requirements than to include an aspirational goal for such infrastructure (item 13, 13% score 1 vs. 45% score 2).

Lastly, urban and suburban Wisconsin municipalities are very unlikely to include one active transportation topic in their comprehensive plans: the co-location of community services in school buildings (item 19). Over three-quarters of Wisconsin municipalities do not include this item in their comprehensive plan (78% score 0) at all.

3.3.1.3 Healthy Food Access item scores

Out of all the items in the Scorecard, Wisconsin municipalities score the lowest on items in the Healthy Food Access section. Only one item in this section is included in local comprehensive plans at a moderate rate: about two-thirds of municipalities include goals for farmland preservation in their comprehensive plans (item 20, 67% score 1 or 2) and half of municipalities include at least one strongly-worded strategy, such as low-density rural zoning, transfer of development rights programs, or the use of extraterritorial zoning (item 20, 50% score 2).

Wisconsin municipalities include the remaining seven items from this section in their comprehensive plans at low to very low rates. One-quarter to one-half of Wisconsin

municipalities support local and specialty food production (item 21, 45% score 1 or 2), community gardens (item 23, 30% score 1 or 2), and farmers' markets (item 24, 37% score 1 or 2) in their comprehensive plans. About one-third of municipalities include a specific goal, policy, or objective about supporting local food production (item 21, 33% score 2) rather than a more general statement about the importance of local foods.

Half of the items in this section are discussed in less than 15% of comprehensive plans in Wisconsin: explicitly addressing the need to increase healthy food access (item 22; 7% score 1 or 2), including a goal for more full-service grocery stores in underserved areas (item 25; 9% score 1 or 2), support for businesses that serve healthier food options (item 26; 11% score 1 or 2), and promoting drinking water access in public and commercial spaces (item 27; 6% score 1 or 2). When they are included in a comprehensive plan, three of these are more likely to be included in aspirational or general statements rather than concrete plans. However, when municipalities include support for local businesses to serve healthier food options, they are more likely to recommend specific actions rather than make vague statements (item 26, 10.5% score 2 vs 0.5% score 1).

3.3.1.4 Parks & Recreation item scores

Urban and suburban municipalities in Wisconsin are very likely to include goals to improve access to parks (item 28; 88% score 1 or 2) and refer to the latest Statewide Comprehensive Outdoor Recreation Plan (SCORP) (item 29; 83% score 1 or 2) in their local comprehensive plans. However, the majority of municipalities that discussed these items in their comprehensive plan did so in aspirational terms. Just over one-third of municipalities use data to identify park access needs or have specific plans to increase access to parks (item 28, 36% score 2) and refer

to specific data in the SCORP to target their parks and recreation goals and policies or have an up-to-date standalone local Comprehensive Outdoor Recreation Plan (item 29, 37% score 2).

A moderate percentage of Wisconsin municipalities include the other three items in the Parks & Recreation section in their comprehensive plans. About half of Wisconsin municipalities address the need to keep parks safe, attractive, and clean (item 30, 49% score 1 or 2) and over one-third of municipalities include aspirational statements about facilitating physical activity, fitness, sports, active recreation, or active play for all members of their community (item 32, 39% score 1 or 2) in their local comprehensive plans. However, only a small percentage of municipalities include specific details or actions to ensure these goals are met (item 30, 8% score 2; item 32, 13% score 2). Two-thirds of Wisconsin municipalities include a goal to have developers contribute to parks and open spaces (item 31, 65% score 1 or 2), while about half of those have specific policies for ensuring that this occurs (item 31, 36% score 2).

3.3.1.5 Health Care Access item scores

Most urban and suburban municipalities in Wisconsin discuss the distribution of health care resources in and near their community in their local comprehensive plan (item 33, 87% score 1 or 2). However, only a very small percentage of those municipalities use maps or other data to identify gaps in health care access in their comprehensive plan (item 33, 6% score 2).

Close to two-thirds of urban and suburban Wisconsin municipalities support aging in place in their comprehensive plans (item 35, 64% score 1 or 2). That is, municipalities address the need to help seniors maintain mobility and access to services within the community as they age. Close to half of municipalities also include at least one specific strategy to achieve this goal in their comprehensive plan (item 35, 46% score 2).

Lastly, less than half of municipalities include a goal to improve access to health care services in their community (item 34, 41% score 1 or 2) with an even smaller fraction including specific plans to work with relevant agencies to improve health care access (item 34, 12% score 2).

3.3.1.6 Community Design item scores

One item in the Community Design section is included by almost all urban and suburban municipalities in Wisconsin in their comprehensive plans: support for intergovernmental coordination to provide access to services and mobility (item 50, 96% score 1 or 2). Moreover, Wisconsin municipalities that support intergovernmental coordination in their comprehensive plans overwhelmingly also include specific plans or mentioned formal agreements for doing so (item 50, 86% score 2). Out of all the items in the Scorecard, this item is included—and included in a specific, actionable way—by the highest percentage of municipalities.

Two other items in the Community Design section are included in Wisconsin comprehensive plans at high rates: support for mixed use (item 36, 83% score 1 or 2) and infill development (item 41, 83% score 1 or 2). The majority of municipalities that include these items in their comprehensive plans do so with at least one specific strategy, recommended action, or policy (item 36, 66% score 2; item 41, 57% score 2).

Wisconsin municipalities include roughly half of the items in the Community Design section in their comprehensive plans at moderate rates. These include identifying the need to plan and build connected, pedestrian friendly street networks (item 37, 59% score 1 or 2); promoting compact development patterns (item 38, 65% score 1 or 2); supporting Traditional Neighborhood Development, or village-style development (item 40, 52% score 1 or 2); supporting the repurposing, adaptation, and reuse of older buildings rather than demolition and

new construction on greenfields (item 42, 65% score 1 or 2); promoting connectivity between developments (item 43, 68% score 1 or 2); promoting "third places" or informal public spaces for community gathering (item 45, 51% score 1 or 2); and addressing the use of street trees for shade and enhanced walkability (item 46, 58% score 1 or 2). Municipalities are more likely to discuss the items about pedestrian friendly street networks, compact development patterns, and "third places" with concrete action plans or specific policies rather than aspirational goals (in order: item 37, 40% score 2 vs. 19% score 1; item 38, 51% score 2 vs. 15% score 1; item 45, 38% score 2 vs. 13% score 1). Roughly half of the municipalities that include items concerning Traditional Neighborhood Development, adaptive reuse of older buildings, connectivity between developments, and street trees in their comprehensive plans do so with specific policies or action plans (in order: item 40, 28% score 2 vs. 24% score 1; item 42, 36% score 2 vs. 29% score 1; item 43, 30% score 2 vs. 38% score 1; item 46, 30% score 2 vs. 28% score 1).

Wisconsin municipalities include four items in this section in their comprehensive plans at low rates. Fewer than one-third of municipalities support transit-oriented development (item 39, 28% score 1 or 2) and third-party standards for healthy building design, such as LEED (item 48, 26% score 1 or 2) in their local comprehensive plans. When municipalities do discuss these items, they almost always do so with aspirational goals rather than specific incentives or strategies for deployment (item 39, 8% score 2 vs. 20% score 1; item 48, 4% score 2 vs. 22% score 1). Furthermore, fewer than one-sixth of municipalities in Wisconsin support "natural surveillance," or the orientation of buildings and windows to face the street to making walking safer (item 47, 13% score 1 or 2) and third-party standards for sustainable, healthy mixed-use communities such as STAR Communities or LEED for Neighborhood Development (item 49, 4% score 1 or 2) in their comprehensive plans.

3.3.2 Items mandated by Wisconsin state statute

Half of the items in the Scorecard are not discussed at all in Wisconsin's state comprehensive planning statute (Table 3.3). Out of the items that are discussed in the state statute, about two-thirds are mandated with general language and only seven items are mandated with specific language. Appendix 5 contains more detailed information about if and how each item is mandated in the state statute.

Table 3.3: Frequency and percentage of Scorecard items with different types of mandates in the Wisconsin state statute.

Type of mandate	Freq.	Percent
Item is mandated with specific language	7	14.6
Item is mandated with general language	17	35.4
Item is not mandated	24	50.0

3.3.2.1 Specific mandates in the state statute

Among the items mandated with specific language are those supporting infill, redevelopment, and the adaptation and repurposing of older building (items 41 and 42). These items are specifically required by the state statute as part of the Land Use element of local comprehensive plans, which must "guide the future development and redevelopment of public and private property" and "analyze trends in the supply, demand and price of land, opportunities for redevelopment" (Wis. Stat. § 66.1001).

Item 20, supporting the preservation of working farms, and item 28, which is about improving park access for community members, are mandated as part of the Agricultural, Natural, and Cultural Resources element of local plans. This element must include "objectives, policies, goals, maps and programs for the conservation, and promotion of the effective management, of natural resources such as….productive agricultural areas…parks, open spaces…recreational resources…" (Wis. Stat. § 66.1001). Item 28 is even more specifically

referred to as part of the Utilities and Community Facilities element, which must address the development of facilities like parks, and "include an approximate timetable that forecasts the need in the local governmental unit to expand or rehabilitate existing utilities and facilities or to create new utilities and facilities" (Wis. Stat. § 66.1001). Furthermore, both item 20 and item 28 must be addressed in the Land Use element of local comprehensive plans, which must map existing and future land uses, including agricultural lands and parks, based on future population projections (Wis. Stat. § 66.1001).

Item 33, which is about the current distribution of health care facilities in the jurisdiction, is another required part of the Utilities and Community Facilities element, similar to parks. Item 16, which is about ensuring mobility for seniors and those with disabilities, is required as part of the Transportation element, which must include a plan for "…transit, transportation systems for person with disabilities….electric personal assistive mobility devices" (Wis. Stat. § 66.1001). Lastly, item 50, regarding intergovernmental cooperation, is required by the Wisconsin state statute as its own element in local comprehensive plans.

3.3.2.2 General mandates in the state statute

The general mandates in the state statute were much broader and often covered more than one item in the Scorecard. For example, the Transportation element of local comprehensive plans is required to include a "compilation of objectives, policies, goals, maps and programs to guide the future development of the various modes of transportation, including….bicycles….walking…" (Wis. Stat. § 66.1001), which was coded as a general mandate for many of the items in the Active Transportation section of the Scorecard. Required components of the Agricultural, Natural, and Cultural Resources and the Utilities and Community Facilities elements were coded as general mandates for many of the items in the Parks & Recreation section of the Scorecard,

though none rose to the level of a specific mandate except for item 28 about promoting access to parks.

Item 3, which is about addressing health and social inequities in the community, and item 35, which is about supporting aging in place, were addressed laterally in the requirements for the Housing element. This element is required to include policies and programs to provide housing choices to "…meet the needs of persons of all income levels and of all age groups and persons with special needs…" including promoting the "…availability of land for the development or redevelopment of low-income and moderate-income housing…" (Wis. Stat. § 66.1001). Item 6, which is about the connection between land use and social cohesion and mental health is referred to very broadly in the statute's definition of a comprehensive plan as "a guide to the physical, social, and economic development of a local governmental unit" (Wis. Stat. § 66.1001).

3.3.3 Relationship between state statute mandates and item scoring percentages

Figure 3.2 shows the mean scoring percentages for items within the categories "not mandated by state statute," "mandated by state statute with general language," and "mandated by state statute with specific language." This figure clearly shows that items not mandated by state statute are the least likely to be included in local plans (i.e. score a 0); they are included, on average, in only about 30% of comprehensive plans. In contrast, items mandated with general language are included in about 64% of local comprehensive plans and items mandated with specific language are included in about 81% of comprehensive plans.

This pattern also holds for the rate at which items are included with actionable language in local comprehensive plans (i.e. score a 2). Items that are not mandated by state statute are included with actionable language in only about 16% of local comprehensive plans, items mandated with general language are included with actionable language in about 38% of local

plans, and items that are mandated with specific language in the state statute are included with actionable language in about 48% of local comprehensive plans.

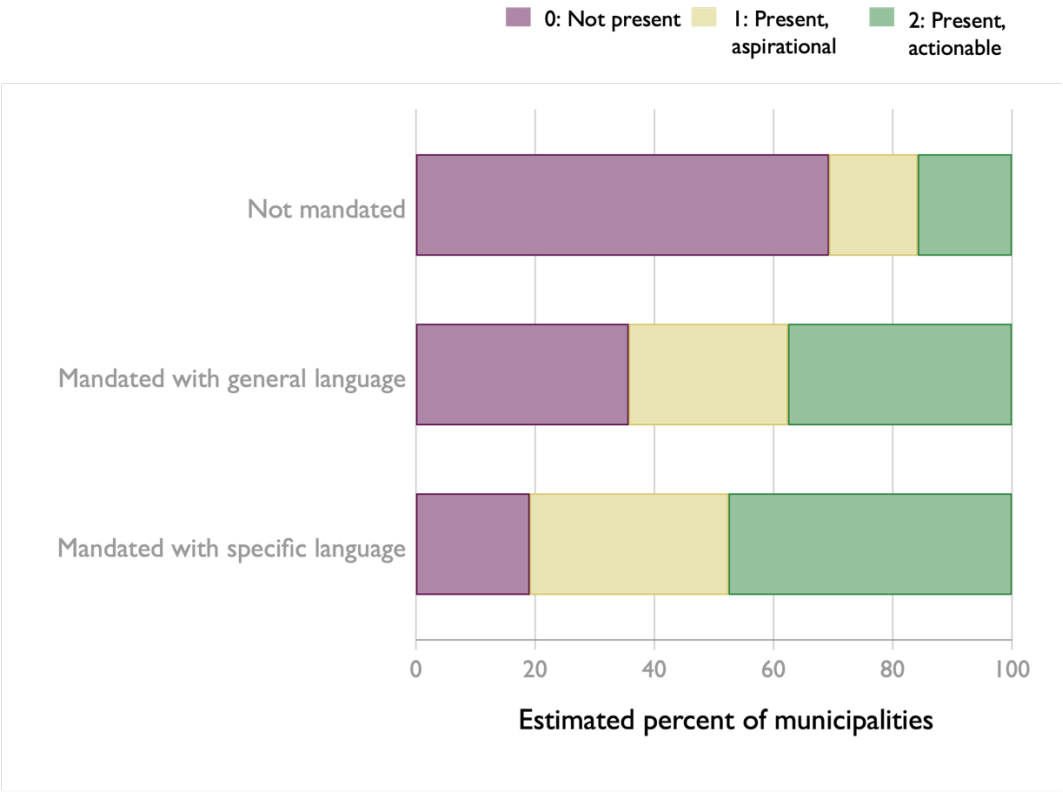


Figure 3.2: Statewide mean percentage of municipalities scoring 0 (not present), 1 (present but aspirational or vague), and 2 (present, actionable and specific) among items that are not mandated, mandated with general language, and mandated with specific language in the Wisconsin state comprehensive planning statute. See Appendix 6 for a table of mean scoring percentages and 95% confidence intervals for items with each type of mandate.

Compared to having no mandate for an item, mandating an item with general language is associated with a 33.6 percentage point higher inclusion rate in local comprehensive plans and a 21.8 percentage point higher inclusion rate with actionable language. Mandating an item with specific language in the state statute is associated with a 50.2 percentage point higher inclusion rate in local comprehensive plans and a 31.8 percentage point higher inclusion rate with actionable language. Each of these associations is statistically significant at the 0.05 confidence level and most are statistically significant at the 0.01 level (Table 3.4). Items mandated with

specific language in the state statute are also significantly more likely to be included (i.e. score a 1 or 2) in local comprehensive plans than items mandated with general language (Welch test p-value: 0.0051). However, the Welch tests for *specifically* scoring a 1 or *specifically* scoring a 2 showed no statistically significant differences between items mandated with specific vs. general language.

Table 3.4: Difference in estimated percentage of municipalities scoring 0, 1 and 2 on items mandated with different types of language versus not mandated in the Wisconsin state statute.

	Score 0	**Score 1**	**Score 2**
General language	-33.6 (0.0000) [-46.3, -20.9]	11.9 (0.0008) [4.8, 18.9]	21.8 (0.0001) [11.0, 32.5]
Specific language	-50.2 (0.0000) [-63.7, -36.8]	18.5 (0.0475) [-4.2, 41.13]	31.8 0.0066) [8.6, 54.9]

P-values of one-way Welch tests in parentheses; 95% confidence interval in brackets. Score 0: Item not present. Score 1: Item present, aspirational. Score 2: Item present, actionable.

3.4 DISCUSSION

This study shows that, in Wisconsin, HEAL-related items that are mandated by state statute are more likely to be included in local comprehensive plans than items that are not mandated. Items that are mandated are also more likely to be included in local comprehensive plans in an actionable, concrete manner, which may make them more likely to be implemented.

HEAL-related items that are mandated with *specific language* in the state statute are included in local plans at higher rates than items mandated with *general language*. When items are mandated with specific language, their inclusion rate in local plans is, on average, 50 percentage points higher than items that are not mandated. However, very few HEAL-related items are mandated with specific language in the Wisconsin state statute.

These results also show that mandating by state statute that an item be included in local comprehensive plans does not ensure that it *will* be included in every plan. However, our results indicate higher inclusion percentages than other similar studies that have been conducted in the past.

3.4.1 Higher inclusion of HEAL-related items than in previous evaluations

This study is one of the first to provide estimates of how well HEAL is incorporated into local comprehensive plans. Our results broadly mirror those of Ricklin et al.'s (2012) evaluation of 18 comprehensive plans and four sustainability plans. Like us, they found that most plans lack an explicit discussion of the connection between planning, the built environment, and health as well as goals and policies related to healthy food systems. Out of the 34 items measuring similar concepts in our study and Ricklin et al.'s (2012) study, 26 items scored higher in the Ricklin et al. study, sometimes by as much as 50 percentage points. This is unsurprising, given that the plans evaluated in the Ricklin et al. study were only selected into the sample if they explicitly referenced public health and contained at least 10 public health related goals or policies, while the plans in our study were randomly sampled.

When compared to other studies with large, random samples, our results indicate higher inclusion of goals and policies regarding mixed land use and infrastructure for active transportation. For example, in Aytur et al.'s (2008) survey of 67 North Carolina county land use plans, 40% addressed mixed land use, 28% addressed greenways, and 19% addressed bicycle paths. In Peterson et al.'s (2018) analysis of the nationally representative CBS HEAL survey, 72% of urban, municipal land use plans addressed mixed use development, 59% promoted street connectivity, and 40% referenced a Complete Streets policy. Compare this to 83% of Wisconsin

comprehensive plans addressing mixed land use; 86% promoting trails, paths, or greenways; 68% promoting street connectivity; and 59% referencing a Complete Streets policy in our study.

Both Aytur et al. and Peterson et al. used survey data, rather than content analysis of plan documents. However, we would expect survey data to, if anything, inflate the inclusion of HEAL-related goals and policies due to social desirability bias. Aytur et al.'s (2008) survey was completed in 2003 and the CBS HEAL in 2014, so our higher scoring percentages could be due to more recent uptake of HEAL-promotion in comprehensive plans. Another possible explanation is that, when compared to other states, Wisconsin has a relatively strong and prescriptive comprehensive planning mandate, especially when it comes to policies that are likely to promote physical activity (e.g. parks and recreation, active transportation) (Charron et al., 2021; Schilling & Keyes, 2008).

3.4.2 Even mandated items are not always included in local comprehensive plans

While the scoring percentages we presented in our results are higher than those in previous studies, they are still not very high, even for some mandated items. For example, adaptive reuse of older buildings and farmland preservation policies are mandated with specific language by the statute, but only 65% and 67% of municipalities address them, respectively, in their local plans. Many items mandated with general language are addressed in less than two-thirds of local plans. The Wisconsin state comprehensive planning statute does not include enforcement mechanisms to ensure that local plans abide by its mandates, which could explain why many plans do not include mandated items.

The item about intergovernmental collaboration, on the other hand, has near-perfect uptake in local comprehensive plans in Wisconsin. Moreover, municipalities that do address it in their plan almost always do so in an actionable way. Among the items we evaluated,

intergovernmental collaboration is the only one that is mandated as one of the nine required elements in local comprehensive plans. Other items are mandated to be included as smaller pieces of one or more of the nine required elements. This offers evidence, even if limited, that when required as an element, a component is more likely to be included in local plans. It raises the question: What if community health was a required element in comprehensive plans? This may very well lead to greater uptake of HEAL-promoting components, as well as other public health related policies, being included in local comprehensive plans.

3.4.3 Limitations

This study has several limitations. First, this is a cross-sectional study and the results should not be interpreted as causal. While the results point to a relationship between requirements contained in the Wisconsin state statute and incorporation of HEAL-promoting components in local comprehensive plans, we cannot rule out reverse causation or confounding factors. For example, it is possible that the state statute, passed in 2000, reflects planning domains and practices that were already in heavy use in Wisconsin. It is also possible that a third factor, such as the focal points of regional planning commissions or planning advocacy organizations, explain the relationship between state statute requirements and local planning practice. Future qualitative research could investigate the mechanisms behind the relationships observed in this study.

This study was limited to municipal comprehensive plans from urban and suburban communities in Wisconsin. The results should not be generalized to rural communities, county comprehensive plans, or communities outside of Wisconsin. In addition, we only coded the state comprehensive planning statute to the exclusion of other state-level regulations, administrative procedures, or court cases that could also impact local-level comprehensive planning. Lastly, this

study only investigated the content of local comprehensive plans, and not their implementation, as this was outside the scope of the present study.

3.5 Conclusion

3.5.1 Research and policy implications

This study found differences in the uptake of HEAL-related items in local comprehensive plans compared to previous studies conducted in other states; however, it is unclear if differential state statute mandates are a determining factor in these differences. Targeted cross-state comparative evaluations could be conducted to shed light on this question. In the past, such cross-state comparisons have linked strong state planning mandates to more hazard mitigation and sustainability components included in local comprehensive plans (Berke & French, 1994; Burby & Dalton, 1994; Manta Conroy & Berke, 2004).

This study did find that state mandates for comprehensive planning for HEAL are associated with greater uptake of HEAL-related items in local comprehensive plans. Therefore, if more HEAL-related items were mandated by state law, it is possible local communities would include more HEAL-promoting goals, objectives, and policies in their local plans. However, even items that are specifically mandated by state statute are not always included in local plans. Taking this into account alongside the fact that changes to state planning statutes are large undertakings; enforcement, encouragement, and technical assistance mechanisms could also potentially be strengthened in order to promote planning for HEAL at the local level.

Currently, municipalities must send a copy of their officially adopted comprehensive plan to the Wisconsin Department of Administration (DOA), but the plans are not checked for compliance with the statute (WI DOA, 2024). From 2000-2010, state grants to offset the cost of

developing comprehensive plans were prioritized for communities that included all mandated components and addressed 14 state planning goals; however that grant program has since been discontinued (Keane, 2015; Schilling & Keyes, 2008). When the state comprehensive planning statute was passed in 2000, the DOA and UW-Extension produced a number of resources to help local communities develop their comprehensive plans. More targeted technical assistance is decentralized, offered through regional planning commissions, county planning offices, and local University of Wisconsin campuses. It is possible that stronger comprehensive enforcement mechanisms, a re-establishment of grant fundings, and more centralized technical assistance programs would translate to even greater adherence to Wisconsin's current state planning statute.

3.5.2 Concluding remarks

Comprehensive plans can promote HEAL through coordinated built environment goals and policies. Our study provides evidence that, at least in Wisconsin, state-level planning mandates may influence how well local comprehensive plans address HEAL. Moreover, how HEAL components are mandated by state statute also matters—using specific language and requiring that public health be included as a specific element or chapter may increase uptake in local plans. Even when HEAL-related items are mandated by state statute, though, they may not always be included in local plans. This suggests that, beyond changing state statutes, stronger enforcement and encouragement mechanisms may be warranted.

3.6 References

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2008). The sociodemographics of land use planning: Relationships to physical activity, accessibility, and equity. *Health & Place*, *14*(3), 367–385. https://doi.org/10.1016/j.healthplace.2007.08.004

Berke, P. R., & French, S. P. (1994). The influence of state planning mandates on local plan quality. *Journal of Planning Education and Research*, *13*(4), 237–250. https://doi.org/10.1177/0739456X9401300401

Brody, S. D., Carrasco, V., & Highfield, W. E. (2006). Measuring the adoption of local sprawl reduction planning policies in Florida. *Journal of Planning Education and Research*, *25*(3), 294–310. https://doi.org/10.1177/0739456X05280546

Burby, R. J., & Dalton, L. C. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review*, *54*(3), 229–238. https://doi.org/10.2307/976725

Charron, L. M., Joyner, H. R., LaGro, J., & Gilchrist Walker, J. (2019). Research note: Development of a comprehensive plan scorecard for healthy, active rural communities. *Landscape and Urban Planning*, *190*, 103582. https://doi.org/10.1016/j.landurbplan.2019.05.013

Charron, L. M., Joyner, H. R., LaGro Jr., J. A., Lehr, N., Villegas, D. E., Jeppson, T., Gomez Parra, S., Gangnon, R., & Lindberg, S. M. (forthcoming). Comprehensive planning for healthy eating and active living: A systematic assessment from Wisconsin. *Journal of Planning Education and Research*.

Charron, L. M., Milstein, C., Moyers, S. I., Abildso, C. G., & Chriqui, J. F. (2021). Do state comprehensive planning statutes address physical activity?: Implications for rural communities. *International Journal of Environmental Research and Public Health*, *18*(22), Article 22. https://doi.org/10.3390/ijerph182212190

Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, *8*(1), 23. https://doi.org/10.20982/tqmp.08.1.p023

Heeringa, S. G., West, B. T., & Berglund, P. A. (2010). *Applied Survey Data Analysis*. Chapman & Hall/CRC.

Hodgson, K. (2012). *Planning for Food Access and Community-Based Food Systems: A National Scan and Evaluation of Local Comprehensive and Sustainability Plans*. American Planning Association. https://planning.org/publications/document/9148238/

Kaplan, M., Maiden, K., Miller, P., Celano, G., & Walling, L. A. (2016). *Healthy Living and Active Design: A Scorecard for Comprehensive Plans*. Cedar Creek Sustainable Planning Services & Nemours Children's Health System. http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf

Keane, M. J. (2015). *Wisconsin's Comprehensive Planning Law* (Legislative Brief 15–12; Wisconsin Briefs, p. 3). Wisconsin Legislative Reference Bureau. https://docs.legis.wisconsin.gov/misc/lrb/wisconsin_briefs/2015/wb_15_12.pdf

Klein, B., Meck, S., Morris, M., Cobb, R., Hecimovich, J., Gregory, M., & Kenders, T. (1996). *Modernizing State Statutes* (The Growing Smart Working Papers Volume 1). American Planning

Association. https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/growingsmart/pdf/PAS462.pdf

Manta Conroy, M., & Berke, P. R. (2004). What makes a good sustainable development plan? An analysis of factors that influence principles of sustainable development. *Environment and Planning A: Economy and Space*, *36*(8), 1381–1396. https://doi.org/10.1068/a367

McDonald, J. H. (2009). *Handbook of Biological Statistics* (2nd ed.). Sparky House Publishing. http://biostathandbook.com/HandbookBioStatSecond.pdf

Meck, S. (2002). *Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change*. American Planning Association. https://www.planning.org/growingsmart/

Peterson, E. L., Carlson, S. A., Schmid, T. L., & Brown, D. R. (2018). Prevalence of master plans supportive of active living in US municipalities. *Preventive Medicine*, *115*, 39–46. https://doi.org/10.1016/j.ypmed.2018.08.004

Ricklin, A., Klein, W., & Musiol, E. (2012). *Healthy Planning: An Evaluation of Comprehensive and Sustainability Plans Addressing Public Health*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Healthy-Planning.pdf

Schilling, J., & Keyes, S. D. (2008). The promise of Wisconsin's 1999 comprehensive planning law: Land-use policy reforms to support active living. *Journal of Health Politics, Policy and Law*, *33*(3), 455–496. https://doi.org/10.1215/03616878-2008-005

Shah, S., & Wong, B. (2020). *Toolkit to Integrate Health and Equity into Comprehensive Plans* (p. 37). American Planning Association. https://www.planning.org/publications/document/9201866/?utm_campaign=2020-08-06+HIP+content+order&utm_medium=email&utm_source=Pew

StataCorp. (2021). *Stata Statistical Software: Release 17* (17.0) [Computer software]. StataCorp LLC.

Stevens, M. R., Lyles, W., & Berke, P. R. (2014). Measuring and reporting intercoder reliability in plan quality evaluation research. *Journal of Planning Education and Research*, *34*(1), 77–93. https://doi.org/10.1177/0739456X13513614

WI DOA. (2024, January 12). *Comprehensive Planning*. State of Wisconsin Department of Administration. https://doa.wi.gov/Pages/LocalGovtsGrants/Comprehensive-Planning.aspx

Chapter 4: It's not just about health: A scoping review of interconnections between planning for healthy eating and active living and the 17 Sustainable Development Goals

4.1 Introduction

Planning for HEAL is often conceptualized as primarily a public health intervention. However, as was discussed in Chapter 1 of this dissertation, many studies in the last 15 years have investigated co-benefits of planning for HEAL, particularly in the realm of environmental sustainability. The many potential synergies and trade-offs of planning for HEAL to environmental, social, economic, and other development goals have not yet been systematically mapped. Sallis et al. conducted a literature review of physical health, mental health, social, safety/injury prevention, environmental, sustainability, and economic co-benefits of built environment approaches to promote active living (2015). However, these co-benefit domains were not linked to an external framework of goals, nor was it entirely clear which co-benefits were considered within each of these domains.

Mapping potential synergies and trade-offs of planning for HEAL more systematically could serve researchers and practitioners in many ways. First it could offer the field of HEAL-focused researchers and practitioners, especially those focused on built and social environment interventions (e.g. the Physical Activity and Nutrition and Obesity Policy Research and Evaluation networks, PAPREN and NOPREN) a menu of options for linking their work to broader global development goals. It could propose new collaborative opportunities for researchers and practitioners alike. It could also offer policymakers a more holistic view of actions to promote HEAL, which could ensure that local-level resources are used efficiently (i.e. to achieve multiple aims with one action), help make the case for planning for HEAL, and add

political expediency to planning for HEAL, helping to overcome policy inertia (Swinburn et al., 2019)

4.1.1 Why connect planning for HEAL to the Sustainable Development Goals?

In 2015, all 193 member states of the United Nations signed onto the Sustainable Development Goals (SDGs), a set of 17 goals and 169 targets to guide global progress for people, the planet, and prosperity (Table 4.1 for SDGs; see Appendix 7 for a list of all targets) (United Nations, 2015). The 17 SDGs are a globally agreed upon roadmap to transform the world for the better (Alcamo et al., 2020; DiPrete Brown, 2023; Morton et al., 2017; United Nations, 2015). Therefore, I use the SDGs as an organizing framework for mapping synergies and trade-offs of planning for HEAL. Not only does this tie planning for HEAL to a globally-recognized framework, but it also places planning for HEAL on the global development agenda. Furthermore, the SDGs were formulated to be interconnected and there is precedent in the sustainability and global development literature for assessing synergies and trade-offs between goals (Kroll et al., 2019; Nilsson et al., 2016; Pradhan et al., 2017) and between the SDGs and other issues of relevance (e.g. ecosystem services, COVID-19-resilient cities) (Alnusairat et al., 2023; M. J. A. Maes et al., 2019).

DiPrete Brown introduced the concept of an "SDG 360 analysis" or an "emergent systems science approach to sustainability that uses the SDG goals, targets, and indicators as a starting point to systematically study a specific challenge or policy through a holistic lens that includes human, ecosystem, and planetary survival and well-being" (2023, p. 12). Though the focus of SDG 360 analyses is on connecting local-level programs and policies to the SDGs in order to better understand connections, interactions, feedback loops, co-benefits, and trade-offs,

Table 4.1: The 17 Sustainable Development Goals. Source: (United Nations, n.d.).

	End poverty in all its forms everywhere
	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
	Ensure healthy lives and promote well-being for all at all ages
	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
	Achieve gender equality and empower all women and girls
	Ensure availability and sustainable management of water and sanitation for all
	Ensure access to affordable, reliable, sustainable and modern energy for all
	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
	Reduce inequality within and among countries
	Make cities and human settlements inclusive, safe, resilient and sustainable
	Ensure sustainable consumption and production patterns
	Take urgent action to combat climate change and its impacts
	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
	Strengthen the means of implementation and revitalize the global partnership for sustainable development

it can also be a powerful tool for creating more policy-relevant research by connecting narrow research agendas to broader global and local development goals (DiPrete Brown, 2023).

This project therefore sought to conduct an SDG 360 analysis of planning for HEAL, using a scoping review to identify and summarize the potential interconnections between planning for HEAL and the SDGs.

4.1.2 Research questions

5. What conceptual interconnections have been proposed between planning for HEAL and the United Nations' Sustainable Development Goals?
    a. What is the direction for each proposed interconnection (HEAL to SDG or SDG to HEAL)?
    b. What is the type for each proposed interconnection (indivisible, reinforcing, enabling, co-benefits, trade-offs, and/or intertwined considerations)?

4.1.3 Planning for HEAL and the SDGs – previous studies

Previous research has conceptualized the interconnections between aspects of planning for HEAL and the SDGs. However, these studies have all either been too narrow (e.g. active transportation and the SDGs (Macmillan et al., 2020)), too broad (e.g. urban health and the SDGs (Ramirez-Rubio et al., 2019)), or both (e.g. physical activity promotion and the SDGs (Salvo et al., 2021) for my purposes.

Many previous studies also lack complexity in the conceptualization of interconnections. For example, Salvo et al. used a literature review, conceptual linkage exercise, and agent-based modeling to develop a framework for how physical activity promotion strategies can impact the SDGs (2021). They did not consider, however, how action on the SDGs might impact physical activity, nor more complex interconnections (Salvo et al., 2021). Other studies lack a nuanced discussion of the types of interconnections that might exist between planning for HEAL (or related topics) and the SDGs. Many studies limit interconnection types to "direct" or "indirect,"

interconnections or do not discuss the type of interconnection at all (e.g. Giles-Corti et al., 2020; Ramirez-Rubio et al., 2019).

By mapping a variety of interconnection directions and types, this review sought to provide a more comprehensive framework of interconnections between planning for HEAL and the SDGs and better clarity about the nature of such interconnections.

4.2 Methods

I used a scoping review to identify conceptual interconnections between planning for HEAL and the 17 SDGs. Scoping reviews may be done for a variety of purposes, but generally include an exploratory focus; mapping of concepts, policies, or literature; and identification of research gaps (Levac et al., 2010). Unlike systematic reviews, scoping reviews generally do not include an evaluation of the quality of the publications included (Levac et al., 2010; Tricco et al., 2018). A scoping review was particularly suitable for my research question because: a) I sought to expansively explore and map interconnections, b) potentially relevant literature was diverse, and c) I did not seek to evaluate the empirical evidence for interconnections. I followed the PRISMA-ScR checklist for developing and reporting the methodology for this scoping review, though a protocol was not registered (Tricco et al., 2018).

I identified articles, reports, essays, and other works that conceptually linked a) urban, regional, city, or community planning, design, or policy for b) healthy eating, active living, obesity, chronic disease prevention, or urban health or liveability to c) the SDGs. The scope of the review was broad in that both peer-reviewed and grey literature were considered; works and authors from any field, sector, and country of origin were included; and no exclusion was made based on methodology, geographic area, urbanicity, or developing/low-income versus

developed/high-income status. This broad focus was meant to capture diverse perspectives on how planning for HEAL might be connected to the SDGs.

However, this broad scope was balanced with several narrow eligibility criteria to ensure that the works selected served the purpose of the review and because the study had limited capacity (i.e. one researcher). Therefore, to be considered eligible for inclusion, works had to consider all SDGs (as opposed to one, two, or a subset) for conceptual linkages to their topic of interest. Furthermore, connections to the SDGs had to be explicit. That is, the works had to directly engage with the 17 SDGs, rather than considering objectives aligned with one or more SDGs (i.e. works discussing the connection to climate change mitigation without directly discussing SDG 13 would not be considered). Based on these criteria, this review excludes works that empirically tested specific co-benefits between related topics and SDGs, unless all SDGs were considered for inclusion. Reviewing the empirical evidence for co-benefits was outside the scope of this study.

4.2.1 Search strategy

The search proceeded in three iterative phases, as recommended by Levac et al. (2010). The first phase included an informal, preliminary search using Google and Google Scholar. Publications identified via this search were reviewed and data was extracted before the second and third search phases began. This helped me get a broad idea of the types of conceptualizations that might exist, determine that a scoping review was necessary, refine the research purpose and question, develop and refine search terms, and develop and test the utility of the data charting method.

The second and third phases were conducted systematically, each searching Web of Science Core Collection, Scopus, PubMed, PAIS, SocIndex, Greenfile, Sustainability Science

Abstracts, Worldwide Political Science Abstracts, ProQuest Dissertations and Theses Global, and Google Scholar using Boolean search strings. These systematic searches were constructed with the help of a research librarian at UW-Madison and can be found in Appendix 8.

In the second search phase, each database was searched using keywords related to a) the SDGs; b) healthy eating, active living, obesity, chronic disease, urban health and liveability; and c) urban planning and the built environment (Table 4.2). After the second phase, I thought there might be specific planning for HEAL interventions that were missed with the more general search terms. Therefore, I proceeded with a third phase using more specific keywords from the assessment items in the Healthy Living and Active Design Scorecard for Comprehensive Plans (see Chapter 2 for more information about this Scorecard) (Table 4.3). In both phase two and phase three systematic searches, SDG keywords were searched in titles only while all other keywords were searched in abstracts, titles, and article keywords.

Table 4.2: Phase two search keywords.

Topic	Search string
SDGs	"sustainable development goals" or "sdgs"
	AND
Healthy eating	*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access"
	OR
Active living	"physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*"
	OR
Obesity and chronic disease	obesity or "chronic disease*" or "non-communicable disease*"
	OR
Urban health and liveability	(urban or city) and (health or liveability)
	AND
Urban planning and the built environment	((urban or city or community or regional) and (planning or design or policy)) or "built environment*")

Full Boolean strings used to search each database are available in Appendix 8.

Table 4.3: Phase three search keywords.

Topic	Search string
SDGs	"sustainable development goals" or "sdgs"
	AND
Active transportation	“bik*” or “walk*” or “bicycl*” or “pedestrian*” or “transit” or “public transport*” or “complete street*” or “traffic calm*” or “safe routes to schools”
	OR
Healthy food access	“farm* preserv*” or ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*)) or “local food*” or “food desert*” or “food swamp*” or “healthy food access” or “community garden*” or “farmer* market*”
	OR
Parks and recreation	“parks*” or “recreat*” or “open space*” or “green space*” or “playground*”
	OR
Health care access	“health care access” or (“access to” and (“health care” or “health service*”)) or “aging in place” or “age-friendly”
	OR
Community design	“mixed use*” or “compact development*” or “smart growth” or “transit-oriented development*” or “transit-oriented design*” or “traditional neighborhood development*” or “new urbanis*” or “infill” or “adaptive reuse” or “third place*” or “third space*” or “public space*” or “street tree*” or “urban canop*” or “tree city” or “natural surveillance” or “eyes on the street” or “healthy building design” or “healthy community design” or “activity hub*” or “Main Street*” or “town center” or “historic downtown” or “designated growth area*” or “conservation subdivision*” or “rural home cluster*” or “sprawl*”
	AND
Urban planning and the built environment	((urban or city or community or regional) and (planning or design or policy)) or "built environment*")

Full Boolean strings used to search each database are available in Appendix 8.

4.2.2 Screening

I imported citation information about all works identified via the phase two and three searches into Zotero and identified and deleted duplicates. I then screened first the titles and abstracts of each publication, and then the full text, for inclusion in the review. I tagged each publication in the Zotero library as “Screen – include” or “Screen – exclude” at the abstract screening stage and “FT screen – include” or “FT screen – exclude” at the full text screening stage.

4.2.3 Data charting

4.2.3.1 Initial data charting

The main organization for data charting was established and tested for utility with publications identified in the preliminary (phase one) search and then iteratively adjusted after coding the first five publications identified in the phase two search (Levac et al., 2010).

I charted data about the publications by tagging them in the Zotero PDF reader (Corporation for Digital Scholarship, 2022). This allowed me to highlight relevant passages in the work, tag with an appropriate identifier (see Table 4.4), and add notes. I then used a custom-written Python program[13] using the Zotero API to pull all relevant highlights and notes into a spreadsheet organized by publications (in rows) and tags (in columns). The final spreadsheet pulled from Zotero can be found in the OSF repository for the project (https://osf.io/m3k5p/).

I reviewed and tagged all main publications and relevant supplementary materials. Material that could not be tagged in Zotero (e.g. print books or Excel spreadsheets of supplementary material) was manually tagged in a spreadsheet and then appended to the Zotero spreadsheet output.

Many publications were focused on topics broader than planning for HEAL. For example, one connected physical activity promotion to the SDGs and several others focused on urban health and liveability. For most cases, in the original data charting, I tagged *all* connections between the publication's topic and the SDGs, whether they were related

[13] The Zoqoder program is openly available at https://github.com/julianirwin/zoqoder.

specifically to planning for HEAL or not.[14] For example, in a publication about micromobility, I tagged interconnections concerning the material used to develop e-bike batteries and SDGs 13, 14, and 15. This was partially done because connections were often discussed as highly interconnected, with the intent to tease out the interconnections related specifically to planning for HEAL at a later stage in the analysis.

Table 4.4: List of tags used to chart data in included publications.

Tag	Meaning
author-affiliations	Institutional affiliations of author(s)
topic	Topic the publication is linking to the SDGs
methods	Methods used in the research
geo-pop-focus	Geographic and/or population focus
conceptual-framework-sdg	Any conceptual framework regarding the SDGs, sustainability, or SDG interconnections broadly speaking
conceptual-framework-topic	Any conceptual framework regarding the topic or the connection between the topic and the SDGs
visualization	Any type of visualization used to show the connection between the topic and the SDGs
sdg1, sdg2, sdg3…	An instance relating the topic to an SDG
target1.1, target1.2, target2.1, target2.2…	An instance relating the topic to an SDG target
sdg-interconnections	Background information, quotes, or resources about interconnections among SDGs or between SDGs and related topics
sdg-localization	Background information, quotes, or resources about the process of localizing the SDGs

Full methodological notes about what each tag includes can be found in Appendix 8.

4.2.3.2 Refining codes: Interconnection direction and type

For the second phase of data charting, I uploaded all highlighted text, tags, and comments from Zotero into Dedoose (SocioCultural Research Consultants, LLC, 2024). All highlighted text and

[14] The only exception was a lengthy supplementary spreadsheet associated with one article, which included expert opinion scores for connections between all 17 SDGs and seven physical activity promotion strategies (Salvo et al., 2021). For this document, I tagged only the results for active transportation and urban design strategies (and not, for example, education or sports strategies).

comments appeared as excerpts, while the tags from Zotero appeared as codes and (in some cases) descriptors for the publications (e.g. year, authors).

I used qualitative content analysis methods to further refine descriptive codes. For example, the "geo-pop-focus" code was refined to included rural, suburban, urban, high-income, and low-middle-income subcodes. I also refined or further coded for journal type, type of methods used, topic covered, and author information (field, industry, region).

Lastly, I closely reviewed each excerpt that had previously been coded as discussing an interconnection to an SDG or SDG target. For excerpts specifically discussing an interconnection to planning for HEAL, I coded the interconnection *direction* and *type*. Interconnection *direction* was derived from the 2017 Global Nutrition Report, which described interconnections between nutrition and the SDGs as having two major directionalities: how interventions on nutrition could impact the SDGs and how interventions on each SDG could impact nutrition (Development Initiatives, 2017). Therefore, I coded interconnections as either "HEAL to SDG", "SDG to HEAL", or "direction unclear." "HEAL to SDG" indicated that either planning for HEAL initiatives or progress on increasing HEAL behaviors could impact an SDG. "SDG to HEAL" indicated that progress on an SDG could impact planning for HEAL initiatives or progress on increasing HEAL behaviors.

Interconnection *type* was derived from Nilsson et al.'s seven-level classification of interactions between SDGs (Figure 4.1) (2016). I used Nilsson et al.'s three positive interaction types, collapsed all trade-offs into one "Trade-Off" code (because there were relatively few trade-offs identified in the literature), and did not use the "Consistent" interaction type, as this seems to indicate no interaction.

Interaction	Name	Explanation	Example
+3	Indivisible	Inextricably linked to the achievement of another goal.	Ending all forms of discrimination against women and girls is indivisible from ensuring women's full and effective participation and equal opportunities for leadership.
+2	Reinforcing	Aids the achievement of another goal.	Providing access to electricity reinforces water-pumping and irrigation systems. Strengthening the capacity to adapt to climate-related hazards reduces losses caused by disasters.
+1	Enabling	Creates conditions that further another goal.	Providing electricity access in rural homes enables education, because it makes it possible to do homework at night with electric lighting.
0	Consistent	No significant positive or negative interactions.	Ensuring education for all does not interact significantly with infrastructure development or conservation of ocean ecosystems.
–1	Constraining	Limits options on another goal.	Improved water efficiency can constrain agricultural irrigation. Reducing climate change can constrain the options for energy access.
–2	Counteracting	Clashes with another goal.	Boosting consumption for growth can counteract waste reduction and climate mitigation.
–3	Cancelling	Makes it impossible to reach another goal.	Fully ensuring public transparency and democratic accountability cannot be combined with national-security goals. Full protection of natural reserves excludes public access for recreation.

Figure 4.1: Nilsson et al.'s SDG interaction types. Source: (Nilsson et al., 2016, reproduced with permission).

As I coded, I came across interconnections that did not seem to fall within these interaction types. Therefore, I also inductively added three codes for interconnection type: "Co-benefits," "Intertwined Considerations," and "Pathway Unclear." Diagrams and explanations of each of these codes are included in Figure 4.2 and Figure 4.3.

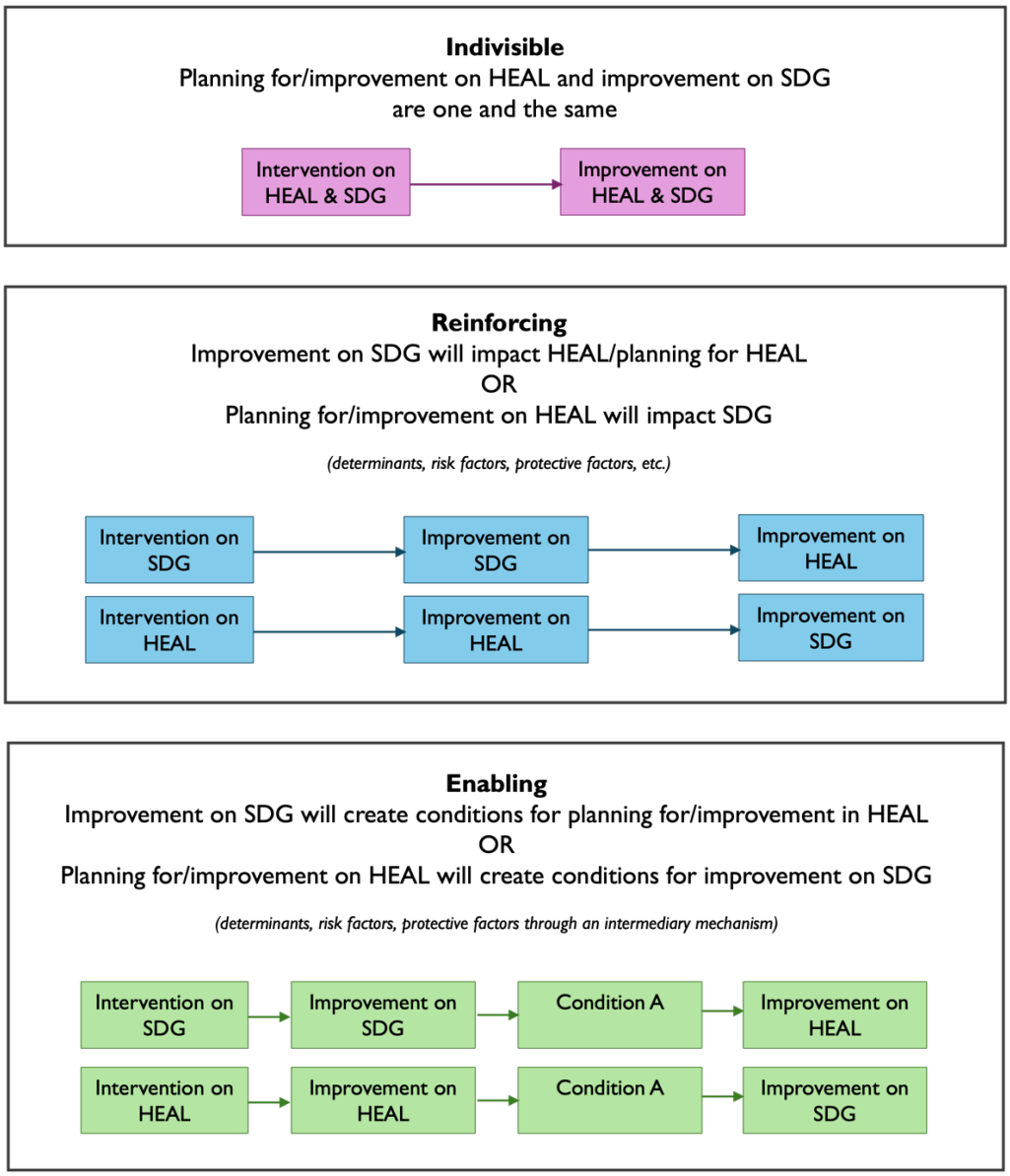
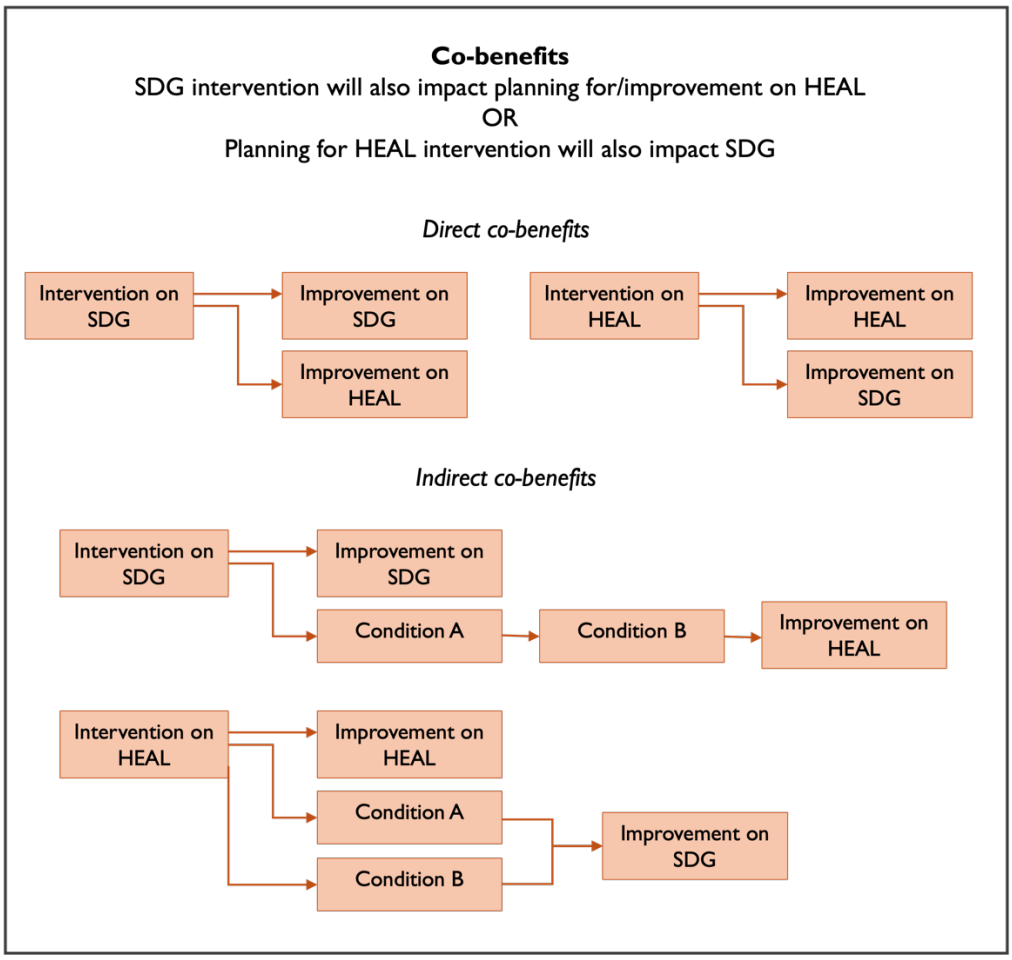


Figure 4.2: Diagrams and explanations of indivisible, reinforcing, and enabling interconnection types. Adapted from (Nilsson et al., 2016).



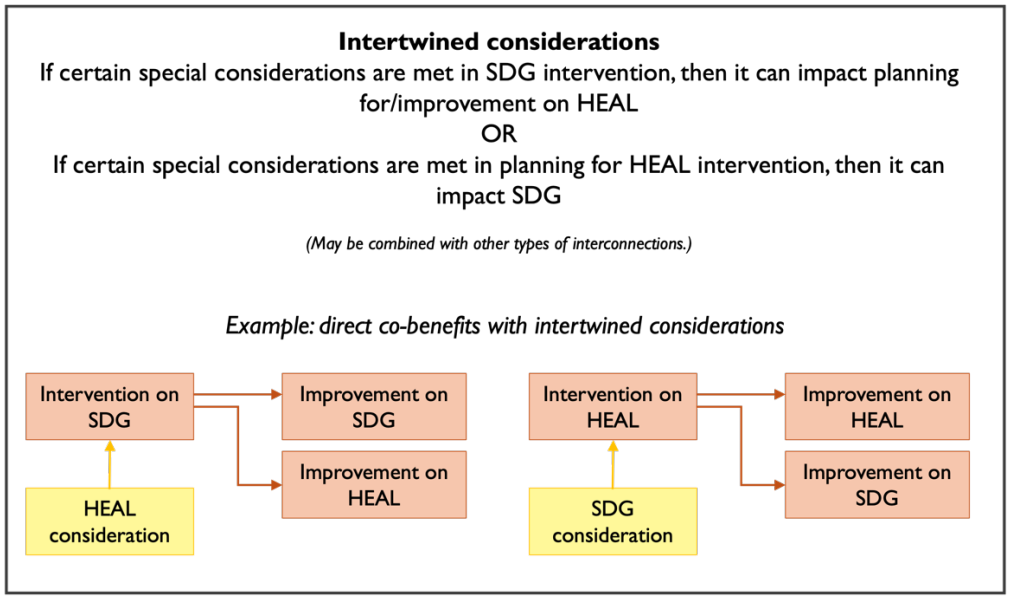


Figure 4.3: Diagrams and explanations of co-benefit and intertwined considerations interconnection types.

4.2.4 Data analysis

I used the code and descriptor analysis tools in Dedoose to describe the publications in the scoping review by type (e.g. peer-reviewed article, report), journal/publisher field (e.g. health, sustainability), year, and author team composition, including industries (e.g. academia, local governance), fields of research, and regions represented. I used the analysis tools to describe the methods employed, geographic/population focus, and topics covered in the included publications.

Next, I used the code analysis tools to count the number and percentage of publications with codes for interconnections between planning for HEAL and a) each SDG and b) each SDG target. Lastly, I reviewed the excerpts coded for each SDG to compile qualitative descriptions of interconnections discussed in the literature, organized by direction and type.

4.3 Description of publications

I identified eight publications in search phase one, 413 in search phase two, and 213 in search phase three (Figure 4.4). Full details of the number of publications found via each database can be found in Appendix 8. After removing duplicates, I screened the title and abstract of 362 publications of which 217 were excluded. I conducted a full text screen of the remaining 145 publications, of which 116 were excluded. A total of 37 publications were included in this review.

Twenty-eight of the publications included in the final review were journal articles, four were book chapters, four were reports, and one was a thesis. Out of the 28 journal articles, 11 were published in health-focused journals; 11 in sustainability or environmental sciences journals; and one each in a law journal, a broad social sciences journal, and a physical sciences

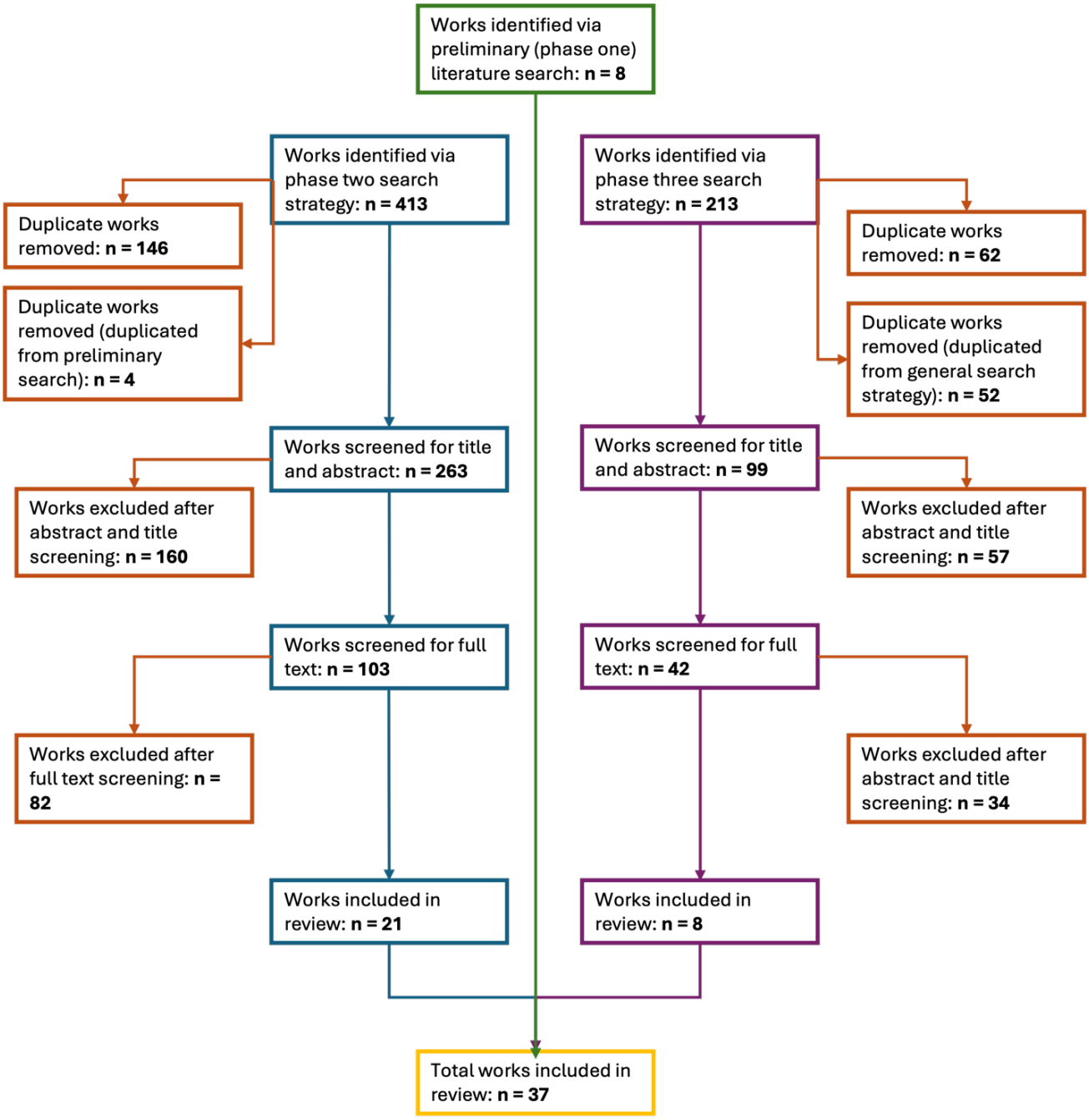


Figure 4.4: Flow diagram of publication identification and screening.

journal. Three were published in interdisciplinary journals: two in policy and sustainability/environmental sciences journals and one in a policy and health journal.

All four of the reports were published by international development organizations or consortia: one by the World Health Organization (WHO), one by the UN Food and Agriculture Organization (FAO), one by a non-profit research organization focused on sustainability and equity, and one by a global partnership of international organizations working on sustainable mobility solutions. The book chapters were found in books about sustainable governance and sustainable food systems. Publications were published between 2017 and 2023 (Figure 4.5).

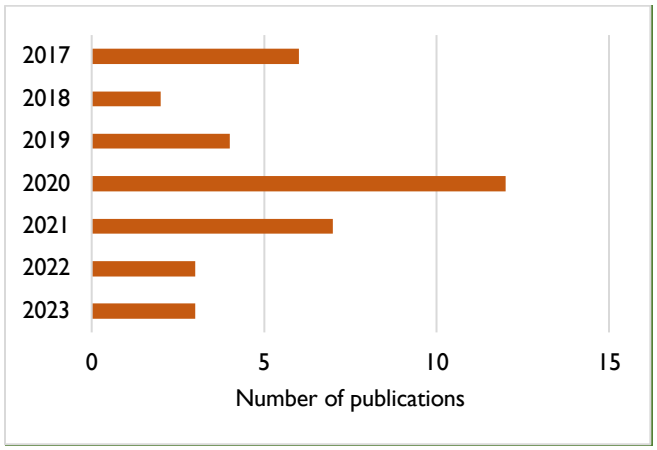


Figure 4.5: Number of publications included in review that were published in each year.

Author teams were large and varied with regard to field of research, regions represented, and industry affiliation. Twenty-one publications had one or more authors from Europe, 15 had authors from North America, 11 from Asia, 11 from Australia and New Zealand, 8 from Africa, and 3 from South and Central America. Most of the authors were from universities, but 15 publications included authors from non-governmental organizations, 10 had authors in governmental positions, 2 had authors from the healthcare sector, 2 had authors from private consultant firms, and 1 had authors from development banks.

The two main fields of research and practice represented by the authors were health and medicine (17 publications), environmental and sustainability studies (10 publications), and urban planning and geography (9 publications). Other fields included engineering and technology (6 publications), policy and law (5), economics and business (5), agricultural and food sciences (3), sports sciences (3), biology and zoology (2), transportation (2), applied sciences (1), social sciences (1), and statistics (1). Seventeen publications had author teams representing two or more different fields. The most frequent collaborations across fields were between sustainability/ environmental studies and: economics/business (3 publications), engineering/technology (3), and urban planning/geography (3). Another frequent collaboration was between urban planning/geography and health/medicine (3 publications).

4.3.1 Methods employed and geographic/population focus

Over 70% of the publications used a literature review to identify connections between the SDGs and their HEAL-relevant topics. The majority (23 out of 26) of these publications used an informal or narrative literature review, often without identifying this explicitly as their methodology. There were two systematic reviews and one scoping review. Six publications used a conceptual linkage exercise based only on the author(s)' analysis and two used a conceptual linkage exercise with a panel of experts. Three referred to other publications' conceptualizations of the connections between the SDGs and their HEAL-related topic, four used qualitative content analysis, two used case studies, and two used interviews. One publication each used an expert advisory group (without a conceptual linkage exercise), network analysis, participatory workshops, scenario modelling, spatial analysis, and systems modelling. For three publications, the methods for connecting the SDGs to their HEAL-related topic were unclear. Twelve publications used two or more of these methods. Eleven publications used case studies, cost-

benefit analysis, scenario modeling, or multi-level modeling to further illustrate or analyze the connections between the SDGs and the HEAL-related topic that they had identified.

The vast majority of the publications had a broad population/geographic focus when identifying connections between SDGs and their HEAL-related topics. However, three publications focused their conceptualization on developed/high-income countries while four focused on developing/low-income countries. Two publications focused on interconnections in a rural context, two in a suburban context, and five in an urban context. Some of the broad conceptualizations were then followed up with more specific case studies or applications. Five of these more specific applications were focused on cases in developing/low-income countries and one was focused on a case in a developed/high-income country. One of these applications was a rural case study and one was an urban case study.

4.3.2 HEAL-related topics that publications connected to the SDGs

Out of the 37 publications, eight connected one or more health outcomes to the SDGs. One of these discussed non-communicable diseases (NCDs) broadly, two discussed obesity, and one each discussed non-alcoholic fatty liver disease, kidney disease, neurological disorders, and unintentional injuries. Seven publications connected some aspect of agriculture or the food system to the SDGs, including three that discussed the issue broadly and one each that covered the topics of agroforestry, roof-harvested rainwater for crops, smallholder agriculture, and urban food system strategies. Five publications connected transportation-related topics to the SDGs, including one that covered transportation broadly, and one each that discussed active transportation, micromobility, public transportation, and road safety.

Four publications connected physical activity or sports to the SDGs, while three discussed nutrition or food security. Four publications discussed urban health, including one that

specifically covered COVID-19-resilient cities. Two publications discussed cities and urban planning, two focused on ecosystem services and management, one focused on multi-use water services, and one discussed demand-side climate change mitigation actions.

4.4 Interconnections identified by number/percent of publications

I found interconnections between planning for HEAL and each of the SDGs in the literature (Figure 4.6). I coded interconnections to SDG 3, which is about promoting good health and well-being for all people, in 30 out of the 37 publications (81%). This was closely followed by interconnections to SDGs 1, 10, 8, and 11 (No Poverty, Reduced Inequalities, Decent Work & Economic Growth, and Sustainable Cities & Communities), each of which I coded in more than two-thirds of publications (>25). I coded interconnections to SDG 7 (Affordable & Clean Energy) in the fewest publications; however, this SDG still appeared in almost one-third of publications.

Out of the 169 SDG targets, I coded interconnections to planning for HEAL for 99 (59%). The top-coded targets are visualized in Figure 4.7. Out of these targets, four are from SDG 11 (Sustainable Cities & Communities) and three are from SDG 3 (Good Health & Well-being). Targets 11.2, 11.7, and 11.6, which are about providing sustainable and accessible transportation systems and public green spaces and reducing the environmental impact of cities, respectively, were each coded in 12 publications (32%) while target 11.3, which is about ensuring urban governance and planning is inclusive and participatory, was coded in six publications (16%). Target 3.4 for reducing noncommunicable disease rates was coded in the greatest number of publications at 17 (46%) while target 3.9 about reducing the impact of toxic

pollutants on health was coded in 12 publications (32%) and target 3.6 about reducing injuries and fatalities from road traffic was coded in nine publications (24%).

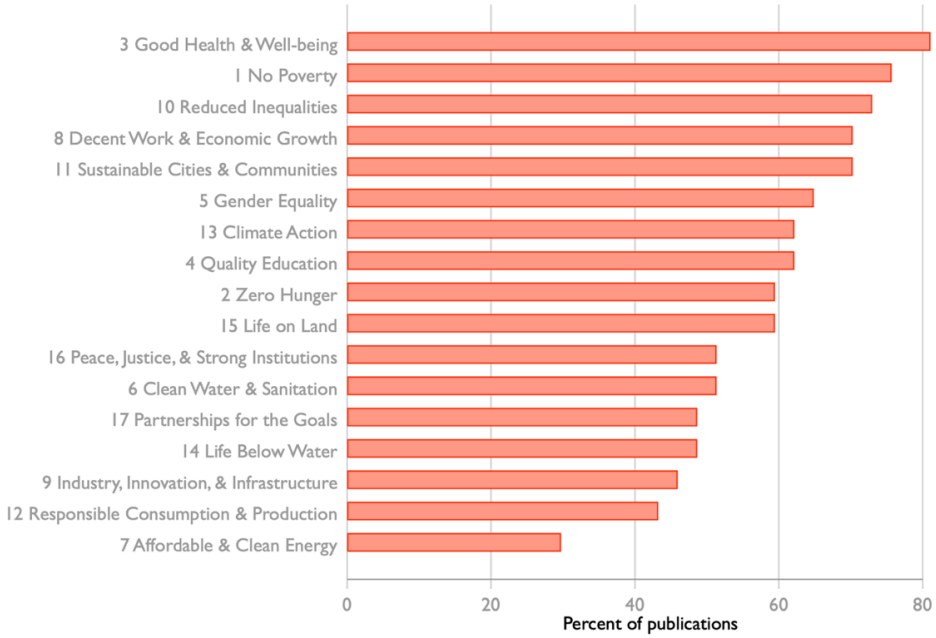


Figure 4.6: Percent of publications that included an interconnection between each SDG and planning for HEAL.

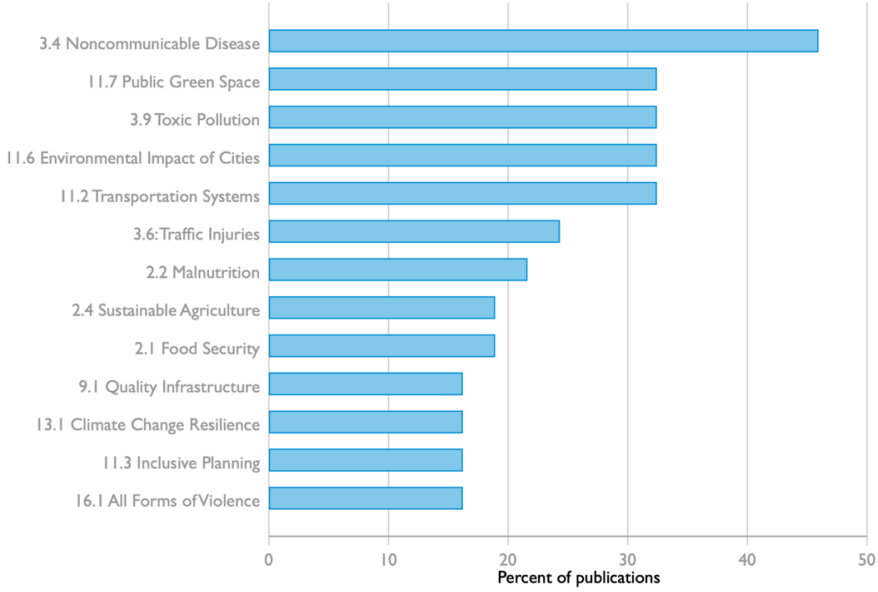


Figure 4.7: Percent of publications that included an interconnection between each SDG target and planning for HEAL (top targets only).

Three targets from SDG 2 (Zero Hunger) are also included in the top-coded targets. These include target 2.2, which seeks to end all forms of malnutrition, which was coded in eight publications (22%) and targets 2.1 and 2.4, with objectives to end food insecurity and promote sustainable agricultural systems, respectively, which were each coded in seven publications (19%). Also included in these top-coded targets was targets 9.1 to build quality, resilient, sustainable infrastructure; target 13.1 to promote climate change adaptation and resilience; and target 16.1 to end all forms of violence, each coded in six publications (16%).

4.5 Summary and qualitative description of interconnections

After coding for interconnection direction and type and summarizing across publications, I identified interconnections between planning for HEAL and every SDG in both directions (i.e., planning for HEAL impacts SDG, progress on SDG impacts HEAL or planning for HEAL). A spreadsheet with short descriptions of these interconnections can be found in the OSF repository for the project (https://osf.io/m3k5p/). The figures in this section reflect all of the interconnections identified, but I highlight in the qualitative descriptions only those most relevant to planning for HEAL in Wisconsin.

4.5.1 Indivisible interconnections

I identified indivisible interconnections to ten different SDGs/targets (Figure 4.8). In the publications reviewed, planning for HEAL was often characterized as indivisible from the entirety of SDG 11 to "make cities and human settlements inclusive, safe, resilient, and sustainable." In fact, this goal was often interpreted as also including "healthy" in the list of adjectives for its vision of cities and human settlements (Alnusairat et al., 2023; Luyckx et al., 2021; Macmillan et al., 2020; Nnamuchi, 2020; Nugent et al., 2018; Ramirez-Rubio et al., 2019).

SDG 11 is thus seen as the most relevant goal for intervening on the social determinants of health and/or systems-level drivers of health and health disparities, including determinants and systems drivers of HEAL (Development Initiatives, 2017; Giles-Corti et al., 2020; Macmillan et al., 2020; Nnamuchi, 2020; Sustainable Mobility for All, 2017). In particular, several publications cited urban food systems strategies and urban agriculture as indivisible from this goal (Allievoi et al., 2019; Development Initiatives, 2017; Ilieva, 2017; Viana et al., 2022).

Figure 4.8: SDGs and SDG targets indivisible from planning for HEAL. Figure produced using sdg360thinking.org.

In addition to being indivisible from SDG 11 in general, the literature also cited indivisible connections to targets 11.2 on accessible transportation systems (Dai & Menhas, 2020; Giles-Corti et al., 2020; Lobstein & Cooper, 2020; Ma et al., 2021; Macmillan et al., 2020; Mateen, 2022; Olabi et al., 2023; Oyeyemi, 2020; Ramirez-Rubio et al., 2019; J. Roy et al., 2021; Salvo et al., 2021; Sustainable Mobility for All, 2017) and 11.7 on accessible public and

green spaces (Amos et al., 2020; Dai & Menhas, 2020; Ilieva, 2017; Lazarus et al., 2022; Lobstein & Cooper, 2020; Macmillan et al., 2020; Ralston et al., 2021; Salvo et al., 2021; Viana et al., 2022; WHO, 2018). Both of these targets are, in and of themselves, planning for HEAL interventions. Planning for walking, biking, and public transport and safe and high-quality parks and green spaces are two of the primary ways that built environment professionals can facilitate physical activity. In addition, urban agriculture spaces are often public green spaces (Amos et al., 2020; Ilieva, 2017; Viana et al., 2022).

Several publications also framed "urban health," which includes planning for HEAL, as indivisible from SDG 3 (Good Health and Well-being) (Alnusairat et al., 2023; Ilieva, 2017; Ramirez-Rubio et al., 2019). The Global Nutrition Report (Development Initiatives, 2017) and Lobstein and Cooper (2020), on the other hand, specifically pointed out the indivisibility of target 3.4 on the prevention and treatment of NCDs from efforts to improve nutrition, stating that malnutrition itself is a form of poor health and that obesity, specifically, is considered an NCD.

Outside of SDGs 11 and 3, specific targets from several other SDGs were described as indivisible from planning for HEAL initiatives. Many publications discussed target 2.1 on ending hunger and food insecurity and target 2.2 on ending all forms of malnutrition as inextricably linked to planning local, healthy food systems (Abraham & Pingali, 2020; Alcamo et al., 2020; Allievoi et al., 2019; Amos et al., 2020; Blay-Palmer & Young, 2019; Development Initiatives, 2017; Giles-Corti et al., 2020; Hall et al., 2017; Ilieva, 2017; Leni-Konig, 2020; Luyckx et al., 2021; Nugent et al., 2018; Pérez-Escamilla, 2017; Ralston et al., 2021; Viana et al., 2022). Target 6.1 on access to safe drinking water was discussed as indivisible from planning for HEAL because drinking water is an essential component of a healthy diet (Allievoi et al., 2019; Development Initiatives, 2017; Lobstein & Cooper, 2020).

Target 9.1 to develop quality, reliable, sustainable, and resilient infrastructure was also described as indivisible from planning for HEAL because transportation systems—including those for walking, biking, and public transportation—are a form of infrastructure (Olabi et al., 2023; Ray, 2023; J. Roy et al., 2021; Salvo et al., 2021; Sustainable Mobility for All, 2017; WHO, 2018). Indeed, indicator 9.1.2 for this target deals specifically with transportation mode shares, which is an oft-used metric in active transportation research (Giles-Corti et al., 2020). In addition, green infrastructure could be included under this target, in which case it would also cover the development of parks, green spaces, and urban agriculture (Ilieva, 2017). Lastly, if target 10.3 to "reduce inequalities of outcomes" is interpreted to include physical activity and nutrition as "outcomes," then planning for HEAL can be seen as indivisible from this target. Inequalities exist in rates of HEAL behaviors by gender, race/ethnicity, income, disability status, and geographic location, and overall improvement on HEAL can only be achieved if these inequalities are addressed (Development Initiatives, 2017; Salvo et al., 2021; WHO, 2018).

4.5.2 HEAL-to-SDG interconnections

Figure 4.9 visualizes all of the ways identified in the literature that planning for HEAL and improvement on HEAL could impact SDGs and targets. I identified 20 reinforcing interconnections, 41 enabling interconnections, 67 co-benefits, and 29 trade-offs in the literature. These include reinforcing or enabling interconnections for 16 out of 17 SDGs (the exception being SDG 17) and co-benefits for 16 out of 17 SDGs (the exception being SDG 9). Meanwhile, they include trade-offs for 13 out of 17 SDGs. I identified reinforcing/enabling interconnections for 28% of the targets (47 out of 169), co-benefits interconnections for 37% of

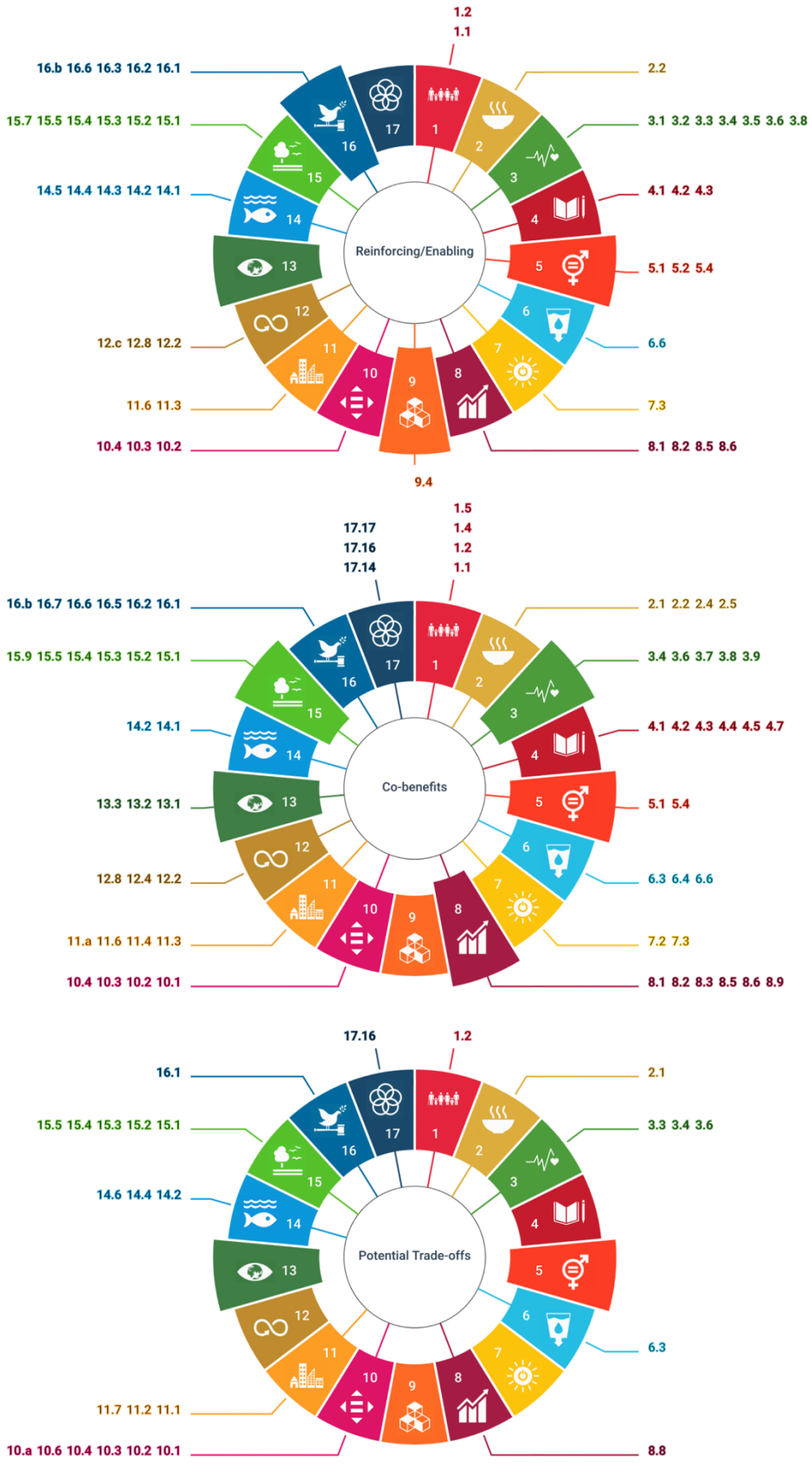


Figure 4.9: Interconnections identified in the literature review; how improvements on HEAL or planning for HEAL initiatives can potentially reinforce, enable, produce co-benefits for, or create trade-offs for SDGs and SDG targets. Produced using sdg360thinking.org. SDGs are highlighted if the literature noted a) an interconnection to the SDG not captured by a target or b) an interconnection to the SDG as a whole.

the targets (63 out of 169), and trade-off interconnections for 15% of the targets (26 out of 169). Many of the SDGs and targets have more than one type of interconnection (e.g. enabling and co-benefit interconnections) and more than one interconnection of each type (e.g. several different enabling interconnections).

4.5.2.1 Selected reinforcing and enabling interconnections

4.5.2.1.1 HEAL is protective against disease

The introduction to this dissertation already discussed the link between HEAL and health and well-being (SDG 3). However, it is worth noting that the literature cited a vast array of NCDs (target 3.4), NCD risk factors, and other health conditions that HEAL can protect against: cardiovascular disease, stroke, diabetes, obesity (target 2.2), hypertension, kidney disease, asthma, depression, stomach and intestinal ulcers, mood and anxiety disorders, migraines, bowel disorders, back problems, arthritis, colorectal cancer (specifically related to overconsumption of red meats), neurological conditions (specifically related to unvaried diets), chronic lung disease, many other cancers, and infectious diseases (target 3.3) (Allievoi et al., 2019; Blay-Palmer & Young, 2019; Campillo-Sánchez et al., 2021; Dai & Menhas, 2020; Development Initiatives, 2017; Luyckx et al., 2021; Ma et al., 2021; Macmillan et al., 2020; Mateen, 2022; Nnamuchi, 2020; Nugent et al., 2018; J. Roy et al., 2021; Salvo et al., 2021; Sustainable Mobility for All, 2017; WHO, 2018).

4.5.2.1.2 HEAL's contribution to economic and education goals

Better nutrition and physical activity lead to more human capacity for education, employment, economic contribution, and innovation. They ensure that children have appropriate cognitive development, increase the ability to focus, and prevent health problems that may keep them from

attending school (targets 4.1, 4.2, 4.3) (Development Initiatives, 2017; Ilieva, 2017; Mateen, 2022; Nugent et al., 2018; Pérez-Escamilla, 2017). Well-nourished and physically active adults can more readily contribute to the economy through full and productive employment (targets 1.1, 1.2, 8.1, 8.2, 8.5, 8.6) and help drive innovation (SDG 9) due to their better mental capacity, increased energy, and reduced absenteeism (Allievoi et al., 2019; Development Initiatives, 2017; Nnamuchi, 2020; Pérez-Escamilla, 2017; WHO, 2018).

Increased HEAL behaviors also impact poverty (targets 1.1, 1.2) and economic development (targets 8.1, 8.2, 8.5) by averting catastrophic health care expenditures through better health and decreased likelihood of NCDs (Allievoi et al., 2019; Luyckx et al., 2021; M. J. A. Maes et al., 2019; Nnamuchi, 2020; Nugent et al., 2018). It is estimated that 100 million people per year are impoverished due to catastrophic health care costs (Luyckx et al., 2021).

4.5.2.1.3 Increased active transportation enables health, safety, social connection, and environmental sustainability

Building safe active transportation infrastructure reduces the likelihood of pedestrian and bicyclist injuries and fatalities (target 3.6) (Dai & Menhas, 2020; Giles-Corti et al., 2020; Ma et al., 2021; Macmillan et al., 2020; Olabi et al., 2023; Oyeyemi, 2020; S. Roy et al., 2012; Salvo et al., 2021; Sustainable Mobility for All, 2017; WHO, 2018). In addition, when there are more pedestrians and bicyclists on and near roads, automobile operators tend to drive slower and more cautiously and are more aware of their surroundings, which leads to further increased traffic safety (target 3.6) (Ma et al., 2021; Macmillan et al., 2020).

Switches from private automobile travel to active modes, including walking, bicycling, and public transportation, also leads to less air pollution (target 3.9), which can protect against many diseases, including respiratory disease, kidney disease, cardiovascular disease, stroke, cancer, and obesity (Dai & Menhas, 2020; Giles-Corti et al., 2020; Lobstein & Cooper, 2020;

Luyckx et al., 2021; Ma et al., 2021; Macmillan et al., 2020; Nugent et al., 2018; Salvo et al., 2021; Sustainable Mobility for All, 2017; WHO, 2018). Macmillan et al. cite that as many as half of the 4.2 million annual deaths due to ambient air pollution globally can be attributed to vehicle-related air pollution (2020).

When more people are out and about in a neighborhood, walking, bicycling, playing, exercising, etc., it can lead to informal encounters between people, fostering social connections and an increased sense of community. This can lead to greater inclusion and less discrimination (target 10.2) (Ma et al., 2021; Macmillan et al., 2020; WHO, 2018). This greater sense of social connection can also lead residents to live for longer periods of time in the same neighborhood, which increases social connection even more, in a reinforcing loop (Macmillan et al., 2020). These longer tenancies also lead to a greater tendency for community members to get involved in decision making, contributing to participatory urban planning (target 11.3) (Macmillan et al., 2020).

In addition, the presence of many people on streets and in parks can lead to greater "natural surveillance," or crime prevention via the presence of onlookers (Macmillan et al., 2020; WHO, 2018), which can lead to greater perceived and actual safety. All of this can lead to less violence (target 16.1), including violence against women (target 5.2) and children (target 16.2). Macmillan et al. note that this can lead to a reinforcing loop: greater neighborhood safety encourages people to walk and bike, which promotes social connection and natural surveillance, which improves neighborhood safety (2020).

Greater active transportation mode share mitigates the environmental harms associated with motor vehicle travel, including carbon emissions and other toxic pollutants, (targets 11.6, SDG 13), and reduces the overall energy (target 7.3) and resource (targets 12.2, 12.c) use of the

transportation sector (Dai & Menhas, 2020; Ma et al., 2021; Macmillan et al., 2020; Nugent et al., 2018; Olabi et al., 2023; Oyeyemi, 2020; Ray, 2023; J. Roy et al., 2021; Salvo et al., 2021; Sustainable Mobility for All, 2017; Vardoulakis et al., 2020; WHO, 2018). This also can reduce the pollutants that run off into freshwater systems (targets 6.6, 15.1) and oceans (target 14.1), and find their way into terrestrial ecosystems (target 15.1) and degrade soil (target 15.3). Reduced carbon emissions can also mitigate ocean acidification (target 14.3) (Olabi et al., 2023; Sustainable Mobility for All, 2017).

4.5.2.1.4 Planning for HEAL initiatives can reduce inequalities *(intertwined considerations)* Initiatives to plan for HEAL should take account of special considerations if they are to reduce inequalities (targets 10.2, 10.3) in, for example, active transportation and healthy food access. Policies to encourage active transportation and provide healthy food access can prioritize walking, biking, and public transportation infrastructure in lower income areas or places that have historically experienced inequities due to religion, ethnicity, or other factors (target 10.4) (Ilieva, 2017; Leni-Konig, 2020; Macmillan et al., 2020). Ilieva discusses the many planning for HEAL strategies that can be employed to reduce inequalities in access to healthy foods: gleaning programs via partnerships with urban and peri-urban farmers, distributed to food insecure areas; food pantries, community kitchens, soup kitchens, and emergency food assistance programs; incentives for supermarkets in underserved neighborhoods; shuttles between neighborhoods and food markets; farmers' markets, especially those that accept EBT and WIC; mandating fresh food in affordable housing developments; and mobile fruit and vegetable vendors (2017).

In addition, when planning to encourage active transportation, there are special considerations that should be made for encouraging women (SDG 5) to bike and walk (Macmillan et al., 2020; Nugent et al., 2018; Olabi et al., 2023; Ramirez-Rubio et al., 2019; J.

Roy et al., 2021; Sustainable Mobility for All, 2017). Because women still do the majority of childcare and housekeeping duties in many places around the world, active transportation for women should consider the transport of cargo and passengers; allow for longer trips and for multiple destinations; consider the accessibility of destinations necessary for household duties (e.g. preschools, grocery stores); and prioritize separated bike paths and lanes (Macmillan et al., 2020).

4.5.2.1.5 Sports and physical activity as a tool against discrimination and inequality *(intertwined considerations*)

Many publications noted the intrapersonal and social benefits that can come from participating in physical activity, especially group and organized physical activities such as team sports. Dai and Menhas (2020) and the WHO (2018) noted that sports and physical activity can have an empowering impact on women's live in particular (SDG 5), including the development of new skills and internal qualities like self-reliance. In addition, sports and group physical activities can address gender discrimination, racial discrimination, and bigotry (target 5.1, 10.2) by challenging traditional gender roles; showcasing the talents and accomplishments of women and marginalized individuals; promoting social connections for people of different gender identities, age groups, nationalities, religions, and political beliefs; and encouraging pro-social behavior and inclusion (Campillo-Sánchez et al., 2021; Dai & Menhas, 2020; WHO, 2018).

4.5.2.1.6 Outdoor physical activity raises awareness of and connection to nature

Whether cycling, walking, running, hiking, kayaking, swimming, or playing, outdoor physical activity can encourage awareness about and connection to the natural spaces in which it occurs (target 12.8) (WHO, 2018). Whether these natural spaces are oceans (target 14.2), beaches (target 14.5), mountains (target 15.4), rivers (target 6.6), wetlands, forests, prairies, deserts, or

other ecosystems (target 15.1), this deeper connection to nature can prompt people use them sustainably and take action for their conservation (WHO, 2018). Such conservation efforts also protect biodiversity, including threatened species (target 15.5) (WHO, 2018). In addition, actions like biking and walking for transportation can increase an individual's and their social contacts' awareness about the environmental impact of personal mobility decisions (target 12.8) (WHO, 2018).

4.5.2.2 Selected co-benefit interconnections

4.5.2.2.1 Planning for HEAL initiatives provide employment and economic benefits

Agriculture, which is the source of healthy diets, is globally one of the largest sources of employment, income, and economic growth (targets 1.1, 1.2, 8.1) (Abraham & Pingali, 2020; Blay-Palmer & Young, 2019; Dolley et al., 2020; Ilieva, 2017; Leni-Konig, 2020; Oyeyemi, 2020; Viana et al., 2022). Agriculture is an especially important source of employment and income in rural areas, low-income countries, for the poor, and for women, so supporting and enhancing such employment has the potential to address economic and gender inequalities (SDG 5, target 10.1).

The sports and physical activity industry also provides employment and contributes to the economic development of communities (targets 8.1, 8.3, 8.5, 8.6) (Campillo-Sánchez et al., 2021; Dai & Menhas, 2020; Olabi et al., 2023; J. Roy et al., 2021; WHO, 2018). Job and business opportunities can be created for physical activity-related service or program provision, such as bike shops, and for the implementation of policy recommendations, such as the building of bike paths and parks (J. Roy et al., 2021; WHO, 2018). In addition, many areas can draw tourists (target 8.9) with sports and physical activity opportunities, including walking and cycling oriented neighborhoods or cities (WHO, 2018).

4.5.2.2.2 Accessible transportation systems facilitate educational, economic, and social opportunities

Building compact, connected communities where it is safe and easy to bike, walk, and take public transportation makes accessing employment (targets 8.5, 8.6), education (targets 4.1, 4.2, 4.3, 4.5), health care (target 3.7, 3.8), and basic services (target 1.4) easier (Giles-Corti et al., 2020; Ma et al., 2021; Macmillan et al., 2020; J. Roy et al., 2021; Sustainable Mobility for All, 2017). This might be particularly important for low-income individuals, children, older adults, and people with disabilities, who may not have access to or the ability to operate a private automobile (Ma et al., 2021; Macmillan et al., 2020; Mateen, 2022; Sustainable Mobility for All, 2017). Active modes are relatively low cost alternatives and can open up opportunities for employment and education that would otherwise be inaccessible in a more car-oriented community (targets 10.1, 10.2, 10.3) (Macmillan et al., 2020; J. Roy et al., 2021; Sustainable Mobility for All, 2017).

Transportation systems that do not rely solely on private automobile ownership can also build community and household resilience to climate-related disasters and economic shocks (target 1.5), especially for those with low incomes (Macmillan et al., 2020). In particular, there is some evidence that biking and walking may be the only form of available transportation following a natural disaster (target 13.1), and may facilitate access to emergency services (Macmillan et al., 2020). Lastly, accessible transportation systems can mitigate transport-related social exclusion, allowing individuals who do not own a private automobile to participate in social and cultural events (target 10.2, 10.3, 10.4), and can facilitate participation in urban planning and governance processes (targets 11.3, 16.7) (Giles-Corti et al., 2020; Ma et al., 2021).

4.5.2.2.3 Healthier diets are better for the planet

Many publications discussed that if agricultural systems would shift to producing healthier diets, this shift would also have co-benefits for climate change mitigation and adaptation and natural resource protection. These discussions centered around two primary changes: increasing crop diversity and reducing meat production and consumption.

Crop diversity in agricultural systems yields more food, increases the nutrients available, and promotes diet diversity, which is essential for health (Development Initiatives, 2017). Crop diversity directly contributes to the biodiversity of agricultural lands (target 15.5) (Viana et al., 2022). It also reduces farms' vulnerability to pests, which can reduce the use of pesticides (also contributing to biodiversity protection, target 15.5), and make farms more resilient to climate change-induced increases in pest problems (target 13.1) (Development Initiatives, 2017; Viana et al., 2022).

Meat consumption, especially red and processed meat, is linked to many NCDs, including obesity, cardiovascular disease, diabetes, and some cancers, especially colorectal cancer (Development Initiatives, 2017; Swinburn et al., 2019). Meat production is also one of the biggest culprits when it comes to environmental degradation. Transitioning to more plant-based diets has been identified as the single most significant action that can be taken to limit greenhouse gas emissions (target 13) (Allievoi et al., 2019). In addition, the production of meat for consumption uses about 70% of agricultural land and thousands of times as much water per kilogram of food than plant-based crops (Development Initiatives, 2017; Ilieva, 2017). Lastly, concentrated agricultural feeding operations often lead to animal waste running off into nearby bodies of water (target 6.3) and eventually to the ocean (target 14.2), producing ocean dead zones (Allievoi et al., 2019). Agricultural systems that produce plant-based foods can therefore provide healthier diets, as well as contributing to reducing greenhouse gases (SDG 13);

conserving water (target 6.4) and land (SDG 15); protecting marine (target 14.1, 14.2), water (target 6.6), and terrestrial ecosystems (targets 15.1, 15.2, 15.3, 15.4); and conserving biodiversity in those ecosystems (target 15.5).

4.5.2.2.4 Environmental co-benefits of parks and urban agriculture

Parks, green spaces, and urban agriculture provide many ecosystem services. They act as carbon sinks (SDG 13), reduce air pollutants (target 11.6), and mitigate stormwater runoff (targets 6.3, 6.6, 13.1, 14.1, 14.2) (Dai & Menhas, 2020; Ilieva, 2017; Leni-Konig, 2020; M. J. A. Maes et al., 2019; Viana et al., 2022). They also mitigate the urban heat island effect, which will only get more intense with climate change (target 13.1). Lastly, parks, green spaces, and urban agriculture can protect ecosystems and biodiversity (targets 15.1, 15.3, 15.4, 15.5) (Ilieva, 2017; Leni-Konig, 2020; M. J. A. Maes et al., 2019; Mateen, 2022; Viana et al., 2022).

4.5.2.2.5 Planning for HEAL as a platform to build better governance capacities *(intertwined considerations)*

The literature discussed the opportunity of planning for HEAL initiatives to serve as examples and build capacities for participatory urban planning (target 11.3), better regional and urban-rural linkages (target 11.a), and overall good governance (targets 16.6, 16.7) (Development Initiatives, 2017; Ilieva, 2017; Leni-Konig, 2020; Macmillan et al., 2020; Ramirez-Rubio et al., 2019; WHO, 2018). Macmillan et al., for example, note that planning active transportation systems can provide opportunities for involving community members in the design of streets and parks, and that this can build governments' skills in responsive, inclusive, and representative planning (2020). Planning for regional sports centers, compact neighborhood design, farmland preservation, and regional food systems can increase coordination between cities and the rural areas that surround them (Ilieva, 2017; WHO, 2018).

In addition, planning for HEAL initiatives can constitute concrete projects around which to convene partnerships across sectors (targets 17.16, 17.17) (Allievoi et al., 2019; Development Initiatives, 2017; Ilieva, 2017; Leni-Konig, 2020; Ramirez-Rubio et al., 2019; WHO, 2018). They can also create new leadership roles that span sectors, such as food system planners, healthy community planners, or active transportation coordinators. Several publications also noted that planning for HEAL initiatives can increase multinational partnerships, such as via regional, continental, or global coalitions (target 17.16) (Leni-Konig, 2020; Oyeyemi, 2020).

Lastly, planning for HEAL initiatives can act as a nexus for integrating social, economic, environmental, racial justice and other aims, thereby uniting disparate sectors and actors around a common project (Development Initiatives, 2017; Ilieva, 2017). Not only does this contribute to the partnership goals of SDG 17, but also to target 17.14 on policy coherence.

4.5.2.3 Selected potential trade-offs

4.5.2.3.1 Potential trade-offs of active transportation infrastructure

Some publications noted the potential for active transportation improvements to increase inequalities. Macmillan et al. (2020) and Ramirez-Rubio et al. (2019, p.10) noted that these types of infrastructural improvements are often concentrated in already-privileged neighborhoods and designed to meet the needs of those who are “healthy, wealthy, and male” (SDG 5, targets 10.2, 10.3, 10.4). When active living improvements are made, they can increase housing prices, leading to gentrification and displacement of residents (target 11.1) (Macmillan et al., 2020). This can also reduce social connections within neighborhoods, potentially contributing to an increase discriminatory behavior (target 10.2), crime, and violence (target 16.1) (Macmillan et al., 2020).

In addition, if bicycling and walking mode share increases, the number of bicycle and pedestrians injured or even killed in roadway crashes may also increase (target 3.6) (Macmillan et al., 2020; Olabi et al., 2023; J. Roy et al., 2021; Salvo et al., 2021). Macmillan et al. also noted that this could lead to a destabilizing loop by which people seeing an increase in crashes are discouraged from walking or biking, leading to a decrease in overall active transportation mode share (2020).

4.5.2.3.2 Increased agricultural productivity for healthy, stable food supply could endanger environment

In order to supply food to the global population, it is estimated that agricultural areas need to double production (Viana et al., 2022). This increase in food production could have devastating consequences for the environment if concurrent changes in the way the food and agriculture system operates are not also enacted (Abraham & Pingali, 2020; Allievoi et al., 2019; Development Initiatives, 2017; Ilieva, 2017; Viana et al., 2022).

For example, the literature cited agriculture as accounting for anywhere from 10-12% (Abraham & Pingali, 2020) to 51% (Development Initiatives, 2017) of all greenhouse gas emissions (SDG 13), 70% of all global freshwater use (SDG 6) (Development Initiatives, 2017), and 38% of global land use (SDG 15) (Development Initiatives, 2017). Current agriculture practices contribute to the destruction of land-based ecosystems (targets 15.1, 15.2, 15.4) and biodiversity loss (target 15.5) through clearing land, monocropping, and the overuse of pesticides and herbicides (Viana et al., 2022). They also lead to topsoil depletion (target 15.3) and the pollution of both inland (targets 6.3) and ocean (target 14.2) waters through the runoff of pesticides, herbicides, fertilizer, and animal waste (Allievoi et al., 2019; Ilieva, 2017). In addition, increases in consumption of fish (which is part of a healthy diet), if not done

sustainably, could lead to the depletion of fisheries globally (targets 14.4, 14.6) (Blay-Palmer & Young, 2019; Development Initiatives, 2017; Leni-Konig, 2020; Mateen, 2022)

However, the literature in this review is clear that healthy diets for all *can* be produced sustainably if changes to the current agricultural system take place. Changes proposed by the literature include: using agroecology, agroforestry, and permaculture methods; increasing crop diversity on farms; reducing food waste; reusing/recycling water; greywater and/or rainwater harvesting for irrigation; using no-tillage methods; using organic fertilizers; rotating crops and cover cropping; limiting nitrogen and phosphorous fertilizers; planting more crops for direct human consumption; selecting drought-resistant crops; and using hydroponics or aeroponics (Allievoi et al., 2019; Blay-Palmer & Young, 2019; Dolley et al., 2020; Ilieva, 2017; Leni-Konig, 2020; Viana et al., 2022).

4.5.2.3.3 Trade-offs of urban agriculture

Some urban agriculture strategies can increase risks to human health, if not properly planned. Depending on where it is grown, food grown in urban areas may contain contaminants from current or former industrial sites, putting consumers at risk (target 2.1) (Dolley et al., 2020). Other agricultural techniques common to agroecology approaches, such as collecting rainwater and using wastewater for irrigation, may also increase risks for infectious diseases (target 3.3) via mosquitoes or contaminated food (Amos et al., 2020).

4.5.3 SDG-to-HEAL interconnections

Figure 4.10 visualizes all of the ways identified in the literature that progress on SDGs and SDG targets could impact HEAL and/or planning for HEAL initiatives. I identified 20 reinforcing interconnections, 54 enabling interconnections, 7 co-benefits, and 12 trade-offs in the literature.

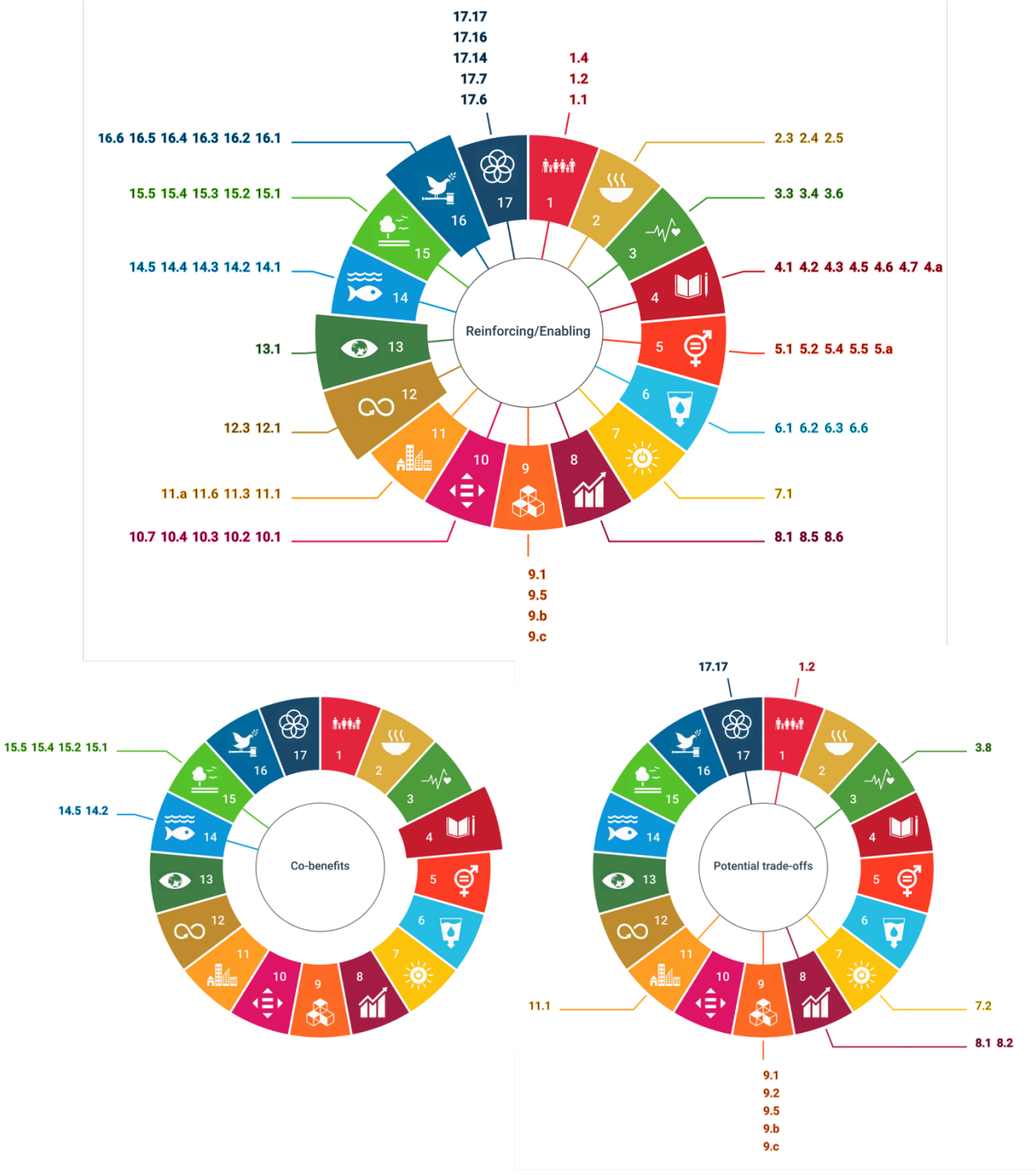


Figure 4.10: Interconnections from the literature review; how progress on SDGs and SDG targets can potentially reinforce, enable, produce co-benefits for, or create trade-offs for HEAL or planning for HEAL initiatives. Produced using sdg360thinking.org. SDGs are highlighted if the literature noted a) an interconnection to the SDG not captured by a target or b) an interconnection to the SDG as a whole.

I identified reinforcing or enabling interconnections for all 17 SDGs, co-benefits for three SDGs, and potential trade-offs for seven SDGs. I identified reinforcing or enabling interconnections for 39% of the targets (66 out of 169), co-benefits interconnections for 4% of the targets (6 out of 169), and trade-off interconnections for 7% of the targets (12 out of 169).

4.5.3.1 Selected reinforcing and enabling interconnections

4.5.3.1.1 Low education, low income, and inequality lead to lower HEAL rates and higher NCDs

Poverty and low income (targets 1.1, 1.2), unemployment (targets 8.5, 8.6), low education (targets 4.1, 4.2, 4.3, 4.5), and income inequality (target 10.1) are all direct risk factors for food insecurity, low physical activity, malnutrition, and NCDs; so, improvements in these areas are likely to increase HEAL behaviors and prevent disease (Allievoi et al., 2019; Blay-Palmer & Young, 2019; Development Initiatives, 2017; Ilieva, 2017; Lazarus et al., 2022; Leni-Konig, 2020; Lobstein & Cooper, 2020; Mateen, 2022; Nnamuchi, 2020; Nugent et al., 2018; Pérez-Escamilla, 2017).

Publications in this review discussed how poverty increases the risk for food insecurity, undernutrition, and obesity, depending on the type of national economy (Development Initiatives, 2017; Lobstein & Cooper, 2020). Lower socioeconomic status in low- and middle-income countries is associated with eating less fruit, vegetables, fish, and fiber, while in high-income countries it is associated with NCDs (Development Initiatives, 2017). Moreover, Lobstein and Cooper note that higher child and adult obesity rates are associated with greater country-level inequality (2020). Education, for its part, can lead to better economic prospects, and thus more access to healthy foods and physical activity opportunities, as well as other social determinants of good health (Blay-Palmer & Young, 2019; Luyckx et al., 2021; Nnamuchi, 2020; Pérez-Escamilla, 2017).

Many publications also noted that lack of HEAL behaviors and NCDs are, at their root, caused by social inequalities (targets 10.3, 10.4) (Allievoi et al., 2019; Development Initiatives, 2017; Lazarus et al., 2022; Lobstein & Cooper, 2020; Luyckx et al., 2021; Nnamuchi, 2020; Nugent et al., 2018; Pérez-Escamilla, 2017; Ramirez-Rubio et al., 2019; Salvo et al., 2021). Addressing racism, discrimination, oppression, colonialism, and socioeconomic and political injustice (targets 5.1, 10.3, 10.4, SDG 16) would help promote HEAL and reduce NCD prevalence (Development Initiatives, 2017; Luyckx et al., 2021; Nnamuchi, 2020; Pérez-Escamilla, 2017).

Furthermore, Lobstein and Cooper note that discrimination (target 10.2) against those with obesity can make it difficult to engage in HEAL behaviors and to seek health care (2020). I would add that the focus on stigmatizing and blaming individuals with obesity can make it more difficult to address structural drivers of HEAL behaviors, obesity, and NCDs.

4.5.3.1.2 Healthy diets depend on natural resources and a stable climate

All of the food we eat comes from the earth's natural resources and ecosystems. Therefore, when these natural resources are depleted and threatened by climate change, it makes it more difficult to provide healthy, balanced diets to the global population.

For example, fish are an important source of nutrients globally, but are threatened by pollution of marine and freshwater systems, as well as overfishing (Development Initiatives, 2017; Leni-Konig, 2020; Luyckx et al., 2021; Mateen, 2022; Nnamuchi, 2020; Pérez-Escamilla, 2017). Biodiversity loss (target 15.5) can lead to an increase in pest problems in agricultural systems, leading to the production of less food for consumption (Viana et al., 2022). Degradation of soil (target 15.3) makes it more difficult to grow crops without external inputs (e.g. fertilizer).

Climate change (SDG 13) also has negative impacts on our ability to provide healthy food to the global population (Abraham & Pingali, 2020; Development Initiatives, 2017; Pérez-Escamilla, 2017; Viana et al., 2022). Increased temperatures can increase the frequency of diseases and pests and lower crop yields, including staple crops like wheat, rice, and maize (Abraham & Pingali, 2020; Development Initiatives, 2017; Viana et al., 2022). Increased levels of carbon dioxide in the air decreases the micronutrients available in crops such as rice, wheat, and field peas (Abraham & Pingali, 2020; Development Initiatives, 2017). Rising temperatures and humidity levels can also increase the risk of food contaminants like mycotoxins in cereals and pulses, reducing the available food supply and increasing the risk of disease for those who consume contaminated foods (Abraham & Pingali, 2020). In addition, the frequency of extreme weather events like droughts and floods will increase due to climate change, with negative impacts on agriculture (Abraham & Pingali, 2020; Viana et al., 2022).

Providing healthy diets in the future therefore requires action on making growing food more sustainable (target 2.4); combatting and building resilience to climate change (SDG 13, target 13.1); reducing pollution (targets 6.3, 11.6, 14.1); and preserving ecosystems, biodiversity, and natural resources (targets 6.6, 14.2, 14.3, 14.4, 14.5, 15.1, 15.2, 15.3, 15.4, 15.5) (Allievoi et al., 2019; Cumming et al., 2017; Development Initiatives, 2017; Mateen, 2022; Nnamuchi, 2020; Pérez-Escamilla, 2017; Viana et al., 2022).

4.5.3.1.3 A stable climate and natural resources enable physical activity

Physical activity is influenced my climatic factors such as temperature and humidity; therefore mitigating climate change (SDG 13) may influence active living (Dai & Menhas, 2020). In addition, being active outside is safer and more attractive when air pollution is lower; therefore, mitigating the environmental impact of cities (target 11.6) can have a cyclical impact on physical

activity rates (Lobstein & Cooper, 2020). Lastly, many sports and physical activities are dependent on natural areas in which to do them, including hiking, kayaking, rock climbing, among others (Dai & Menhas, 2020; WHO, 2018). Therefore, preserving mountain (target 15.4), forest (target 15.2), coastal (target 14.5), marine (target 14.2), and other inland (target 15.1) ecosystems could enable more active living.

4.5.3.1.4 Infrastructure for healthy diets

Reliable infrastructure of all kinds (target 9.1); reliable, affordable energy services (target 7.1); and safe household water supply (target 6.1) are necessary to grow, process, package, transport, preserve, market, and prepare healthy foods (Abraham & Pingali, 2020; Blay-Palmer & Young, 2019; Development Initiatives, 2017; Hall et al., 2017; Ilieva, 2017; Lazarus et al., 2022; Pérez-Escamilla, 2017). This includes "hard" infrastructure such as roads, refrigeration, internet technology, food logistics terminals, rail service, irrigation, and watershed management as well as less tangible infrastructure such as markets, financing, and research and development (Abraham & Pingali, 2020; Development Initiatives, 2017; Ilieva, 2017).

4.5.3.1.5 Safety and inclusion facilitate physical activity

When streets, parks, and communities feel safe (targets 5.2, 16.1, 16.2), people are more likely to engage in physical activity outside (Lazarus et al., 2022; Macmillan et al., 2020). In addition, some people may be deterred from using active transportation modes due to discrimination or racism (Olabi et al., 2023), so improvement on target 10.2 may help facilitate greater physical activity.

4.5.3.1.6 Gender inequalities in unpaid labor as barriers to active transportation

Many publications discussed the unequal burden of housekeeping, shopping, childcare, and elder care placed on women (target 5.4) as a potential barrier to using active transportation modes (Macmillan et al., 2020; Nugent et al., 2018; Olabi et al., 2023; Ramirez-Rubio et al., 2019; J. Roy et al., 2021; Sustainable Mobility for All, 2017). These tasks often involve transporting other people (e.g. children, grandparents) or objects (e.g. groceries, household supplies), making biking, walking, or taking public transportation more difficult or impossible. Reducing the burden of unpaid labor on women could therefore allow more opportunity for them to use active transportation modes.

4.5.3.1.7 Responsible consumption and reduced food waste can address food security

Several publications noted that promoting more responsible consumption of food in general (SDG 12) and reducing food waste in particular (target 12.3), could help address food security (Abraham & Pingali, 2020; Allievoi et al., 2019; Blay-Palmer & Young, 2019; Development Initiatives, 2017; Ilieva, 2017; Lobstein & Cooper, 2020; Nugent et al., 2018; Pérez-Escamilla, 2017; Sustainable Mobility for All, 2017; Viana et al., 2022). Ilieva states that: “Global cities are hotspots of global food consumption and are strategically positioned to affect change through the everyday consumption choices that people make and the associated waste disposal, reuse, and recycling practices” (2017, p. 18).

Two publications also note that market interventions (target 12.1) could be used to promote more sustainable and healthier food consumption (Lobstein & Cooper, 2020; Nugent et al., 2018). Pertaining to food waste in particular, the publications discuss the sheer volume of food that is lost and wasted during production, storage, transportation, processing, and consumption of food. One-third of all food produced, or 1.3 billion metric tons, is wasted each

year, including 33-45% of all fruits and vegetables (Development Initiatives, 2017; J. Roy et al., 2021). If this food waste could be saved and consumed, it could therefore provide healthy food to more people while also cutting down on the environmental degradation associated with the food system.

4.5.3.1.8 Good governance needed to implement planning for HEAL

While section 4.5.2.2.5 discussed how planning for HEAL interventions can be platforms to build good governance capacities, it is just those capacities that are necessary to create successful planning for HEAL initiatives. For example, Macmillan et al. note that active transportation infrastructure that is planned with active input from community members (targets 11.3, 16.7), including women (target 5.5) and other marginalized groups, is more likely to meet the needs of the community and encourage physical activity (2020). Abraham and Pingali (2020) and Ilieva (2017) discuss how urban-rural linkages (target 11.a) are needed for strong regional food systems.

Many publications also note that multisectoral, and even global, partnerships (targets 17.16, 17.17) are necessary to implement planning for HEAL interventions and increasing HEAL behaviors (Abraham & Pingali, 2020; Allievoi et al., 2019; Development Initiatives, 2017; Ilieva, 2017; Lazarus et al., 2022; Lobstein & Cooper, 2020; Ralston et al., 2021; Ramirez-Rubio et al., 2019; J. Roy et al., 2021; Salvo et al., 2021; Sustainable Mobility for All, 2017; WHO, 2018). Macmillan further discusses that partnerships between researchers, communities, and policymakers (target 17.6) can lead to better and more evidence-based decision making (2020).

Lastly, policy coherence across all of the SDGs (target 17.14) is necessary for improving HEAL, as well as the global development agenda (Campillo-Sánchez et al., 2021; Development

Initiatives, 2017; Lazarus et al., 2022; Sustainable Mobility for All, 2017). This includes identifying actions that will benefit multiple SDGs and minimizing trade-offs between them.[15]

4.5.3.2 Potential trade-offs

4.5.3.2.1 Economic development increases risk of obesity

While economic and income growth (targets 1.2, 8.1) are likely to lead to lower undernutrition rates, they may also lead to higher obesity rates and NCDs (Development Initiatives, 2017; Lazarus et al., 2022; Lobstein & Cooper, 2020; Ralston et al., 2021). In general, in high-income countries, obesity is more prevalent at lower income levels. However, in low- and middle-income countries, sometimes obesity is more prevalent at higher incomes (as people have more access to packaged and processed foods) (Development Initiatives, 2017). In general, most current developed economic systems (e.g. the United States, Australia) tend to lead to unhealthy lifestyles with overnutrition, nutrient deficiency, and lack of physical activity (Ralston et al., 2021).

4.5.3.2.2 Development displaces parks, green spaces, and urban and peri-urban agriculture

Largescale industrial and economic development (targets 8.2, 9.2) and building housing (target 11.1) within an urban area can displace parks and green space and urban agriculture (Dolley et al., 2020; Ilieva, 2017; M. J. A. Maes et al., 2019). This can reduce space for physical activity and make the provision of healthy, local foods for nearby communities more difficult, as well as eliminating the environmental co-benefits of these spaces (see section 4.5.2.2.4). On the other

[15] I have skipped listing the co-benefit interconnections of SDGs for HEAL/planning for HEAL. These interconnections are rather limited, and thus I do not believe they warrant discussion in this chapter.

hand, if communities build new housing, commercial, or industrial development in a sprawling development pattern, this makes active transportation more difficult and it can displace peri-urban agriculture, disrupting another potentially important source of healthy foods (Dolley et al., 2020). This highlights the necessity for urban planners to balance multiple competing needs and think about unintended consequences.

4.5.3.2.3 Advances in health care could have negative impacts on public health approaches

Advances in precision medicine technology (targets 9.5, 9.b) and universal health care coverage (target 3.8) could shift research, funding, and policy attention away from population-based approaches to improving public health, including planning for HEAL initiatives (Lobstein & Cooper, 2020; Luyckx et al., 2021). This could also increase focus on the contribution of individual-level factors for health and disease, including placing blame and stigma on individuals with obesity (Lobstein & Cooper, 2020).

4.5.3.2.4 Potential dangers of private sector partnerships

Involving private sector actors in partnerships (target 17.17) for HEAL interventions could be a conflict of interest. In the past, industries such as tobacco, alcohol, and baby formula have inserted profit-driven interests into the policymaking process, with disastrous consequences for public health (Lobstein & Cooper, 2020). Lobstein and Cooper therefore caution that private sector partnerships for HEAL should only be implemented if they can be visible and accountable (2020).

4.6 Discussion

4.6.1 Summary of positive interconnections

This scoping review identified two SDGs as indivisible from planning for HEAL: SDG 3 on human health and wellbeing and SDG 11 on building inclusive, sustainable, and resilient cities and communities. I also identified eight targets as indivisible from planning for HEAL, including targets for SDGs 2, 3, 6, 9, 10, and 11, addressing hunger and malnutrition, health, water and sanitation, infrastructure, inequalities, and sustainable communities. The review showed that planning for HEAL could impact each and every SDG, through reinforcing, enabling, or co-benefit interconnections; and that progress on each of the SDGs could impact planning for HEAL or improvement on HEAL, mostly through reinforcing and enabling relationships. Overall, I identified 128 positive and 29 potentially negative HEAL-to-SDG interconnections as well as 81 positive and 12 potentially negative SDG-to-HEAL interconnections.

Many of these interconnections have a cyclical aspect, whereby planning for HEAL can impact an SDG target, and progress on that SDG target can impact planning for HEAL or HEAL. For example, planning for HEAL initiatives can be used to build multisectoral partnerships and inclusive, participatory, and accountable governance capacities; those partnerships and capacities are also the very things that are needed to implement planning for HEAL initiatives. In the same vein, planning for active transportation is likely to improve social connections, which can reduce violence and increase perceived safety; reduced violence and greater perceived safety, in turn, makes it more likely that people will use active transportation modes.

4.6.2 Summary of trade-offs

Compared to positive interconnections, I identified relatively few trade-offs in the literature review. This should not be taken to mean that trade-offs are necessarily limited; it could simply reflect the focus of the publications included in the review. Many of the trade-offs I did identify are limited in scope or applicability, and all of them can be mitigated with careful planning and execution. For example, trade-offs of urban agriculture include the potential for food to become contaminated with industrial pollutants, for the use of wastewater as fertilizer to pose infectious disease risks, and for rainwater collection to result in greater risk of mosquito-borne illness. However, all of these can be mitigated by steps such as soil testing and proper water filtration and storage.

However, there are four potential trade-offs that warrant particular attention from planning and public health researchers and practitioners. Firstly, the productivity of the global food system must increase to provide healthy, stable diets, but this could increase the threats of climate change and natural resource degradation, which then, cyclically, further threaten the global food supply. The second trade-off I want to highlight is that, as countries develop economically, they often experience a rise in obesity and NCDs, largely due to changes in diet to processed, high-calorie, and nutrient-poor foods. These two trade-offs are not locked in; however, mitigating them will require rather extreme changes in the way that economic development and agriculture are done globally. This has been discussed at length by the Global Nutrition Report, the UN's Food and Agriculture Organization, and the Lancet Commission on Obesity, including strategies for meeting the challenge with more sustainable agricultural practices, healthier diets, and shifts from profit-only development models to ones that consider planetary health (Development Initiatives, 2017; FAO, 2019; Swinburn et al., 2019). While

generally these problems are seated within the realms of agriculture and economics, the planning and public health fields can and should intervene as well.

The third trade-off I want to highlight is that the development of active transportation infrastructure has the potential to increase inequalities. It has traditionally been built with the needs of the already-privileged in mind and it can threaten housing security through gentrification processes. The active transportation research community is aware if these issues and has started to develop mitigation research and best practices (Lemon et al., 2023; Serrano et al., 2022). However, this direction in the field is not well developed and requires more attention.

Lastly, urban and regional planners may face trade-offs between several of the targets in SDG 11 on building inclusive, sustainable, resilient, and healthy cities and communities. Urban development for housing, commercial, or industrial uses could threaten green spaces and urban agriculture, while urban sprawl for those same purposes creates communities that lock in motor vehicle travel. This highlights the need for urban planners and policymakers to carefully consider the trade-offs of development decisions, even if the overall goal is to promote HEAL.

4.6.3 Several surprising interconnections

I identified several interconnections via the scoping review that are not discussed very frequently in the planning for HEAL literature, at least in the United States. Firstly, the provision of clean, household water is necessary for healthy diets, both for direct consumption and for cooking and cleaning. In addition, the provision of household water can facilitate home-based agriculture and save time for women and children who would otherwise have to fetch it. This topic did not appear in the Scorecard used to assess comprehensive plans in Wisconsin, though the provision of drinking water in public places did. While clean, household drinking water is the norm in the United States and other developed countries, drinking water is not uncommonly contaminated

with lead (e.g. Flint, Michigan water crisis), industrial, and agricultural contamination (Denchak, 2024; Laitos & Ruckriegle, 2012; Spearing-Bowen & Schneider, 2017). Moreover, in many places in the United States, drinking water supply and infrastructure are becoming more and more at risk due to climate change. For example, largescale flooding in July of 2023 in Vermont caused over 200 hazardous chemical spills and led to boil notices in several towns (Giles & Dockser, 2023; Pintair, 2023) and in 2022 flooding damaged a water treatment plant in Jackson, Mississippi, leaving several thousand residents without clean drinking water (Lewis, 2022). Therefore, planners should consider the stability and resilience of clean drinking water supply in their initiatives to promote HEAL.

Secondly, many of the publications in the review discussed reducing food loss and waste as a strategy for promoting food security and healthy diets, while also contributing to overall less consumption of resources, degradation of natural resources, and greenhouse gas emissions. Planning strategies to reduce food loss and waste include building local and/or regional food processing facilities, creating direct-to-consumer marketing opportunities for farmers, improving rural-urban linkages and transportation infrastructure, and promoting growing food near consumers in order to negate the need to keep food fresh over long distances. Reducing food loss and waste does not explicitly appear in the Healthy Living and Active Design Scorecard, nor in the APA's Healthy Planning assessment of 22 plans (Kaplan et al., 2016; Ricklin et al., 2012). Hodgson's APA assessment of food system strategies in comprehensive and sustainability plans showed that "the reduction, reuse, or recycling of food waste" was addressed in 29% of sustainability plans and 19% of comprehensive plans; however, examples in the publication show that this is focused on diverting food waste from landfills (e.g. via composting), rather than

reducing food waste in the first place (Hodgson, 2012). Planning for HEAL efforts should, therefore, include more explicit consideration for reducing food loss and waste.

Lastly, several publications in the review discussed at length the relationship between peace and stability and food security. On the one hand, food security fosters peace, stability, and non-violence. As an example, the Global Nutrition Reports says, “The legacies left by decades of competition over resources, and the food price spikes of 2008, have been credited with initiating social unrest, conflicts and political demonstrations in more than 50 countries” (Development Initiatives, 2017, p. 60). On the other hand, peace and stability are necessary conditions for ensuring food security and access to healthy diets. Conflicts and wars often lead to famines, as well as the destruction of assets, livelihoods, crops, livestock, and the infrastructure necessary to grow, process, and transport food. Additionally, corrupt, unaccountable, and inefficient governance systems can make it difficult to implement initiatives to promote the provision of healthy diets, including planning for HEAL initiatives. This topic rarely features in discussions of planning for HEAL in the developed world. However, as politics become ever more divisive and climate change potentially threatens the stability of our food supply and infrastructure, planners in developed countries may be forced to consider this interconnection and what it means for planning for HEAL.

4.6.4 Limitations

There are several limitations to this scoping review. One researcher identified and selected relevant studies, charted data, and summarized and reported results. It is recommended that at least two reviewers independently review all abstracts and publications for inclusion in scoping reviews (Levac et al., 2010); however, that was not possible for this study due to resource constraints. This inserted an element of subjectivity into a) which publications were selected for

inclusion in the review, b) which interconnections were assessed as related enough to "planning for HEAL" to be included in final data analysis, c) the assignment of reinforcing, enabling, and co-benefit interconnection types, and d) the manner in which interconnections were summarized across publications. In order to improve my consistency in these decisions, I took detailed notes about marginal or difficult decisions and referred to these notes throughout the process, as well as referring frequently to the definitions and diagrams of interconnection types. On the other hand, having only one reviewer conduct all data charting removed any concerns of inter-reviewer inconsistencies.

While in one sense this scoping review was quite broad—a variety of topics related to planning for HEAL, HEAL, and NCDs were included—it was also limited to publications that explicitly connected HEAL-related topics to the SDGs. Other publications might discuss interconnections between planning for HEAL and SDG-related topics without explicitly mentioning the 17 SDGs. Limiting the review in this way was necessary due to capacity, however the review may have missed some important, relevant publications due to this constraint. If such publications exist, they may be identified via the (future) consultation phase of the study. In addition, SDG interconnections were not included in the qualitative compilation or mapped if there was not enough detail or clarity about the interconnection in the publication to determine the direction or type (e.g. if an interconnection was simply listed or incorporated into a figure without explanation).

The review also did not make any assessment of the quality of methodology or risk of bias in the publications it included. Interconnections gleaned from informal literature reviews were charted alongside those from expert panels, conceptual linkage exercises, systems modelling exercises, and a number of other methodologies. Some publications in the review

rated interconnections they discussed (e.g. based on number of articles that studied them or number of experts who thought them plausible). I did not include any of these ratings in my analysis of interconnections. This methodology is in line with the overall goal of the study, which was to expansively summarize possible conceptual interconnections between planning for HEAL and the SDGs, not to assess the plausibility or evidence for such interconnections. This methodology is also in line with best practices for scoping reviews, which do not usually include a critical appraisal of publications included in the review (Levac et al., 2010; Tricco et al., 2018).

Lastly, I did not separate interconnections based on urban vs. rural geography nor developing/low-income vs. developed/ high-income countries. Most of the publications did not make such distinctions, but instead discussed interconnections more generally, even if they used a case study in a particular city or country to illustrate those interconnections. In the data analysis and summarization phase, it was difficult to determine which interconnections might apply to which urbanicity level or country type, especially because of economic and climatic shifts currently underway. Many developing countries are developing issues related to highly motorized transportation systems; sedentary time; and processed, nutrient poor, and meat-heavy diets, including rising obesity rates and NCDs. Meanwhile, climate change puts at risk the very infrastructure that developed nations take for granted to deliver healthy diets, such as clean, household drinking water and stable electricity systems. Therefore, the lines between which interconnections apply (or *will* apply) to which geographic areas is not so clear. I suggest that those using the database of interconnections (available at OSF: https://osf.io/m3k5p/) should decide for themselves which interconnections apply to their contexts.

4.7 Conclusion

4.7.1 Future research directions

The review stopped short of the "Consultation" stage, which Levac et al. describe as essential to the scoping review methodology (2010). Further work could be done to consult HEAL researchers and practitioners, possibly via PAPREN and NOPREN, to verify and possibly expand the findings, provide direction for further analysis and distillation of results, and brainstorm strategies for dissemination.

The review also did not assess empirical evidence for the interconnections identified. The HEAL research communities may want to consider following this scoping review up with several systematic reviews of empirical studies of the interconnections. Not only would this provide the evidence needed to determine if the conceptual interconnections appear in reality, but they could also identify areas for with empirical studies have not yet been conducted.

HEAL researchers should also consider discussing the broader implications of their research with regard to global development challenges, for example in peer-reviewed articles, research briefs, reports, and best practice guides. This scoping review provides an organizing framework and array of potentially relevant interconnections to frame those discussions. In addition, researchers could consider including outcomes from a variety of SDGs (instead of just health) in studies evaluating planning for HEAL initiatives.

4.7.2 Policy and practice implications

The findings of this review have implications for both a) professionals, policymakers, and organizations seeking to promote HEAL and b) professionals, policymakers, and organizations seeking to advance the SDGs through local action.

For those seeking to promote HEAL in their local communities, this map of SDG interconnections can be used to convene partners with diverse goals (e.g. health, sustainability, poverty alleviation); identify a broader set of potential benefits of planning for HEAL initiatives, thereby driving community and political will for action; and consider potential trade-offs of planning for HEAL interventions.

For those seeking to advance the SDGs, I believe that these findings may be helpful in overcoming some of the challenges of SDG localization. Barriers to SDG localization include the overwhelming nature of goals and targets; suspicions regarding the relevance of the global SDG agenda to local priorities and challenges; and the political viability of connecting local action to the SDGs, especially in an increasingly divided polity (DiPrete Brown, 2023). However, it is widely accepted that achievement of the SDGs cannot be successful without making them relevant at scales smaller than nations (Alcamo et al., 2020; DiPrete Brown, 2023).
In order to overcome some of these barriers, Alcamo et al. introduced the concept of a "synergy driver," or a policy or measure apart from the SDGs that nevertheless helps achieve two or more of the SDGs by taking advantage of their many inherent interconnections (2020, p. 1567).

Based on the many interconnections identified in this study, planning for HEAL has the potential to be a *localized synergy driver* for the SDGs. That is, it could be a concrete, specific, easily-communicated local-level initiative that taps into local priorities for action and has tangible local-level, as well as global, benefits across the SDGs. This could allow a more manageable jumping-in point for communities to engage with and contribute to the SDGs. Pilot projects and community-based research could be done to explore this potential. The sustainability and global development community, in particular, may want to explore planning for HEAL as a useful tool for localizing the SDGs.

4.7.3 Concluding remarks

This scoping review identified a vast array of interconnections between planning for HEAL and the SDGs. Planning for HEAL can contribute to each and every one of the SDGs and each and every SDG can contribute to planning for HEAL initiatives or improvements on HEAL. SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities) were identified as indivisible from planning for HEAL, as were several targets from other SDGs. The findings of this review offer a map of potential interconnections that may be useful for HEAL researchers; professionals, policymakers, and organizations seeking to promote HEAL through planning; and professionals, policymakers, and organizations seeking to advance the SDGs through local action. This scoping review should be seen as a first step in understanding the broad array of interconnections between planning for HEAL and the SDGs. The results of this review could be further refined and analyzed through the help of stakeholder engagement. In addition, the empirical evidence for the interconnections identified should be reviewed. Lastly, planning for HEAL should be explored as a *localized synergy driver* to advance progress on the SDGs.

4.8 References

Abraham, M., & Pingali, P. (2020). Transforming Smallholder Agriculture to Achieve the SDGs. In S. Gomez y Paloma, L. Riesgo, & K. Louhichi (Eds.), *The Role of Smallholder Farms in Food and Nutrition Security* (pp. 173–209). Springer International Publishing; Scopus. https://doi.org/10.1007/978-3-030-42148-9_9

Alcamo, J., Thompson, J., Alexander, A., Antoniades, A., Izabela, D., Dolley, J., Marshall, F., Menton, M., Middleton, J., & W, S. J. P. (2020). Analysing interactions among the Sustainable Development Goals: Findings and emerging issues from local and global studies. *Sustainability Science*, *15*(6), 1561–1572. https://doi.org/10.1007/s11625-020-00875-x

Allievoi, F., Antonelli, M., Dembska, K., & Principato, L. (2019). Understanding the Global Food System. In R. Valentini, J. L. Sievenpiper, M. Antonelli, & K. Dembska (Eds.), *Achieving the Sustainable Development Goals Through Sustainable Food Systems* (p. 262). Springer International Publishing; Scopus. https://doi.org/10.1007/978-3-030-23969-5

Alnusairat, S., Abu Qadourah, J., & Khattab, R. (2023). Assessing the future city post COVID-19: Linking the SDGs, health, resilience, and psychological impact. *Sustainability*, *15*(1). Scopus. https://doi.org/10.3390/su15010811

Amos, C. C., Rahman, A., Gathenya, J. M., Friedler, E., Karim, F., & Renzaho, A. (2020). Roof-harvested rainwater use in household agriculture: Contributions to the Sustainable Development Goals. *Water*, *12*(2). Scopus. https://doi.org/10.3390/w12020332

Blay-Palmer, A., & Young, L. (2019). Food System Lessons from the SDGs. In S. Dalby, S. Horton, R. Mahon, & D. Thomaz (Eds.), *Achieving the Sustainable Development Goals: Global Governance Challenges* (pp. 19–35). Routledge.

Campillo-Sánchez, J., Segarra-Vicens, E., Morales-Baños, V., & Díaz-Suárez, A. (2021). Sport and Sustainable Development Goals in Spain. *Sustainability*, *13*(6). https://doi.org/10.3390/su13063505

Corporation for Digital Scholarship. (2022). *Zotero* (6.0.37) [MacOS]. Corporation for Digital Scholarship. https://www.zotero.org/

Cumming, T. L., Shackleton, R. T., Förster, J., Dini, J., Khan, A., Gumula, M., & Kubiszewski, I. (2017). Achieving the national development agenda and the Sustainable Development Goals (SDGs) through investment in ecological infrastructure: A case study of South Africa. *Ecosystem Services*, *27*, 253–260.

Dai, J., & Menhas, R. (2020). Sustainable Development Goals, sports and physical activity: The localization of health-related Sustainable Development Goals through sports in China: A narrative review. *Risk Management and Healthcare Policy*, *13*, 1419–1430. https://doi.org/10.2147/RMHP.S257844

Denchak, M. (2024). *Flint Water Crisis: Everything You Need to Know* [Guide]. Natural Resources Defense Council. https://www.nrdc.org/stories/flint-water-crisis-everything-you-need-know

Development Initiatives. (2017). *Global Nutrition Report 2017: Nourishing the SDGs*. Development Initiatives. https://globalnutritionreport.org/reports/2017-global-nutrition-report/

DiPrete Brown, L. (2023). 360 Thinking in local governance advances sustainability, economic prosperity, and equity. In *Oxford Research Encyclopedia of Economics and Finance*. https://doi.org/10.1093/acrefore/9780190625979.013.831

Dolley, J., Marshall, F., Butcher, B., Reffin, J., Robinson, J. A., Eray, B., & Quadrianto, N. (2020). Analysing trade-offs and synergies between SDGs for urban development, food security and poverty alleviation in rapidly changing peri-urban areas: A tool to support inclusive urban planning. *Sustainability Science*, *15*(6), 1601–1619. https://doi.org/10.1007/s11625-020-00802-0

FAO. (2019). *Transforming Food and Agriculture to Achieve the SDGs: 20 Interconnected Actions to Guide Decision-Makers* (Revised Edition). Food and Agriculture Organization of the United Nations. https://www.fao.org/documents/card/en?details=ca1612en

Giles, A., & Dockser, C. (2023, August 24). July flooding pulled nutrients, waste into Vermont's waters—And climate change is making it worse. *Vermont Public*. https://www.vermontpublic.org/local-news/2023-08-24/july-flooding-pulled-nutrients-waste-into-vermonts-waters-and-climate-change-is-making-it-worse

Giles-Corti, B., Lowe, M., & Arundel, J. (2020). Achieving the SDGs: Evaluating indicators to be used to benchmark and monitor progress towards creating healthy and sustainable cities. *Health Policy*, *124*(6), 581–590. https://doi.org/10.1016/j.healthpol.2019.03.001

Hall, R. P., Ranganathan, S., & Kumar G.C., R. (2017). A general micro-level modeling approach to analyzing interconnected SDGs: Achieving SDG 6 and more through multiple-use water services (MUS). *Sustainability*, *9*(2). Scopus. https://doi.org/10.3390/su9020314

Hodgson, K. (2012). *Planning for Food Access and Community-Based Food Systems: A National Scan and Evaluation of Local Comprehensive and Sustainability Plans*. American Planning Association. https://planning.org/publications/document/9148238/

Ilieva, R. T. (2017). Urban food systems strategies: A promising tool for implementing the SDGs in practice. *Sustainability*, *9*(10). https://doi.org/10.3390/su9101707

Kaplan, M., Maiden, K., Miller, P., Celano, G., & Walling, L. A. (2016). *Healthy Living and Active Design: A Scorecard for Comprehensive Plans*. Cedar Creek Sustainable Planning Services & Nemours Children's Health System. http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf

Kroll, C., Warchold, A., & Pradhan, P. (2019). Sustainable Development Goals (SDGs): Are we successful in turning trade-offs into synergies? *Palgrave Communications*, *5*(1), 1–11. https://doi.org/10.1057/s41599-019-0335-5

Laitos, J. G., & Ruckriegle, H. (2012). The Clean Water Act and the challenge of agricultural pollution. *Vermont Law Review*, *37*(4), 1033–1070.

Lazarus, J. V., Mark, H. E., Colombo, M., Demaio, S., Dillon, J. F., George, J., Hagström, H., Hocking, S., Lee, N., Nieuwenhuijsen, M. J., Rinella, M. E., Romero-Gomez, M., Soriano, J. B., Schattenberg, J. B., Tacke, F., Tsochatzis, E. A., Valenti, L., Zelber-Sagi, S., Ashworth Dirac, M., & Huang, T. T.-K. (2022). A Sustainable Development Goal framework to guide multisectoral action on NAFLD through a societal approach. *Alimentary Pharmacology and Therapeutics*, *55*(2), 234–243. Scopus. https://doi.org/10.1111/apt.16720

Lemon, S. C., Neptune, A., Goulding, M., Pendharkar, J. A., Dugger, R., & Chriqui, J. F. (2023). Integrating equity into bicycle infrastructure, planning, and programming: A mixed methods exploration of implementation among participants in the bicycle friendly community program. *Preventing Chronic Disease*, *20*, 230119. https://doi.org/10.5888/pcd20.230119

Leni-Konig, K. (2020). *Beyond school gardens: Permaculture food forests enhance ecosystem services while achieving education for Sustainable Development Goals* [ALM, Harvard University]. https://www.proquest.com/pqdtglobal/docview/2480285164/abstract/D188A7D36FB7417BPQ/1

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, *5*(1), 69. https://doi.org/10.1186/1748-5908-5-69

Lewis, M. M. (2022, September 2). Climate and environmental injustice: Thousands without water in Jackson, Mississippi. *American Rivers*. https://www.americanrivers.org/2022/09/climate-and-environmental-injustice-thousands-without-water-in-jackson-mississippi/

Lobstein, T., & Cooper, K. (2020). Obesity: A ghost at the feast of the Sustainable Development Goals. *Current Obesity Reports*, *9*(4), 470–478. https://doi.org/10.1007/s13679-020-00405-x

Luyckx, V. A., Al-Aly, Z., Bello, A. K., Bellorin-Font, E., Carlini, R. G., Fabian, J., Garcia-Garcia, G., Iyengar, A., Sekkarie, M., & Van Biesen, W. (2021). Sustainable Development Goals relevant to kidney health: An update on progress. *Nature Reviews Nephrology*, *17*(1), 15–32.

Ma, T., Peden, A. E., Peden, M., Hyder, A. A., Jagnoor, J., Duan, L., Brown, J., Passmore, J., Clapham, K., Tian, M., Rahman, A. K. M. F., & Ivers, R. Q. (2021). Out of the silos: Embedding injury prevention into the Sustainable Development Goals. *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention*, *27*(2), 166–171. https://doi.org/10.1136/injuryprev-2020-043850

Macmillan, A., Smith, M., Witten, K., Woodward, A., Hosking, J., Wild, K., & Field, A. (2020). Suburb-level changes for active transport to meet the SDGs: Causal theory and a New Zealand case study. *Science of the Total Environment*, *714*, 136678. https://doi.org/10.1016/j.scitotenv.2020.136678

Maes, M. J. A., Jones, K. E., Toledano, M. B., & Milligan, B. (2019). Mapping synergies and trade-offs between urban ecosystems and the Sustainable Development Goals. *Environmental Science & Policy*, *93*, 181–188. https://doi.org/10.1016/j.envsci.2018.12.010

Mateen, F. J. (2022). Progress towards the 2030 Sustainable Development Goals: Direct and indirect impacts on neurological disorders. *Journal of Neurology*, *269*(9), 4623–4634. Scopus. https://doi.org/10.1007/s00415-022-11180-1

Morton, S., Pencheon, D., & Squires, N. (2017). Sustainable Development Goals (SDGs), and their implementation. *British Medical Bulletin*, *124*(1), 81–90. Scopus. https://doi.org/10.1093/bmb/ldx031

Nilsson, M., Griggs, D., & Visbeck, M. (2016). Policy: Map the interactions between Sustainable Development Goals. *Nature*, *534*(7607), Article 7607. https://doi.org/10.1038/534320a

Nnamuchi, O. (2020). The Sustainable Development Goals (SDGS) and the right to health: Is there a nexus? *Florida Journal of International Law*, *32*, 147.

Nugent, R., Bertram, M. Y., Jan, S., Niessen, L. W., Sassi, F., Jamison, D. T., Pier, E. G., & Beaglehole, R. (2018). Investing in non-communicable disease prevention and management to advance the Sustainable Development Goals. *Lancet*, *391*(10134), 2029–2035. https://doi.org/10.1016/S0140-6736(18)30667-6

Olabi, A. G., Wilberforce, T., Obaideen, K., Sayed, E. T., Shehata, N., Alami, A. H., & Abdelkareem, M. A. (2023). Micromobility: Progress, benefits, challenges, policy and regulations, energy sources and storage, and its role in achieving Sustainable Development Goals. *International Journal of Thermofluids*, *17*. Scopus. https://doi.org/10.1016/j.ijft.2023.100292

Oyeyemi, B. (2020). Achieving the Sustainable Development Goals (SDGs) through road safety management in Nigeria. *International Journal of Research in Arts and Social Sciences*, *12*, 21.

Pérez-Escamilla, R. (2017). Food security and the 2015–2030 Sustainable Development Goals: From human to planetary health. *Current Developments in Nutrition*, *1*(7), e000513. https://doi.org/10.3945/cdn.117.000513

Pintair, O. Q. (2023, July 12). Statewide flooding puts drinking water quality at risk. *VTDigger*. http://vtdigger.org/2023/07/12/statewide-flooding-puts-drinking-water-quality-at-risk/

Pradhan, P., Costa, L., Rybski, D., Lucht, W., & Kropp, J. P. (2017). A systematic study of Sustainable Development Goal (SDG) interactions. *Earth's Future*, *5*(11), 1169–1179. https://doi.org/10.1002/2017EF000632

Ralston, J., Cooper, K., & Powis, J. (2021). Obesity, SDGs and ROOTS: A framework for impact. *Current Obesity Reports*, 1–7. https://doi.org/10.1007/s13679-020-00420-y

Ramirez-Rubio, O., Daher, C., Fanjul, G., Gascon, M., Mueller, N., Pajín, L., Plasencia, A., Rojas-Rueda, D., Thondoo, M., & Nieuwenhuijsen, M. J. (2019). Urban health: An example of a "health in all policies" approach in the context of SDGs implementation. *Globalization and Health*, *15*(1), 87. https://doi.org/10.1186/s12992-019-0529-z

Ray, T. K. (2023). Environmental consciousness and Sustainable Development Goal with special reference to public transportation in India: A review. In P. Singh, Y. Milshina, A. Batalhão, S. Sharma, & M. Mohd Hanafiah (Eds.), *The Route Towards Global Sustainability: Challenges and Management Practices* (pp. 263–274). Springer; Scopus. https://doi.org/10.1007/978-3-031-10437-4_13

Ricklin, A., Klein, W., & Musiol, E. (2012). *Healthy Planning: An Evaluation of Comprehensive and Sustainability Plans Addressing Public Health*. American Planning Association. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Healthy-Planning.pdf

Roy, J., Some, S., Das, N., & Pathak, M. (2021). Demand side climate change mitigation actions and SDGs: Literature review with systematic evidence search. *Environmental Research Letters*, *16*(4). https://doi.org/10.1088/1748-9326/abd81a

Roy, S., Byrne, J., & Pickering, C. (2012). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. *Urban Forestry & Urban Greening*, *11*(4), 351–363. https://doi.org/10.1016/j.ufug.2012.06.006

Sallis, J. F., Spoon, C., Cavill, N., Engelberg, J. K., Gebel, K., Parker, M., Thornton, C. M., Lou, D., Wilson, A. L., Cutter, C. L., & Ding, D. (2015). Co-benefits of designing communities for active living: An exploration of literature. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 30. https://doi.org/10.1186/s12966-015-0188-2

Salvo, D., Garcia, L., Reis, R. S., Stankov, I., Goel, R., Schipperijn, J., Hallal, P. C., Ding, D., & Pratt, M. (2021). Physical activity promotion and the United Nations Sustainable Development Goals: Building synergies to maximize impact. *Journal of Physical Activity and Health*, *18*(10), 1163–1180. https://doi.org/10.1123/jpah.2021-0413

Serrano, N., Realmuto, L., Graff, K. A., Hirsch, J. A., Andress, L., Sami, M., Rose, K., Smith, A., Irani, K., McMahon, J., & Devlin, H. M. (2022). Healthy community design, anti-displacement, and equity strategies in the USA: A scoping review. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 1–30. https://doi.org/10.1007/s11524-022-00698-4

SocioCultural Research Consultants, LLC. (2024). *Dedoose* (9.2.007) [Computer software]. SocioCultural Research Consultants, LLC. www.dedoose.com

Spearing-Bowen, J., & Schneider, K. (2017). *Industrial Waste Pollutes America's Drinking Water* [Environment]. The Center for Public Integrity. http://publicintegrity.org/environment/industrial-waste-pollutes-americas-drinking-water/

Sustainable Mobility for All. (2017). *Global Mobility Report 2017: Tracking Sector Performance*. Sustainable Mobility for All. https://www.sum4all.org/publications/global-mobility-report-2017

Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., Brinsden, H., Calvillo, A., De Schutter, O., Devarajan, R., Ezzati, M., Friel, S., Goenka, S., Hammond, R. A., Hastings, G., Hawkes, C., Herrero, M., Hovmand, P. S., Howden, M., … Dietz, W. H. (2019). The Global Syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, *393*(10173), 791–846. https://doi.org/10.1016/S0140-6736(18)32822-8

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473. https://doi.org/10.7326/M18-0850

United Nations. (n.d.). *Sustainable Development Goals*. Retrieved March 19, 2024, from https://www.un.org/sustainabledevelopment/

United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations. https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

Vardoulakis, S., Salmond, J., Krafft, T., & Morawska, L. (2020). Urban environmental health interventions towards the Sustainable Development Goals. *Science of The Total Environment*, *748*, 141530. https://doi.org/10.1016/j.scitotenv.2020.141530

Viana, C. M., Freire, D., Abrantes, P., Rocha, J., & Pereira, P. (2022). Agricultural land systems importance for supporting food security and sustainable development goals: A systematic review. *Science of the Total Environment*, *806*. Scopus. https://doi.org/10.1016/j.scitotenv.2021.150718

WHO. (2018). *More Active People for a Healthier World: Global Action Plan on Physical Activity 2018-2030*. World Health Organization. https://www.who.int/publications/i/item/9789241514187

Chapter 5: Can comprehensive planning for healthy eating and active living contribute to local-level realization of the Sustainable Development Goals? Evidence from Wisconsin

5.1 Introduction

Planning for HEAL can theoretically contribute to many of the United Nations' (UN's) Sustainable Development Goals (SDGs) (see Chapter 4). In particular, planning for HEAL is indivisible from several targets for SDGs 3 and 11, regarding health and well-being and sustainable cities and communities, respectively. However, the extent to which planning for HEAL contributes to these SDGs, and their related targets, has yet to be investigated systematically. I therefore sought to explore the cross-sectional relationships between the incorporation of HEAL-related goals, objectives, and policies in local comprehensive plans and several of the SDG targets that were identified as closely related to planning for HEAL in Chapter 4.

I limited my analysis to SDG targets that are likely to be realized at the local level (i.e. rather than the regional, national, or planetary level). My analysis was also limited to SDG targets and indicators for which there exists openly available sub-county level data for the state of Wisconsin. Because of this latter restriction, I measured some SDG targets by different indicators than those selected by the UN (Table 5.1). Realization of an SDG can depend on outcomes outside of the targets that the UN has selected, and realization of an SDG target can and should be measured by metrics outside of the indicators developed by the UN (Blay-Palmer & Young, 2019; Salvo et al., 2021). SDG targets and indicators were developed by the UN to track nation-level progress on the SDGs. While they offer an important framework for directing action, different indicators and even targets may be more relevant (and readily available) at the local level (Perry et al., 2021; Simon et al., 2016).

Table 5.1: SDGs, targets, and indicators studied in this project and related local-level variables.

SDG	Target	UN nation-level indicator	Local-level variable
11	11.7: By 2030, provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1: Average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities	Proportion of the population living within ½ mile of public park
2	2.1: By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round	2.1.2: Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	Proportion of the population living within ½ mile of grocery store
11	11.2: By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons	11.2.1: Proportion of population that has convenient access to public transport, by sex, age, and persons with disabilities	Proportion of the population living in a highly walkable census block group Proportion of commuters who bike, walk, or take public transit to work
3	3.6: By 2020, halve the number of global deaths and injuries from road traffic accidents	3.6.1: Death rate due to road traffic injuries	Bicycle and pedestrian injuries and fatalities as a proportion of the population
2	2.2: By 2030, end all forms of malnutrition, including achieving, by 2025 the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons	2.2.2: Prevalence of malnutrition (weight for height >+2 or <-2 standard deviations from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)	Proportion of population with obesity
3	3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1: Mortality rate attributed to cardiovascular disease, cancer, diabetes, or chronic respiratory disease	Proportion of population with obesity

In the sections below, I briefly discuss the importance of each of the selected local-level variables to realizing the SDGs in communities in Wisconsin.

5.1.1 Park accessibility

Parks and green spaces (target 11.7) provide communities with space for recreation, socialization, play, exercise, nature watching, retreat, stress relief, and community building. They can promote physical activity, mental health and cognitive function, social capital and cohesion, and a connection to cultural heritage (Dobson et al., 2019; Konijnendijk et al., 2013; Mensah et al., 2016; Reuben et al., 2020; Schipperijn et al., 2017; Svendsen et al., 2016; Twohig-Bennett & Jones, 2018). In addition, the adequate provision of parks has been linked to better physical health, including a lower risk of cardiovascular disease, type 2 diabetes, obesity, and all-cause mortality as well as lower heart rate, blood pressure, cholesterol, cortisol levels, and better self-reported overall health (Konijnendijk et al., 2013; Larson et al., 2016; Twohig-Bennett & Jones, 2018).

Urban and suburban parks can also help communities mitigate and adapt to the effects of climate change. Parks provide shade and cool the air temperature, mitigating the urban heat island effect and reducing energy use for cooling in nearby buildings (Bowler et al., 2010; Nowak & Heisler, 2010). They also pull pollutants from the air, aid in the management of stormwater, and act as carbon sinks (Gratani et al., 2016; Mexia et al., 2018; Nowak & Heisler, 2010; Shadman et al., 2022; US EPA, 2017). Parks and green spaces offer refuge for diverse species of flora and fauna and can be used for growing foods for local consumption and thus contribute to a healthy and resilient urban food system (Hou & Grohmann, 2018; Nielsen et al., 2014).

However, not everyone has access to parks or green spaces and not every community enjoys the economic, social, and sustainability benefits that parks and green spaces can impart. The CDC estimated in 2010 that only 39% of people in the United States lived within a ten-minute walk of a public park (Neusel Ussery et al., 2016). Even in large metropolitan areas, where park accessibility was the highest, fewer than 50% of people had ready access to a park (Neusel Ussery et al., 2016). Park accessibility, size, and quality varies by individual and neighborhood affluence, race and ethnicity, and urbanicity, raising environmental justice concerns about the equitable distribution of the benefits that parks and green spaces can provide (Razani et al., 2020; Reuben et al., 2020; Rigolon, 2016; Zhang et al., 2011).

5.1.2 Food accessibility

Physical access to sources of healthy food is one of the underlying dimensions of food security (target 2.1) (Pérez-Escamilla, 2017). While community residents may obtain healthy foods from sources like farmers' markets or community gardens, the accessibility of a supermarket or other large grocery store, in particular, has been linked to a healthier diet (Pitt et al., 2017; Rahmanian et al., 2014).

However, an estimated 70% of the U.S. population lack geographic access to a supermarket, with lower income, more urban, and less white communities less likely to have access (Bower et al., 2014; Rhone et al., 2022; Sawyer et al., 2021; Walker et al., 2010). In these communities, residents must rely on smaller grocers, convenience stores, or fast food outlets, which often offer a more limited selection of foods that are lower quality, calorie-dense, and nutrient-poor (Walker et al., 2010). Moreover, foods available at these smaller retailers are consistently more expensive than those offered at larger chain stores in more affluent neighborhoods (Walker et al., 2010). To compound the problem, up to two million households

without geographic access to a grocery store also lack the means of transportation to reach larger stores with better variety, quality, and prices (Rhone et al., 2022; Sawyer et al., 2021; Walker et al., 2010).

5.1.3 Walkability

At its most basic level, walkability refers to how conducive a place is for walking, usually for transportation purposes. This includes whether there are connected and traversable paths; whether there are destinations worth walking to within a reasonable distance; whether walking there is safe; and how pleasant, aesthetic, or interesting the walking environment feels (Forsyth, 2015). Walkability has also been used a proxy for good urban design that promotes health and sustainability through: a) increased active transportation (see next section), with its implications for physical, mental, and planetary health; b) livelier streets and downtowns, leading to improved social capital; and c) greater accessibility and inclusion (Baobeid et al., 2021). Measures of walkability therefore represent important built environment considerations for developing a sustainable and accessible transportation system (target 11.2).

Walkability indices often include objective measures of land use mix, street connectivity, presence of pedestrian infrastructure, transit service, and safety. They are associated with not only greater levels of walking for transportation (Clevenger et al., 2023; Hirsch et al., 2013; Smith et al., 2017; Stearns et al., 2023), but also biking and taking public transit (Freeman et al., 2013; Riggs & Sethi, 2020). In addition, more walkable neighborhoods have been linked to a decrease in risk factors for cardiovascular disease (Chandrabose et al., 2019; Coffee et al., 2013), greater social capital (Rogers et al., 2011), and lower carbon emissions (Darwish et al., 2023).

5.1.4 Active commuting

Promoting active transportation—that is, biking, walking, and taking public transit—for utilitarian purposes is vital to creating an accessible and sustainable transportation system (target 11.2). Active transportation modes use far fewer energy resources and produce fewer carbon emissions and other pollutants than motor vehicles (Brand et al., 2021; Grabow et al., 2012; Macmillan et al., 2020). In addition, active transportation can increase community levels of physical activity and improve social capital, both of which contribute to creating a healthy, resilient community (Berglund et al., 2016; Stroope, 2021). Lastly, ensuring that active transportation modes are viable options ensures access for vulnerable populations, including seniors, those without the economic resources to maintain a personal motor vehicle, children, and people with disabilities (Sustainable Mobility for All, 2017).

Despite these reported benefits, a very small fraction of the U.S. population uses active transportation compared with many developed countries. While it is common for 30-60% of the commuters to use active transportation in many European countries, the rate in the United States is around 5% (Bassett et al., 2008; Whitfield, 2020). The only states in the United States that approach European levels of active commuting are those with the largest cities, such as New York (35%), Massachusetts (16%), and Illinois (13%). Some of this difference can likely be explained by European and large American cities having greater residential and employment density and public transportation systems, as well as a mix of land uses and more compact street grids established before the advent of the automobile (Pucher et al., 2010). [16]

[16] See Chapter 1 for an overview of built environment attributes associated with greater physical activity.

5.1.5 Bicycle and pedestrian injuries and fatalities

I chose to focus on bicycle and pedestrian danger in particular, rather than the UN indicator including all roadway injuries and fatalities, because bicycle and pedestrian danger more closely aligns with the interconnection between planning for active living and this target. While walking and bicycling are excellent ways to get physical activity, and are sustainable modes of transportation, pedestrians and bicyclists are not always safe on roadways. Depending on roadway design and infrastructure for biking and walking, it can be very dangerous indeed (target 3.6). The National Highway Traffic Safety Administration estimates that in the United States in 2021, 7,388 pedestrians and 966 cyclists were killed and over 100,000 pedestrians and cyclists were injured in roadway incidents involving motor vehicles (NHTSA, 2023b, 2023a). While bicyclists and pedestrians make up a tiny fraction of all road users in most communities, almost 20% of all roadway fatalities were pedestrians or bicyclists (NHTSA, 2023b, 2023a).

Rates of pedestrian and bicycle injuries and fatalities are growing, too. There was an 11% increase in pedestrian injuries and a 7% increase in bicyclist injuries on U.S. roadways from 2020 to 2021 (NHTSA, 2023b, 2023a). This is a trend that has been observed for decades; pedestrian fatalities have been steadily increasing each year since 2009 and are the highest they have been since 1981 (NHTSA, 2023b; Venson et al., 2022). The United States is one of the only developed countries in the world with this kind of trend; almost all other developed countries have seen steady declines in pedestrian fatalities for the last 30 years (Venson et al., 2022). Again, this can likely be partially explained by the auto-orientation of U.S. communities, many of which were planned with wide, curvilinear streets; high speed roads; and limited bicycle and pedestrian infrastructure (Buehler & Pucher, 2021; Hall, 2014).

5.1.6 Obesity

Obesity is a form of malnutrition[17] (target 2.2) that poses one of the greatest threats to overall health and well-being in the United States (Chooi et al., 2019; Dietz & Pryor, 2022; Skinner et al., 2018; Wang et al., 2020; Warren et al., 2019). Obesity's connection to NCDs is threefold (target 3.4). Obesity itself is considered an NCD (Kyle et al., 2016). It is also a primary risk factor for other NCDs like coronary heart disease, liver disease, type 2 diabetes, depression, and many cancers (Apovian, 2016; Eggers et al., 2016; Kumar & Kelly, 2017; Mitchell et al., 2011). Lastly, two of the main contributors to high obesity rates—high levels of physical inactivity and lack of nutritious diets—are the very same ones that put people at risk of other NCDs, even outside of obesity as a mediator (WHO, 2013, 2017).

Since 2000, obesity rates have steadily risen in the United States (Ludwig, 2018; Skinner et al., 2018; Wang et al., 2020). In 2015-2016, around 40% of adults and 20% of children in the United States had obesity (Wang et al., 2020). The numbers in Wisconsin reflect those of the rest the country, with 41.2% of Wisconsin adults and 14.8% of Wisconsin children having obesity (Joyner et al., 2018). It has been projected that by 2030, almost half of all U.S. adults will have obesity while one-third of all U.S. children ages 6-11 and half of adolescents aged 12-19 will have obesity or be overweight (Wang et al., 2020).

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[17] Malnutrition is generally defined as "inadequate and/or excessive intake of energy and/or nutrients" and includes both undernutrition (including nutrient deficiencies) and overnutrition (including obesity) (Development Initiatives, 2022, p. 132).

5.1.7 Previous efforts to evaluate HEAL-related plan implementation and impact

Several studies have assessed the implementation and impact of active-living oriented plans for SDG-related outcomes. In a survey of North Carolina planning directors, Evenson et al. found that municipalities were more likely to execute bicycle and pedestrian projects, programs, and policies when they were first included in a comprehensive, land use, transportation, trail, parks and recreation, or bicycle and pedestrian plan (2011). More recently, Peterson et al. found that bicycle and pedestrian design standards (e.g. bike infrastructure in roadway expansion projects, traffic-calming features, continuous sidewalk coverage) were more prevalent in communities that had an adopted plan that included objectives related to Complete Streets, street connectivity, and mixed use (2019). In a 2008 study, Aytur et al. found that North Carolina communities with non-automobile transportation improvements, mixed-use land classifications, and comprehensive policies to guide development included in their comprehensive plans, had higher rates of transportation-related physical activity and bicycling, as well as leisure time physical activity (2008).

The studies described above measured both the content and implementation of plans via surveys to planning departments or other municipal staff, which puts the results at risk of social desirability bias. In addition, the studies gathered data on only a small number of active living related aspects of plans (e.g. Complete Streets, mixed use, sidewalks) and impacts rather than a holistic set of goals, objectives, policies, and outcomes related to HEAL. This study is the first to investigate the association between overall HEAL-related comprehensive plan quality and a host of objectively-measured outcomes at the intersection of HEAL and the SDGs.

5.1.8 Research questions

- How can comprehensive planning for HEAL help Wisconsin communities achieve the SDGs?
    - To what extent, if any, is comprehensive planning for HEAL associated with:
        - better local-level park accessibility?
        - better local-level food accessibility?
        - better local-level walkability?
        - higher local-level active commuting rates?
        - lower local-level bicycle and pedestrian danger?
        - lower local-level obesity rates?

5.2 METHODS

5.2.1 Sample

The sample for this analysis is comprised of 116 urban and suburban municipalities in Wisconsin, stratified by urbanicity (urban versus suburban) and regional planning commission (RPC) area. Details about the sampling procedure can be found in Chapter 2.

5.2.2 Description of variables

Table 5.2 contains a summary of the variables included in this analysis and the sections below include more details about each variable.

5.2.2.1 Independent variables

Using the Healthy Living and Active Design Scorecard for Comprehensive Plans (from now, "Scorecard"), a team of five coders evaluated the extent to which adopted, local-level comprehensive plans from the selected municipalities included goals, objectives, policies, and strategies related to HEAL. Full details about coding comprehensive plans can be found in Chapter 2. As a reminder, the Scorecard was developed and validated by Cedar Creek

Sustainable Planning Services and is comprised of 50 assessment items across six sections (Table 5.3) (Kaplan et al., 2016; Maiden et al., 2017).

Table 5.2: Description of variables used in regression analysis.

Variable	**Operationalization in models**	**Data source**
Independent variables		
Overall and six section comprehensiveness scores	% of items that scored 0 or 1; scaled by 20 percentage points	Coded from comprehensive plans
Overall and six section strength scores	Total points scored as a % of total possible points; scaled by 20 percentage points	Coded from comprehensive plans
Dependent variables		
Park accessibility	Log odds of living within ½ mile of a park	CDC Environmental Public Health Tracking Network, 2020
Food accessibility	Log odds of living within ½ mile of supermarket	USDA Food Access Research Atlas, 2019
Walkability	Log odds of living in a "most walkable" or "above average walkability" census block group	EPA Smart Location Mapping program, 2021
Active commuting	Log odds of walking, biking, or taking public transit to work among commuters aged 16 and over	American Community Survey 5-year estimates, 2015-2019
Bike/ped danger	Log odds of pedestrian or bicyclist injury or fatality	Wisconsin Department of Transportation, 2018-2022
Obesity	Log odds of having obesity	Wisconsin Health Atlas, 2015-2016 estimates
Covariates		
Income	Median household income; scaled to $20,000; in some models, also centered at $60,000	American Community Survey 5-year estimates, 2015-2019
Age	Median age; scaled to 8 years	American Community Survey 5-year estimates, 2015-2019
Race	% Black population; scaled to 1 percentage point	American Community Survey 5-year estimates, 2015-2019
Urbanicity	% of land area in municipality within Census Bureau defined Urban Area; scaled to 15 percentage points	U.S. Census, 2010
Bicycle & pedestrian commute mode share	Percent of population that biked or walked to work; used as covariate only in bike/ped danger models	American Community Survey 5-year estimates, 2018-2022

For each item in the Scorecard, a comprehensive plan can score a 0, 1, or 2. The plan scores a 0 if it does not contain the appropriate policy language; a 1 if it contains the appropriate policy language but it is weak, vague, includes loopholes, or is included merely as an aspiration; and a 2 if it contains the appropriate policy language with specific plans or strategies, action-oriented language, and apparent commitment to enacting the policy (Kaplan et al., 2016). A team of five students (including myself) coded the comprehensive plans after undergoing extensive inter-rater reliability training and testing. Then comprehensiveness and strength scores were calculated for each section and overall according to guidance in the Scorecard.

Table 5.3: Sections in the Healthy Living and Active Design Scorecard for Comprehensive Plans, including revised sections titles to align with traditional planning domains (Kaplan et al., 2016)

Original section title	Revised section title	# of items	Summary
Overall plan, vision, and strategy	Vision & Strategy	6	Explicit connection between planning, the built environment, land use, and HEAL-related chronic disease outcomes
Healthy living: How we move around	Active Transportation	13	Goals for increasing active transportation mode share; strategies for making active transportation safer, more comfortable, more efficient, and more equitable
How we eat and drink	Healthy Food Access	8	Goals and strategies for promoting the production and consumption of healthy foods
How we play and get our exercise	Parks & Recreation	5	Goals and strategies to ensure the everyone in the community has access to quality parks, open spaces, and recreation opportunities
How we get and stay well	Health Care Access	3	Goals and strategies to ensure access to health care; goals and strategies for aging in place
Active design	Community Design	15	Urban design strategies for promoting active living, from streetscape to land use scales

5.2.2.2 Dependent variables

5.2.2.2.1 Data sources

Park accessibility data was obtained from the CDC's National Environmental Public Health Tracking Network (CDC, 2023). The CDC estimates park accessibility by multiplying the area of a census tract within ½ mile of a publicly accessible park by the population of the census tract. I used the 2020 park accessibility measure, which is derived using TomTom and PAD-US data. TomTom is a geolocation technology company with proprietary mapping datasets for research and other purposes (TomTom International BV, 2024). PAD-US is a publicly available geodatabase from the U.S. Geological Survey that maps protected land and marine areas (USGS Gap Analysis Project, 2020).

Food accessibility data was obtained from the United States Department of Agriculture's (USDA's) Food Access Research Atlas (USDA, 2023). The USDA estimates population with adequate food access by measuring the distance to the nearest supermarket, supercenter, or large grocery store for each ½-kilometer square in the United States and estimating the total number of people that live within that ½-kilometer square. From this, they estimate the number of people living within ½ mile of a supermarket and then aggregate to the census tract level. The USDA derives the measure from two lists of supermarkets, supercenters, and large grocery stores: the 2019 STARS directory and the 2019 Trade Dimensions TDLinx directory. The STARS is the USDA's list of retailers authorized to accept SNAP benefits (USDA, 2020). TDLinx is a proprietary data product including location information of stores, produced by Nielsen (Nielsen Consumer LLC, 2024).

Walkability data was obtained from the United States Environmental Protection Agency's (EPA) Smart Location Mapping program (US EPA, 2023). The EPA's National Walkability Index combines measures of employment and household entropy, which are meant

to operationalize land use mix; street intersection density; and distance to the nearest transit stop (Chapman et al., 2021). Census block groups are ranked within each of these measures, and then a weighted walkability ranking for the entire country is produced. Each census block group thus receives a final walkability ranking of 1 to 20, with ranks of 1.0-5.75 indicating the least walkable block groups in the country, ranks 5.76-10.5 indicating below average walkability, ranks 10.51-15.25 indicating above average walkability, and ranks 15.26-20.0 indicating the most walkable block groups in the country (Chapman et al., 2021). In order to develop the 2021 release of the National Walkability Index, the Smart Location Mapping program used data from the U.S. Census's 2017 Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics database, HERE Maps (formerly NAVTEQ) 2018 NAVSTREETS road network data, General Transit Feed Specification 2020 data, and the Transit-Oriented Development 2020 Database (Chapman et al., 2021).

Active commuting data was obtained from the American Community Survey (ACS) 2015-2019 five-year estimates, which I obtained from IPUMS NHGIS (Manson et al., 2023). The ACS asks participants 16 years old and over who responded that they worked at some time in the last week what their principal mode of travel to work was during that week (US Census Bureau, 2016). I downloaded totals for the people included in the survey, people who took public transportation to work, people who walked to work, people who biked to work, and people who worked from home. In the ACS, public transportation includes bus, trolley bus, streetcar, trolley car, subway, elevated train, railroad, or ferryboat (US Census Bureau, 2016).

Bicycle and pedestrian danger data was derived from Wisconsin Department of Transportation crash summary data files obtained from the Wisconsin Traffic Operations and Safety Laboratory (TOPS). The TOPS WisTransPortal was queried for any reported crashes

occurring in the years 2018-2022 (inclusive) flagged as involving at least one pedestrian or bicyclist, excluding crashes with deer and including those occurring on private property and driveways or parking lots. I then summed the bicyclist and pedestrian fatalities and injuries for each municipality in the crash summary data file.

Obesity data was obtained from the Wisconsin Health Atlas (WHA).[18] The WHA compiled data from electronic health records of over 1.8 million patients in Wisconsin who had a valid body mass index recorded at a health system in 2015 or 2016 (Joyner et al., 2018). ZIP code level counts were calculated using patient billing ZIP codes (Joyner et al., 2018).

5.2.2.2.2 Data allocation

The obesity, park accessibility, food accessibility, and walkability data used in this analysis was not originally available at the municipality level. Obesity data was available at the ZIP code level, park and food accessibility were available at the census tract level, and walkability was available at the census block group level. To produce municipal-level estimates of these variables, I used GeoCorr crosswalk files, produced by the Missouri Census Data Center (Blodgett, 2019). GeoCorr produces comma-delimited files with allocation factors for calculating weighted count or mean data from one geography type to another.

For each variable that needed allocating, I chose the GeoCorr file version for the year that most closely matched the year and geography used in the original data (Table 5.4). For the obesity, park accessibility, and food accessibility datasets, I calculated population-weighted sums. That is, I multiplied the number of people with the characteristic of interest (e.g. obesity)

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[18] The WHA obesity data is freely available for download from https://www.wihealthatlas.org/obesity/findings.

in the source geography (e.g. ZIP codes) by the proportion of the source geography's population in the target geography (e.g. municipality). Then, I summed the proportional populations for each municipality. For the obesity data, I also produced estimates of the number of people with valid body mass index measurements in each target geography to use as the denominator in the calculation of proportions.

To produce a municipal-level approximation of the National Walkability Index, I first assigned each census block group a walkability rank category based on the EPA's four-category classification system (e.g. least walkable, most walkable). I then summed the proportion of each municipality's population in census block groups within each category. The resulting dataset contained the proportion of each municipality's population living in least walkable, below average walkability, above average walkability, and most walkable census block groups.

Table 5.4: Details about GeoCorr files used for each allocated variable

Variable	Source geography	Target geography	GeoCorr year
Obesity	ZIP Code Tabulation Area*	County subdivision**	2014
Park accessibility	Census tract	County subdivision**	2022
Food accessibility	Census tract	County subdivision**	2018
Walkability	Census block group	Census designated place***	2018

*ZIP Code Tabulation Areas are the Census Bureau's areal representation of the U.S. Postal Service's ZIP Codes.
**County subdivisions are the Census geographic unit that equates to municipalities in Wisconsin.
***Census designated places also equate to municipalities for most of my sample. County subdivisions could not be used as the target geography for walkability data allocation because of a technicality in the way county subdivisions with land in more than one county were represented in the GeoCorr dataset. One municipality—Brookfield town—is not a census designated place; data for Brookfield town was allocated using county subdivision as the target geography and then appended to the walkability dataset.

While it was not possible to verify the resulting municipal-level park accessibility, food accessibility, and walkability estimates, I verified the municipal-level obesity estimates against the CDC's Population Level Analysis and Community Estimates (PLACES) 2019 crude obesity rate estimates for incorporated places. PLACES uses multilevel regression and post stratification

to model small-area estimates of behavioral and health measures from Behavioral Risk Factor Surveillance System (BRFSS) data (Greenlund et al., 2022). The difference between the WHA estimates and the PLACES estimates ranged from -5.0 to 16.6 percentage points with an average discrepancy of 7.1 percentage points. The estimated obesity rate was higher in the WHA estimates in 89% of our sample. This is to be expected, as objectively-measured body mass index is often higher than body mass index derived from survey data. Due to social desirability bias, survey respondents often under-report their weight and over-report their height, leading to lower calculated body mass index and obesity rates (Gorber et al., 2007; Wilson et al., 2019). The mean obesity rate in the municipal-level WHA estimates (40.8%) is also similar to the statewide average reported by the Survey of the Health of Wisconsin for 2008-2013 data (39.4%), which also used objectively measured height and weight (Eggers et al., 2016).

5.2.2.2.3 Calculation of variables

For each dependent variable, I calculated proportions, odds, and log odds using the numerators and denominators in Table 5.5. All but the obesity data contained proportions of 0 and/or 1. It is impossible to calculate log odds in such cases. To remedy this, I used the Agresti-Coull Interval Method, which adds 2 to the numerator and 4 to the denominator, to all but the obesity variables (Agresti & Coull, 1998).

5.2.2.2.4 Missing data

WHA obesity data was missing for 21 municipalities in the sample. This is due to two reasons. First, some health systems did not participate in the WHA project, so ZIP codes that those health systems serve are missing from the dataset (Joyner et al., 2018). In order to protect patient anonymity and ensure stability of the estimates, ZIP codes were also excluded from the WHA

estimates when there were not enough patients with a valid body mass index measurement in the electronic health record data (Joyner et al., 2018).

Table 5.5: Numerator and denominator used in calculation of proportions, odds, and log odds for each variable.

Variable	Numerator	Denominator
Park accessibility	# of people living with ½ mile of park**†	2020 Census population‡
Food accessibility*	# of people living within ½ mile of supermarket**†	2010 Census population‡
Walkability	# of people living in walkable census block group**†	2010 Census population‡
Active commuting	# of people who reported walking, biking, or using public transit to commute†	# of people in ACS survey - # of people who reported working from home‡
Bike/Ped Danger	# of bicyclist and pedestrian injuries and fatalities†	ACS population five-year estimate, 2018-2022‡
Obesity	# of people with obesity**	# of people in municipality with a valid BMI measurement**

*The original USDA dataset contained counts of the population that lived *beyond* ½ mile of a grocery store. After allocating this low food access measure to the municipal level I calculated its inverse.
**Estimated based on GeoCorr allocation from original geography to municipality.
†Added 2 to correct for proportions of 0 and/or 1 in the dataset.
‡Added 4 to correct for proportions of 0 and/or 1 in the dataset.

Municipalities with missing obesity data did not differ appreciably to those with non-missing obesity data with regard to covariates. Those with missing obesity data averaged slightly higher section comprehensiveness and strength scores by about 0-3 percentage points. The differences were slightly larger for strength scores in the Parks & Recreation (6.1 percentage points higher for non-missing municipalities) and Health Care Access (5.9 percentage points higher for missing municipalities) sections. Municipalities with missing data were not, however, evenly spread among the RPC-by-urbanicity strata. Some strata were not missing any municipalities while others were missing about half of their original sample (Table 5.6).

I therefore adjusted the sampling weights for non-response in any analysis using the obesity data. Non-response adjustments were calculated as the inverse probability of response, given a municipality was selected into the sample:

$$\frac{\#\ of\ nonmissing\ municipalities\ in\ stratum}{stratum\ sample\ size}$$

Table 5.6: Percentage of municipalities in each stratum missing obesity data

	Percentage missing		
RPC	**Urban**	**Suburban**	**Total**
Bay Lake	20	0	8
Capitol Area	0	0	0
East Central	20	44	36
Mississippi River	0	17	14
None	0	0	0
North Central	0	0	0
Northwest	0	0	0
Southeastern	19	28	24
Southwestern	0	0	0
West Central	0	57	50
Total	14	20	18

I then multiplied these non-response adjustments by the original sampling weights to produce final weights for the regression analysis.

Several of the dependent variables were also missing for two municipalities in our sample: Silver Lake village in Kenosha County and Fox Crossing village in Winnebago county. Silver Lake village merged with the town of Salem to form Salem Lakes village in 2017; therefore, Silver Lakes village itself ceased to exist in 2017. Fox Crossing village, on the other hand, was created in 2016 out of the former town of Menasha. These municipalities are variably missing depending on the year of census geographies used by the original data sources and how the original data providers chose to deal with discrepancies. In our final dataset, Silver Lake village is missing park accessibility, active commuting, and bike/ped danger variables while Fox

Crossing village is missing walkability, food accessibility, and active commuting variables. Adjustments were not made to the sampling weights to account for these two missing datapoints.

5.2.2.3 Covariates

Data on median household income, median age, and race are from the ACS 2015-2019 five-year estimates at the county subdivision geographic level, obtained from IPUMS NHGIS (Manson et al., 2023). Urbanicity was calculated as the percent of the municipality's land area that fell within a 2010 Urban Area. Urban Areas are defined by the Census Bureau after each decennial census and are defined at the census block group level. They include contiguous land areas that meet certain population and population density thresholds (US Census Bureau, 2021). Commute mode share for bicycling and walking was additionally used as a covariate in the bike/ped danger models, and is calculated from the ACS five-years estimates for 2018-2022. Covariate data was missing for two municipalities: Silver Lake village and Fox Crossing village.

5.2.3 Analysis

I used weighted least squares linear regression models with dependent variables modeled as log odds, or logits. All regression models used sampling weights and the finite population correction. Comprehensive plan scores were scaled by 20 percentage points. All analysis was conducted in StataSE 18.0 (StataCorp, 2023).

Before running the regression models, I conducted exploratory analyses of all variables using histograms, boxplots, scatterplots, and Pearson correlations. This helped me understand the overall distribution of each variable, identify potential relationships between variables, and rule out strong non-linear relationships between independent and dependent variables. For each regression model, I also used scatterplots, residual graphs, Q-Q normal plots, and graphs

overlaying the regression line on fitted values to assess model fit, potential outliers, and the normalcy and homoscedasticity of residuals.[19] There were no problems with the models violating linear regression assumptions and no non-linearity in the relationships between variables was found.

Potential outliers for median household income, park accessibility, active commuting, and Vision & Strategy scores were assessed for their impact on the models. Only the outliers for median household income were found to impact (some of) the regression results. These three municipalities have median household incomes of greater than $120,000, have outlying values on many other variables, and are villages adjacent to or nearby the metro areas of Milwaukee or Madison. Appendix 9 contains more information about these municipalities.

For each combination of independent variable and dependent variable, I ran four models: a) univariate regression without covariates, b) multivariate regression adjusted for covariates, c) multivariate regression adjusted for covariates and clustered on RPC (i.e. the fully adjusted model), and d) multivariate regression adjusted for covariates and clustered on RPC, excluding three municipalities with ultra-high median household incomes. Tables of results containing all four models for each dependent variable can be found in Appendix 10. In the main text of this chapter, I present results of the fully adjusted models and comment on the impact of excluding the three ultra-high-income municipalities from the analysis.

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[19] Many post-estimation statistics for weighted least squares regression using survey sampling characteristics are either not well-theorized or not readily available in statistical software (Heeringa et al., 2010, p. 196; StataCorp LLC, 2021; Williams, 2021). Therefore, I relied on visual assessment of post-estimation graphs to assess regression assumptions, as advised by Heeringa, West, and Berglund (2010, pp. 194–195).

5.3 RESULTS

Descriptive statistics for the section and overall comprehensive plan scores can be found in Chapter 2 and descriptive statistics for the dependent variables and covariates in this analysis are summarized in Table 5.7. Tables of odds ratios, 95% confidence intervals, and p-values for all models can be found in Appendix 10, while Figure 5.1 and Figure 5.2 visualize the odds ratios and confidence intervals for the fully adjusted models.

Table 5.7: Descriptive statistics for dependent variables and covariates.

	Mean	SE	Min	Max
Dependent variables (%)				
Park accessibility	56.6	1.77	4.11	100
Food accessibility	21.7	1.17	0	77.3
Walkability	19.6	1.78	0	100
Active commuting	4.62	0.32	0	31.0
Bike/ped danger	0.12	0.01	0	0.89
Obesity	40.8	0.47	22.2	49.8
Covariates				
Median income	$67,258	$1,452	$35,513	$161,719
Median age	39.5	0.39	21.9	55.1
% Black	2.74	0.32	0	38.7
% Urban	75.3	0.92	50.0	100
% Bike/ped commute	3.49	0.28	0	29.3

All descriptive statistics calculated using sampling weights and finite population correction.

5.3.1 Plan scores and park accessibility

Park accessibility rate is the percentage of the municipal population that lives within ½ mile of a public park. The mean park accessibility rate for urban and suburban Wisconsin municipalities is 56.6%. Several municipalities have rates lower than 10% and Darien village in Walworth county has a park accessibility rate of 4.11%. Meanwhile, many municipalities have park accessibility rates over 90% and three have a park accessibility rate of 100%: Milwaukee city in Milwaukee County, Menasha city in Winnebago County, and Watertown city in Jefferson County.

All section comprehensiveness and strength scores, barring the Health Care Access section, are associated with higher park accessibility rates (Figure 5.1, left plots). A 20

percentage point increase in comprehensiveness scores across sections is associated with 30-46% greater odds of park accessibility and in strength scores across sections is associated with 33-58% greater odds of park accessibility. Among sections, odds ratios are highest for Community Design scores and even higher for overall scores. Each 20 percentage point increase in overall score is associated with 58% higher odds (comprehensiveness scores) and 76% (strength scores) higher odds of park accessibility.

Excluding the three ultra-high-income municipalities identified in the Methods section slightly accentuates the association between most of the scores and park accessibility. Odds ratios are generally about 0.01-0.09 higher. However, the odds ratio for Community Design strength scores increases by 0.21, making it 1.79 in the fully adjusted model when excluding ultra-high-income municipalities. However, there are no differences in statistical significance of associations in the fully adjusted models versus fully adjusted models excluding ultra-high-income municipalities.

5.3.2 Plan scores and food accessibility

Food accessibility rate is the percentage of the municipal population that lives within ½ mile of supermarket or other large grocery store. Food accessibility rates in Wisconsin are significantly lower than park accessibility rates.[20] The mean food accessibility rate is 21.7%, but 18 municipalities have food accessibility rates lower than 1%. On the other hand, Shorewood Hills

[20] The methods for calculating park accessibility and food accessibility were different, as these two measures come from different government agencies (CDC and USDA, respectively), so the rates cannot be compared with statistical certainty. However, there is such a large discrepancy between the rates, this statement seems justified.

village in Dane County has a food accessibility rate significantly higher than any other municipality in Wisconsin, with 77.3% of its population living within ½ mile of a grocery store.

In the fully adjusted models, Vision & Strategy, Active Transportation, and Healthy Food Access comprehensiveness scores and Healthy Food Access and overall strength scores are significantly associated with food accessibility (Figure 5.1, middle plots). Each 20 percentage point increase in Healthy Food Access score is associated with 35% (comprehensiveness scores) and 58% (strength scores) higher odds of food accessibility, while the same increase in Vision & Strategy scores are associated with 59% (comprehensiveness scores) and 68% (strength scores) greater odds of food accessibility.

When excluding the three ultra-high-income municipalities, some of the odds ratios for food accessibility increase slightly by about 0.01-0.02. The odds ratio for Vision & Strategy comprehensive scores decreases by 0.06. There are no changes to the statistical significance of associations observed.

5.3.3 Plan scores and walkability

In this analysis, walkability refers to living in a census block group defined as "most walkable" or "above average walkability" by the EPA's National Walkability Index (which compares all census block groups across the United States). The walkability rate is the percentage of the municipal population that lives in such a block group. The mean walkability rate for urban and suburban municipalities in Wisconsin is 19.6%. Approximately 40% of the municipalities in our sample have walkability rates of 0%, while about 9% of municipalities—mostly in Milwaukee and Dane counties—have walkability rates over 90%. Three municipalities have walkability rates of 100%: Butler village in Waukesha County, Maple Bluff village in Dane County, and Shorewood Hills village in Dane County.

In the fully adjusted models, Healthy Food Access and Community Design comprehensiveness and strength scores, as well as Parks & Recreation strength scores, are associated with better walkability (Figure 5.1, right plots). Each 20 percentage point increase in Healthy Food Access scores is associated with 65-66% higher odds of walkability. Community Design and Parks & Recreation strength scores have odds ratios of about 2, meaning each 20 percentage point increase in these section scores is associated with double the odds of walkability.

Excluding the three ultra-high-income municipalities in the sample significantly changes the odd ratios and—sometimes—the statistical significance of the odds ratios. Vision & Strategy and overall scores become statistically significant correlates of walkability, with odds ratios for Vision & Strategy scores of 1.80-2.01 (up from 1.39-1.45 in the fully adjusted models) and for overall scores of 2.20-2.85 (up from 1.75-2.03 in the fully adjusted models). Healthy Food Access, Community Design, and Parks & Recreation scores see a similar increase in odds ratios, but without any difference in statistical significance, with increases of 0.22 to 0.65. In the models excluding the ultra-high-income municipalities, then, each 20 percentage point increase in Community Design scores is associated with 117% (comprehensiveness scores) and 163% (strength scores) greater odds of walkability. Each 20 percentage point increase in overall plan scores is associated with 120% (comprehensiveness scores) and 185% (strength scores) greater odds of walkability.

5.3.4 Plan scores and active commuting

Active commuting rate is defined as the percentage of commuters who reported biking, walking, or taking public transit as their main form of transportation. The mean active commuting rate in urban and suburban Wisconsin municipalities is 4.62%, with the bulk of active commuters

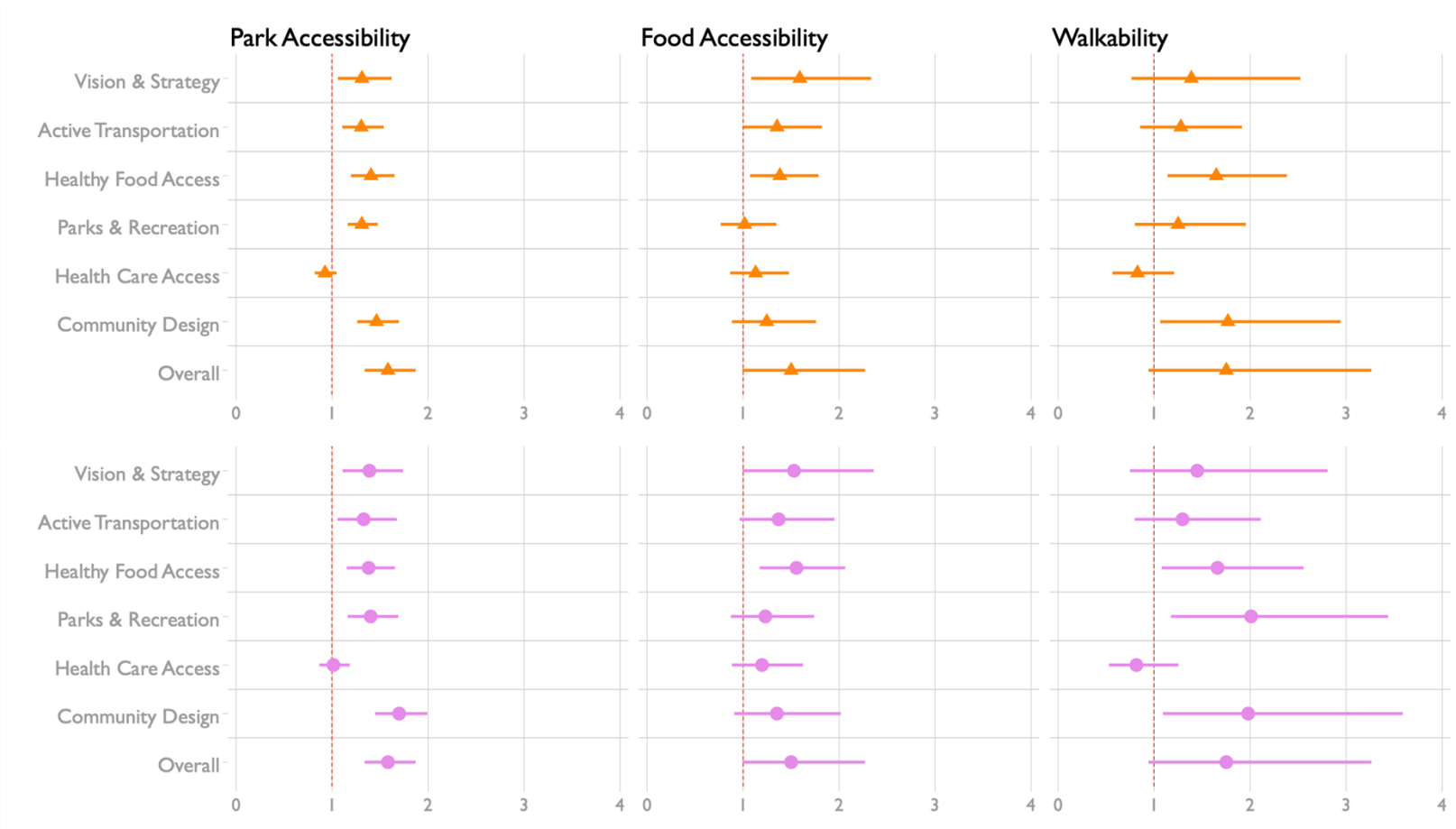


Figure 5.1: Odds ratios and 95% confidence intervals for a 20 percentage point difference in section and overall scores on park accessibility, food accessibility, and walkability dependent variables. Associations with comprehensiveness scores are denoted by orange triangles and associations with strength scores are denoted by magenta squares. All models adjusted for median age, median household income, % Black population, and urbanicity and clustered on regional planning commission.

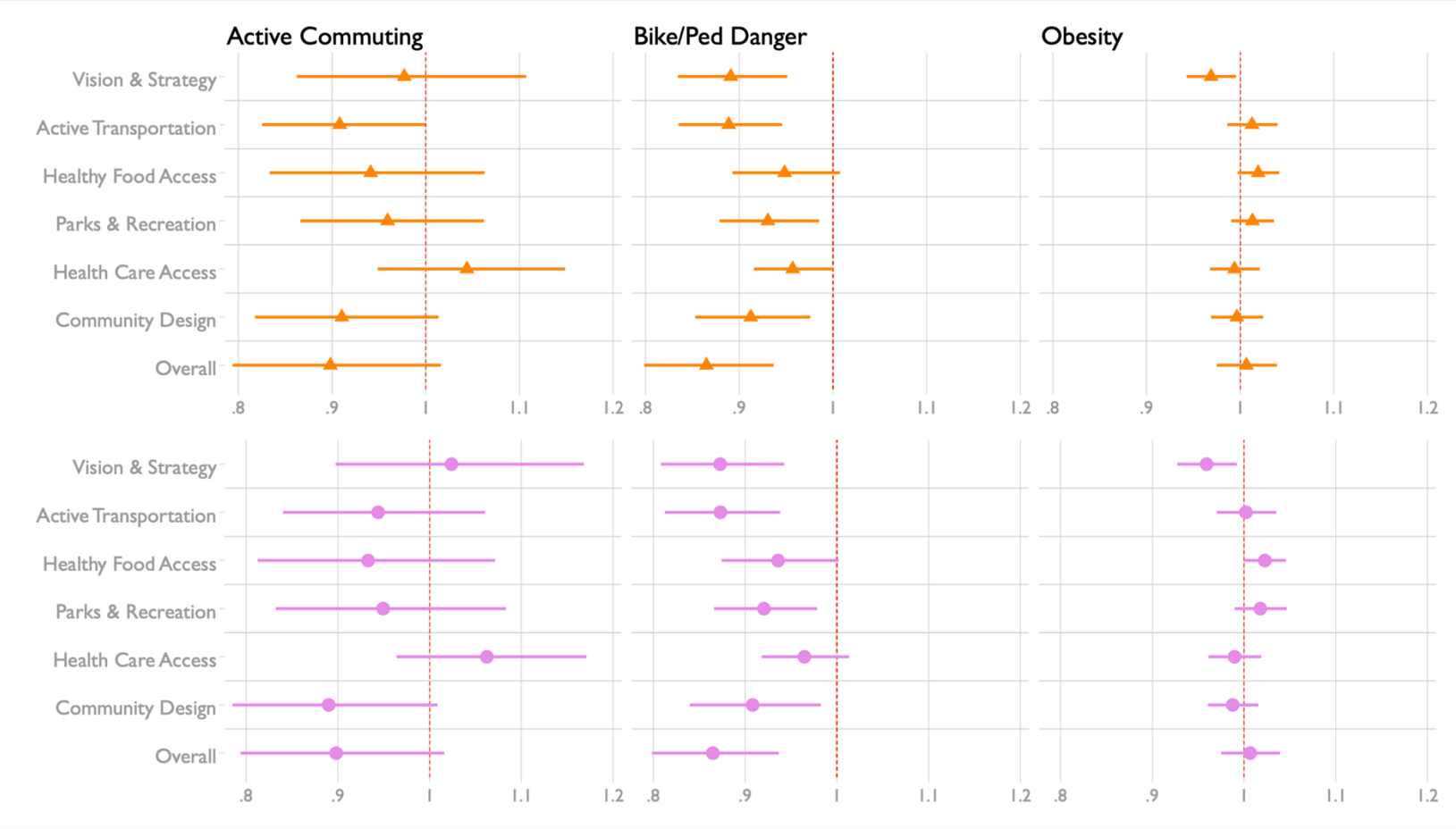


Figure 5.2: Odds ratios and 95% confidence intervals for a 20 percentage point difference in section and overall scores on active commuting, bike/ped danger, and obesity dependent variables. Associations with comprehensiveness scores are denoted by orange triangles and associations with strength scores are denoted by magenta squares. All models adjusted for median age, median household income, % Black population, and urbanicity and clustered on regional planning commission. Bike/ped danger models additionally adjusted for bike/ped commute mode share.

walking rather than biking or taking public transportation. Twelve municipalities have active commuting rate less than 1%. On the other end, Shorewood Hills village in Dane County has a rate of 31.0%, Madison city in Dane County has a rate of 23.9%, and Whitewater city in Walworth County has a rate of 18.2%.

There is very little evidence in the fully adjusted models for a relationship between comprehensive plan scores and active commuting rates (Figure 5.2, left plots). There is one significant association; each 20 percentage point increase in Active Transportation comprehensiveness score is associated with about 9% *lower* odds of active commuting. However, this is just barely statistically significant, with a p-value of 0.049.

These results change when I exclude the three ultra-high-income municipalities from the analysis. While none of the comprehensiveness scores are statistically significantly associated with active commuting, several of the odds ratios change from less than 1 to greater than 1, indicating a switch from possible relationships in the negative direction to the positive direction. The same is true for many of the strength scores. For strength scores that had statistically insignificant, but positive associations with active commuting in the fully adjusted models, excluding the ultra-high-income municipalities makes the odds ratios statistically significant. The odds ratio for Vision & Strategy strength scores is 1.19 (compared to 1.02 in the fully adjusted model) and the odds ratio for Health Care Access strength scores is 1.11 (compared to 1.06 in the fully adjusted model).

5.3.5 Plan scores and bicycle and pedestrian danger

In this analysis, bicycle and pedestrian danger is the number of bicyclist and pedestrian injuries and fatalities as a percentage of the total municipal population in the years 2018-2022. The mean bicycle and pedestrian danger for Wisconsin municipalities is 0.12%, which equates to 120

bicycle/pedestrian injuries or fatalities per 100,000 people during the five-year period. However, about half the municipalities in our sample (n=59) have bicycle/pedestrian danger rates lower than 0.10% (100 injuries/fatalities per 100,000 population) and 19 municipalities have rates lower than 0.05% (50 injuries/fatalities per 100,000 population). The highest rates of over 0.80% (or over 800 injuries or fatalities per 100,000 people) were seen in Shorewood Hills village in Dane County and Lake Delton village in Sauk County. It should, however, be noted that high bicycle/pedestrian danger rates may partially be driven by high rates of transportation via bicycle and walking and/or low population levels.

In the fully adjusted models, all section scores except Healthy Food Access and Health Care Access scores have statistically significant associations with bicycle and pedestrian danger (Figure 5.2, middle plots). Odds ratios for section scores ranged from 0.87 to 0.93 and are even lower for overall scores--0.85 (strength scores) and 0.86 (comprehensiveness scores). This means that every 20 percentage point increase in overall scores is associated with about 15% lower odds of bicycle and pedestrian danger in the municipality.

Excluding the three ultra-high-income municipalities from the analysis slightly increases most of the odds ratios by about 0.02-0.05. The odds ratio for Parks & Recreation strength scores decreases by 0.02 and becomes statistically insignificant. Otherwise, there are no changes to the statistical significance of the associations observed.

5.3.6 Plan scores and obesity

In this analysis, obesity rate is defined as the percentage of people who had obesity among people with a valid body mass index measurement at a participating health care system in Wisconsin in 2015 and 2016. The mean obesity rate for urban and suburban municipalities in

Wisconsin is 40.8%. The lowest obesity rate in our sample is 22.2% in Shorewood Hills village in Dane County and the highest obesity rate is 49.8% in Tomah city in Monroe County.

In the fully adjusted models, most section and overall scores are not associated with lower obesity rates (Figure 5.2, right plots), with odds ratios are between 0.99 and 1.01. However, there is a statistically significant, yet still slight, association between Vision & Strategy scores and obesity, with an odds ratio of 0.97 for comprehensiveness scores and 0.98 for strength scores. Every 20 percentage point increase in Vision & Strategy score is associated with about 2-3% lower odds of obesity.

When excluding the three ultra-high-income municipalities, the relationships between plan scores and obesity rates change very little. The odds ratio for Vision & Strategy comprehensive score decreases by 0.01, making it statistically insignificant. The odds ratio for Vision & Strategy strength score increases by 0.01 with no change in statistical significance. All other odds ratios remain between 0.99 and 1.01.

5.3.6.1 Income-score interaction in obesity models

Out of all the covariate-dependent variable correlations in my analyses, the relationship between median household income and obesity rate is notably strong, with a Pearson correlation of -0.7213 (see Figure 5.3, below). Therefore, the question emerged: does median household income moderate any association between plan scores and obesity rates?

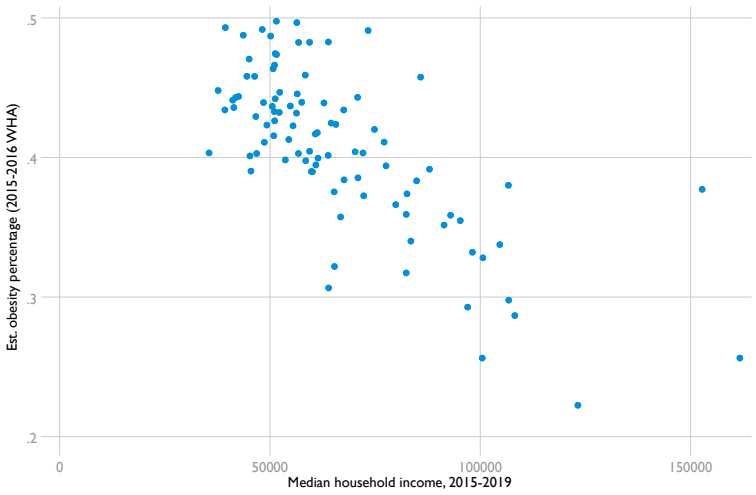
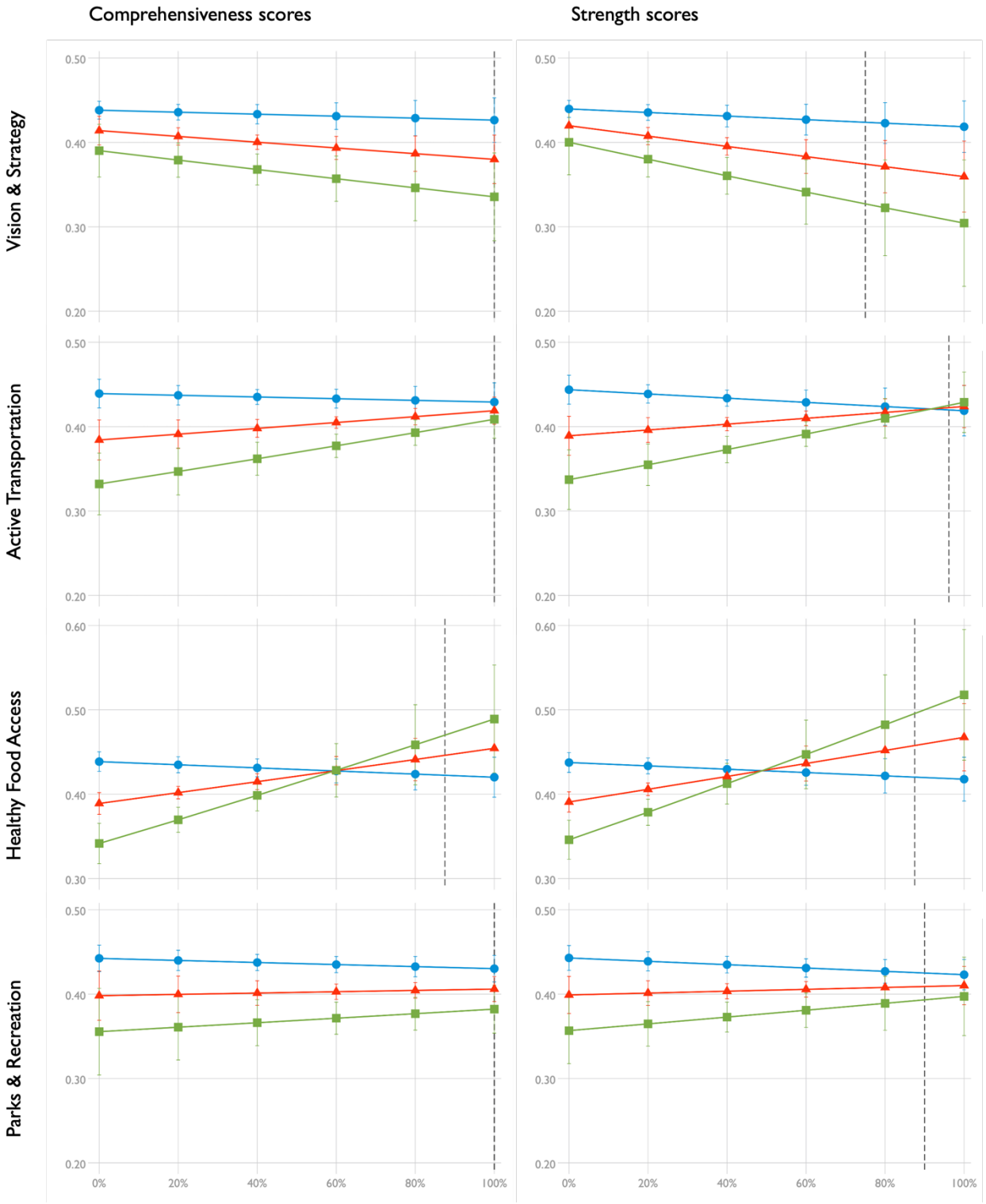


Figure 5.3: Scatterplot of median household income and estimated municipal obesity rate.

I therefore re-ran each a) fully adjusted model and b) fully adjusted model excluding ultra-high-income municipalities, this time including an interaction term between the plan score independent variable and the income covariate. For each model, I also used a Wald test to determine the joint significance of the coefficient for the score variable and the interaction between income and score (see Appendix 11 for the full results of this analysis). In the fully adjusted models, the main associations between scores and obesity remain unchanged from the models without the interaction term. That is, the odds ratios for Vision & Strategy comprehensiveness and strength scores are statistically significant, while the odds ratios for other scores remain statistically insignificant. The Wald tests are significant for the joint association between Vision & Strategy strength score and the income-score interaction as well as the Parks & Recreation strength score and income-score interaction, but the interaction term itself is only significant for the Parks & Recreation strength score.

The results when excluding the three ultra-high-income municipalities are quite different. The regression lines for the association between plan scores and obesity rates at three different levels of median household income are visualized in Figure 5.4. The plots for Vision & Strategy


Comprehensiveness scores
Strength scores
Vision & Strategy
Active Transportation
Healthy Food Access
Parks & Recreation
0.50
0.40
0.30
0.20
0.60
0%
20%
40%
60%
80%
100%

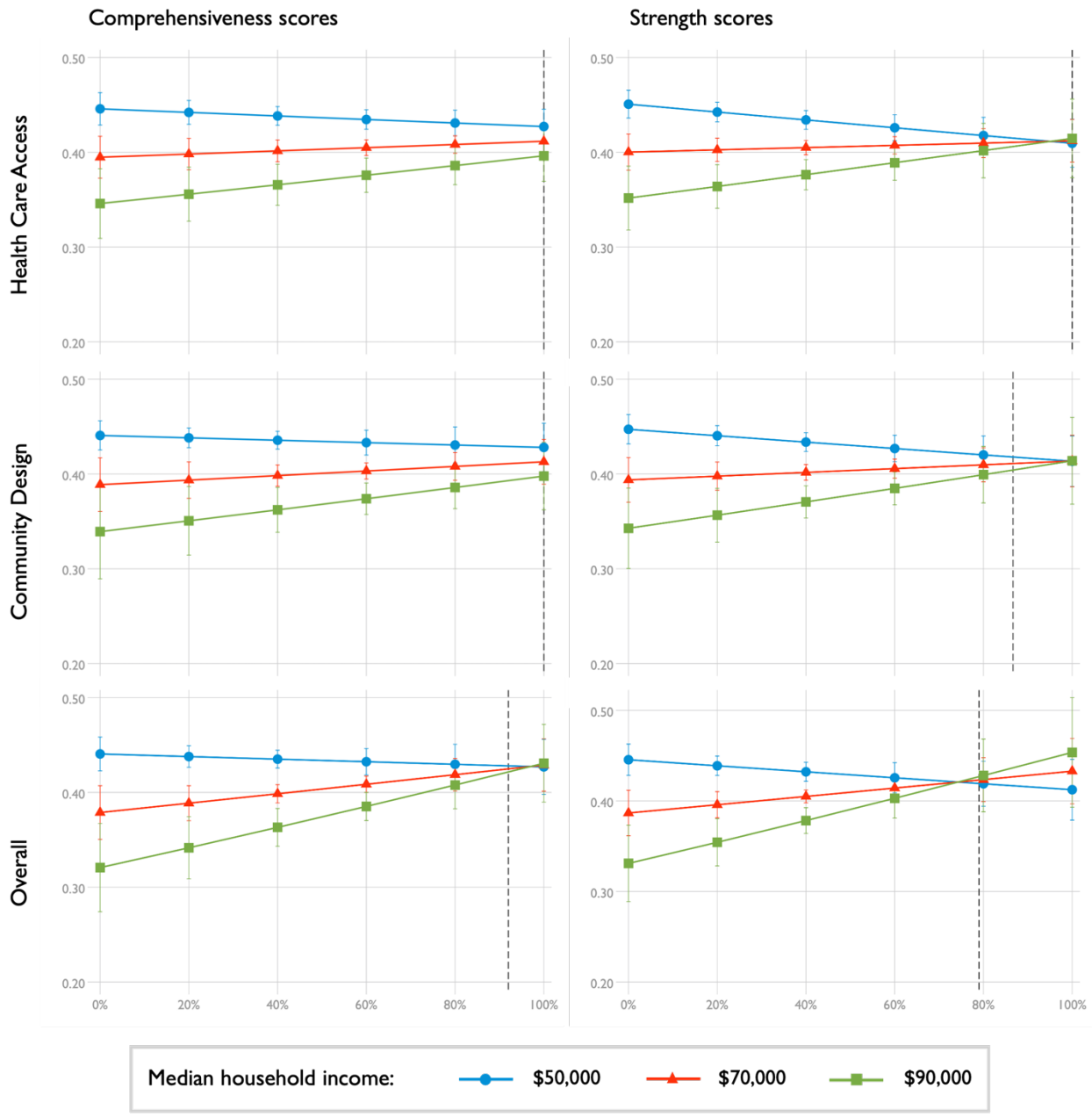


Figure 5.4: Association between plan scores and proportion of the population with obesity at three different median household incomes. Plan scores on the X axes. Obesity proportions estimated from regression models on the Y axes. Dark gray, dashed line indicates the maximum plan score for each section in the dataset. Minimum plans scores for each section are 0. All regression models adjusted for median household income, median age, % Black population, and urbanicity; clustered on regional planning commission; including interaction term for income x score; and excluding ultra-high-income municipalities.

scores show null-to-negative relationships between scores and obesity at all three income levels. Scores have a stronger negative relationship with obesity rates at higher incomes, though the difference between income levels is not statistically significant (neither the score-income interaction term nor the joint test are significant for either Vision & Strategy models).

All other sections, and the overall scores, show the opposite interaction, with null-to-negative relationships between scores and obesity rates at lower incomes but null-to-positive relationships between scores and obesity rates at higher incomes. These differences in regression lines are significant in the Active Transportation, Healthy Food Access, Health Care Access, and overall comprehensiveness and strength scores, as well as for Community Design strength scores (income-score interaction terms are statistically significant in these models). The joint tests of the combined score and score-income interaction terms are also significant for all of these except the Healthy Food Access comprehensive scores. In sum, there is evidence of an interaction between income and scores in all but the Vision & Strategy and Parks & Recreation sections.

The interaction is most pronounced in the Healthy Food Access section, in which the regression lines actually cross each other at around a 60% comprehensiveness score and a 50% strength score. This indicates that, according to these models, starting at those scores, higher income municipalities actually have higher obesity rates that lower income municipalities. The same is also true for Active Transportation and overall strength scores (at scores of around 90% and 75%, respectively).

5.4 Discussion

Although results varied by section of the Scorecard, my analysis provides some of the first evidence that comprehensive planning for HEAL is associated with better park accessibility, food accessibility, and walkability, as well as lower bicycle and pedestrian danger. A 20

percentage point increase in overall plan comprehensiveness score is associated with as much as 64% greater odds of park accessibility, 120% greater odds of walkability, and 11% reduced odds of bicycle/pedestrian danger. The same increase in overall plan strength score is associated with as much as 85% greater odds of park accessibility, 67% greater odds of food accessibility, 185% greater odds of walkability, and 11% lower odds of bicycle/pedestrian danger.

The analysis also provides slight evidence for a relationship between Vision & Strategy plan scores and lower obesity rates, with a 20 percentage point increase in comprehensiveness or strength scores associated with about 3-4% lower odds of obesity. Obesity is the most distal outcome studied in this analysis, and is influenced by a great deal of individual-, interpersonal-, institutional-, community-, and systems-level factors in addition to a HEAL-promoting comprehensive plan and built environment (Payne et al., 2015). Therefore, it is expected that, among the outcomes analyzed, it has one of the least pronounced associations with plan scores. However, because of the complex and distal nature of obesity as an outcome, it is quite telling that this study found any evidence of an association at all. While lower cancer incidence has been linked to pedestrian-oriented zoning codes (Nicholson et al., 2017), this is the first study to link a health outcome to the quality of comprehensive plans.

Lastly, I found no evidence for an association between plan scores and higher active commuting rates in the fully adjusted models. This was perhaps the most surprising finding, as it is the only outcome studied that has several precedents for positive associations (Aytur et al., 2008; Chriqui et al., 2016). However, the margins of error for ACS estimates of active commuting for municipalities—especially small municipalities—are very large. This could mean that estimates are also unstable between five-year increments, thus leading to different results when using different years' data.

This analysis shows that comprehensive planning for HEAL is associated with a variety of SDG-related outcomes. This is a cross-sectional study, though, so the results cannot necessarily show that SDG-related outcomes are caused by the incorporation of HEAL in local comprehensive plan.

There are several possible mechanisms driving the observed associations. It is possible that other factors independently drive both the incorporation of HEAL into a local comprehensive plan and better SDG-related outcomes, even if the comprehensive plan is not the causative factor. Such factors might include local leaders' knowledge or interest in planning for health, sustained collaboration between public health and planning departments, or community-wide salience of SDG-related issues, to name but a few. There may also be an indirect reverse causation at play. People who value having ready access to parks and supermarkets and a walkable built environment may selectively move to communities that already have these characteristics. Then, they could influence the content of the comprehensive plan during public participation processes or because they assume planning or public leadership roles.

5.4.1 A potentially complex picture of plan impact

It is also possible that HEAL-oriented comprehensive plans have an impact on local-level SDG outcomes. I propose that, *if* this is the case, it occurs by more complex means than has previously been considered in assessments relating plans and planning policies to health and sustainability outcomes. Such assessments have assumed that plan implementation occurs through conformance; that is, they have assumed that plan impact occurs through the *blueprint* aspects of the plan. These assessments thus sought to draw lines between closely-related concepts in the plans and policies and the outcomes. (i.e. between Complete Streets policies in comprehensive plans and levels of active transportation). Most of these assessment *have* been successful in

showing that there are linkages between such concepts (e.g. see Aytur et al., 2008; Chriqui et al., 2016; Nicholson et al., 2017).

However, the results of my analysis indicate that it may not be just the blueprint aspect of comprehensive plans that drives impact. The SDG-related outcomes studied here are not just related to the sections of the Scorecard most closely aligned with them. Park accessibility, for example, is not only associated with better Parks & Recreation scores, but also Vision & Strategy, Active Transportation, Healthy Food Access, and Community Design scores. Food accessibility is associated with Active Transportation and Vision & Strategy scores, as well as Healthy Food Access scores. Walkability is associated with Vision & Strategy, Healthy Food Access, and Community Design, but not Active Transportation scores. Bicycle/pedestrian danger is associated with Vision & Strategy, Community Design, and Parks & Recreation, as well as Active Transportation scores. And obesity is associated with only Vision & Strategy scores, and not the sections most closely linked with HEAL behaviors.

This may indicate "leakage" of concepts across sections. For example, there is an item about farmland preservation in the Healthy Food Access section, which has as much to do with community design concepts (e.g. discouraging sprawl, encouraging compact land use) as it does with healthy foods. This may partially explain why greater walkability is associated with seemingly unrelated Healthy Food Access scores. As another example, the promotion of trails and greenways is covered in the Active Transportation section and support for community gardens is addressed in the Healthy Food Access section. Both of these could be considered public parks and recreation areas, partially explaining why park accessibility scores are associated with these sections.

Again, *if* the mechanism underlying the observed associations is that HEAL-oriented comprehensive plans have an impact on local-level SDG outcomes, the disconnect in the observed associations between section concepts and outcome concepts may provide evidence that plan impact occurs through more complicated mechanisms than simple conformance. As discussed in the introduction, comprehensive plan impact may occur via (at least) three mechanisms. Comprehensive plan impact can manifest through conformance of municipal policies, programs, and projects to the comprehensive plan; that is, it could be the *blueprint* aspect of the comprehensive plan that drives outcomes. Impact could also manifest through the influence of the comprehensive plan on decision making within the municipality, outside of the specific strategies listed in the plan; that is, it could be the *vision* aspects of the plan that drive outcomes. A third possibility is that the institutional and community capacity building *process* of developing a comprehensive plan leads to greater institutional and community capacity for planning for HEAL, which drives outcomes. When we consider plan impact through this lens, the causative pathways are complex. Moreover, they also include or are related to many of the potential causal mechanisms for the observed associations previously thought of as potential confounding factors (e.g. community-wide salience of HEAL-related issues, collaboration between public health and planning).

My results pose an important question to comprehensive planning, active living, and healthy eating researchers: how does HEAL-oriented built environment policy translate into on-the-ground outcomes? Beyond the plan blueprint, plan *influence* and *process* may also be important. This is also supported by the fact that the Vision & Strategy section, which includes mostly vision-oriented items, was the only section associated with every outcome studied.

5.4.2 Interactions between planning for HEAL and income for obesity rates

Including interaction terms between median household income and plan scores revealed differential relationships between comprehensive planning for HEAL and obesity at different income levels. At a median household income of $50,000, there are slightly negative relationships between plan scores and obesity across sections. For higher-income municipalities, these negative relationships only hold for the Vision & Strategy section. In all other sections, there is a positive relationship between plan scores and obesity rates at the $70,000 and $90,000 median household income levels. Indeed, in some sections, obesity rates are higher in high-income municipalities than in lower income municipalities once a certain plan score threshold is reached. Unfortunately, this does not indicate that comprehensive planning for HEAL is helping lower income communities fight obesity; the regression line for lower income municipalities is relatively flat across sections. Instead, this indicates that there is something happening in higher income municipalities through which higher plan scores lead to or are otherwise associated with higher obesity rates.

The explanation may lie in reverse causality. Some higher-income municipalities that have higher obesity rates may be more likely to incorporate HEAL-promoting components in their comprehensive plan in order to address the issue. Rather than planning for HEAL driving down obesity rates, higher obesity rates may drive the incorporation of HEAL into plans, but only for higher income municipalities.

Higher obesity rates have been associated specifically with suburban land development patterns (Lopez, 2004; Vandegrift & Yoked, 2004; Zhao & Kaestner, 2010): residential land uses separated from commercial areas; large lots; wide, curvilinear roads; and access to commercial and institutional areas only via arterial roads. These areas also tend to be affluent due to the history of white flight, redlining, and other governmental policies that made it difficult for poor

and Black families to settle there (Rothstein, 2017). It is possible that some higher-income, suburban communities are now including HEAL-promoting components in their local comprehensive plans. However, their sprawling development pattern might lock them into a trajectory towards car reliance, low physical activity, and unhealthy diets. If this is true, then these communities should find ways to retrofit their current land use to incorporate more mixed land uses, build more density into their neighborhood fabric, and develop infrastructure that supports bicycle, pedestrian, and transit connectivity (e.g., see Dunham-Jones, 2009).

5.4.3 Limitations

As discussed, this is a cross-sectional study that cannot determine causality between plan content and outcomes. We only coded HEAL-related components in local comprehensive plans and not in other plans, such as bicycle and pedestrian plans, parks and recreation plans, farmland preservation plans, or regional plans. However, these types of plans were often referred to in the comprehensive plans themselves, and their presence was scored where appropriate. This study also only assessed plans from Wisconsin and excluded rural communities; therefore, results may not be generalizable to other states or to rural or small-town communities. We did not directly measure the implementation of the comprehensive plans, either by assessing downstream planning policies like zoning codes, subdivision codes, or unified development codes or by directly assessing the on-the-ground built environment conditions in each municipality. These evaluations were out of the scope for this project.

Lastly, our simple regression analyses do not necessarily account for the dynamic complexity of planning and urban (or suburban) environments. My analysis, in the words of Emily Talen, skips over “a number of ‘contentious steps’ in the explanatory chain” (1996, p. 255), as illustrated via the conceptual framework in Figure 1.9. However, the nascent nature of

this type of research, as applied to comprehensive plans and SDG-related outcomes, makes such a simple, exploratory approach appropriate. Secondly, I have focused on aspects of plan impact that can be assessed via readily-available data. Future (ideally, well-funded) studies may seek to assess other aspects of the conceptual framework that require more involved data collection efforts.

Talen argues that it may simply be impossible to understand every aspect that contributes to the translation of comprehensive plan quality into impacts; in any case, it would require a large undertaking to map every aspect of such a complex, dynamic system (1996). She nevertheless advocates for quantitative analysis of associations between plan quality and outcomes, as I have done in this study, noting that, while limited, such analyses can still be useful (Talen, 1996).

5.4.3.1 Measurement of SDG-related outcomes

Data for the SDG-related outcomes studied in this analysis come from large, mostly nationwide, openly accessible datasets. There is inherent error in trying to measure things like walkability, access to parks and food, and transportation behavior and safety via such largescale datasets.

For example, the park and food accessibility datasets do not include all places in a municipality where people recreate and obtain food. Unofficial (e.g. informal trails) and private (e.g. golf courses) places for recreation, farmers' markets, and convenience stores, for example, are not included in these datasets. Nor do these measures include quality of parks or food sources available. The walkability data includes measures of street connectivity, land use mix, and transit accessibility, but does not include measures of safety or aesthetics, nor the presence of pedestrian infrastructure. Park and food accessibility data is measured using Euclidean distance and not street network distance, and is measured to the nearest border (at least for parks), which does not

take into account the journey someone would need to take to actually access these resources. Park and food accessibility and walkability are all measured based on where people live. It is possible that people access such resources in areas near where they work, go to school, or near where family members or friends live.

Active commuting data is based on a survey, which might be subject to social desirability bias or simple misremembering. In addition, the margins of error for the active commuting data are large, especially for small municipalities. The bicycle and pedestrian danger variable only reflects crashes reported to the police and the crash summary filles only account for two people involved in each crash. By state law, crashes resulting in an injury or death must be reported; however, it is possible that some are not or that they are reported by an individual involved rather than the police (Wisconsin TOPS, 2019). It also seems likely that, when crashes are reported by police, those individuals with the most serious injuries would be listed first in the report.

Lastly, the proportioning techniques to calculate accessibility and walkability variables at the census tract and block group levels and then to allocate data for accessibility, walkability, and obesity to the municipal level assumes that populations are distributed evenly throughout these geographies. This may not reflect the reality with communities in Wisconsin; population may be concentrated in certain areas of the municipality while other areas have little or no population.

5.5 Conclusion

5.5.1 Implications for research

This study provides some of the first empirical evidence for a relationship between comprehensive planning for HEAL and a broad set of related SDG outcomes. There is plenty of

opportunity for the results to be built upon, extended, and clarified in order to further develop the connections between planning for HEAL and the SDGs. Future studies could investigate mediating relationships between several of the variables in this analysis. For example, there are plausible mediating relationships between bicycle/pedestrian danger and active transportation mode share (Slater et al., 2016) or walkability, park access, or food access and obesity rates.

This analysis shows that there are associations between planning for HEAL and SDG-related outcomes, but many questions remain about why and how those association exist. In-depth qualitative research, perhaps with municipalities in this sample, would be well-placed to elucidate the associations reported. Longitudinal research or research with historical data on plans and SDG-related outcomes may also be able to determine causal mechanisms behind these associations. In addition, the interaction between median household income and plan scores on obesity rates is somewhat puzzling. It could be further explored by profiling several high-, medium-, and low-income municipalities; gathering rich data on each (e.g. factors like economic profile, population changes, land use, health factors); and further clarifying the mechanisms at play.

Lastly, future studies could explore a variety of other SDG-related outcomes with interconnections to planning for HEAL. Chapter 4 contains a map of such interconnections. In order for this research to be possible, though, sub-county level data need to be made available for such outcomes. For instance, SDG target 2.1 on food security was identified as indivisible from planning for HEAL in Chapter 4, but I could not locate a source of sub-county level data on food insecurity rates (beyond access to grocery stores). In addition, there are many climate change and environmental sustainability SDG targets that lack local-level (non-modelled) data. Local-level carbon emissions, air and water pollution, and ecosystem protection indicators, for instance,

could allow researchers to further investigate the theoretical interconnections between planning for HEAL and SDG targets 11.6 (environmental impact of cities), 6.3 (water pollution), 14.1 (marine pollution), 14.2 (protect marine ecosystems), and 15.1 (protect terrestrial and inland water ecosystems), as well as SDG 13 (climate action).

5.5.2 Policy and practice implications

Depending on local priorities, policymakers and planners may want to consider using planning for HEAL as a concrete set of objectives to advance local progress on the SDGs, including those not directly related to health. Diet and physical activity are priorities in almost 90% of local community health assessments in Wisconsin, so planning for HEAL has the potential to be an important motivator towards action on the SDGs in the state. On the other hand, public health leaders may consider highlighting the potential for HEAL interventions to contribute to the SDGs as a way to build multisector coalitions for collective action.

5.5.3 Concluding remarks

This study found that the incorporation of HEAL-promoting goals, objectives, and policies in local comprehensive plans in Wisconsin is associated with greater local-level walkability, park accessibility, and food accessibility, as well as lower bicycle/pedestrian danger. This provides some of the first cross-sectional evidence connecting planning for HEAL to a set of SDG-related outcomes. Public health and sustainability professionals can use these results as the basis for greater multisector collaboration. However, planning for HEAL is feasibly interconnected to a much greater set of SDG-related outcomes. Therefore, while this study provides promising results for clearer connections between public health and the broader global sustainable

development agenda, more research is needed to expand these findings to SDG-related outcomes.

5.6 References

Agresti, A., & Coull, B. A. (1998). Approximate is better than "exact" for interval estimation of binomial proportions. *The American Statistician*, *52*(2), 119–126. https://doi.org/10.2307/2685469

Apovian, C. M. (2016). Obesity: Definition, comorbidities, causes, and burden. *American Journal of Managed Care*, *22*(7 Suppl), s176–s185.

Aytur, S. A., Rodriguez, D. A., Evenson, K. R., Catellier, D. J., & Rosamond, W. D. (2008). The sociodemographics of land use planning: Relationships to physical activity, accessibility, and equity. *Health & Place*, *14*(3), 367–385. https://doi.org/10.1016/j.healthplace.2007.08.004

Baobeid, A., Koç, M., & Al-Ghamdi, S. G. (2021). Walkability and its relationships with health, sustainability, and livability: Elements of physical environment and evaluation frameworks. *Frontiers in Built Environment*, *7*. https://doi.org/10.3389/fbuil.2021.721218

Bassett, D. R., Pucher, J., Buehler, R., Thompson, D. L., & Crouter, S. E. (2008). Walking, cycling, and obesity rates in Europe, North America, and Australia. *Journal of Physical Activity and Health*, *5*(6), 795–814. https://doi.org/10.1123/jpah.5.6.795

Berglund, E., Lytsy, P., & Westerling, R. (2016). Active traveling and its associations with self-rated health, BMI and physical activity: A comparative study in the adult Swedish population. *International Journal of Environmental Research and Public Health*, *13*(5), 455. https://doi.org/10.3390/ijerph13050455

Blay-Palmer, A., & Young, L. (2019). Food System Lessons from the SDGs. In S. Dalby, S. Horton, R. Mahon, & D. Thomaz (Eds.), *Achieving the Sustainable Development Goals: Global Governance Challenges* (pp. 19–35). Routledge.

Blodgett, J. (2019). *Geocorr2014* (2.3) [SAS]. Missouri Census Data Center. https://mcdc.missouri.edu/applications/geocorr.html

Bower, K. M., Thorpe, R. J., Rohde, C., & Gaskin, D. J. (2014). The intersection of neighborhood racial segregation, poverty, and urbanicity and its impact on food store availability in the United States. *Preventive Medicine*, *58*, 33–39. https://doi.org/10.1016/j.ypmed.2013.10.010

Bowler, D. E., Buyung-Ali, L., Knight, T. M., & Pullin, A. S. (2010). Urban greening to cool towns and cities: A systematic review of the empirical evidence. *Landscape and Urban Planning*, *97*(3), 147–155. https://doi.org/10.1016/j.landurbplan.2010.05.006

Brand, C., Dons, E., Anaya-Boig, E., Avila-Palencia, I., Clark, A., de Nazelle, A., Gascon, M., Gaupp-Berghausen, M., Gerike, R., Götschi, T., Iacorossi, F., Kahlmeier, S., Laeremans, M., Nieuwenhuijsen, M. J., Pablo Orjuela, J., Racioppi, F., Raser, E., Rojas-Rueda, D., Standaert, A., … Int Panis, L. (2021). The climate change mitigation effects of daily active travel in cities. *Transportation Research Part D: Transport and Environment*, *93*, 102764. https://doi.org/10.1016/j.trd.2021.102764

Buehler, R., & Pucher, J. (2021). The growing gap in pedestrian and cyclist fatality rates between the United States and the United Kingdom, Germany, Denmark, and the Netherlands, 1990–2018. *Transport Reviews*, *41*(1), 48–72. https://doi.org/10.1080/01441647.2020.1823521

CDC. (2023, May 31). *National Environmental Public Health Tracking Network*. Centers for Disease Control and Prevention. https://ephtracking.cdc.gov

Chandrabose, M., Cerin, E., Mavoa, S., Dunstan, D., Carver, A., Turrell, G., Owen, N., Giles-Corti, B., & Sugiyama, T. (2019). Neighborhood walkability and 12-year changes in cardio-metabolic risk: The mediating role of physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1), 86. https://doi.org/10.1186/s12966-019-0849-7

Chapman, J., Fox, E. H., Bachman, W., Frank, L. D., Thomas, J., & Rourk Reyes, A. (2021). *Smart Location Database Technical Documentation and User Guide Version 3.0*. U.S. Environmental Protection Agency.

Chooi, Y. C., Ding, C., & Magkos, F. (2019). The epidemiology of obesity. *Metabolism*, *92*, 6–10. https://doi.org/10.1016/j.metabol.2018.09.005

Chriqui, J. F., Leider, J., Thrun, E., Nicholson, L. M., & Slater, S. (2016). Communities on the move: Pedestrian-oriented zoning as a facilitator of adult active travel to work in the United States. *Frontiers in Public Health*, *4*. https://doi.org/10.3389/fpubh.2016.00071

Clevenger, K. A., Berrigan, D., Patel, S., Saint-Maurice, P. F., & Matthews, C. E. (2023). Relationship between neighborhood walkability and the prevalence, type, timing, and temporal characteristics of walking. *Health & Place*, *80*, 102983. https://doi.org/10.1016/j.healthplace.2023.102983

Coffee, N. T., Howard, N., Paquet, C., Hugo, G., & Daniel, M. (2013). Is walkability associated with a lower cardiometabolic risk? *Health & Place*, *21*, 163–169. https://doi.org/10.1016/j.healthplace.2013.01.009

Darwish, A. M., Zagow, M., & Elkafoury, A. (2023). Impact of land use, travel behavior, and socio-economic characteristics on carbon emissions in cool-climate cities, USA. *Environmental Science and Pollution Research*, *30*(39), 91108–91124. https://doi.org/10.1007/s11356-023-28487-9

Development Initiatives. (2022). *2022 Global Nutrition Report: Stronger Commitments for Greater Action*. Development Initiatives. https://globalnutritionreport.org/reports/2022-global-nutrition-report/

Dietz, W. H., & Pryor, S. (2022). How can we act to mitigate the global syndemic of obesity, undernutrition, and climate change? *Current Obesity Reports*. https://doi.org/10.1007/s13679-021-00464-8

Dobson, J., Harris, C., Eadson, W., & Gore, T. (2019). *Space to Thrive: A Rapid Evidence Review of the Benefits of Parks and Green Spaces for People and Communities*. The National Lottery Heritage Fund and The National Lottery Community Fund.

Dunham-Jones, E. (2009). *Retrofitting Suburbia: Urban Design Solutions for Redesigning Suburbs*. John Wiley & Sons. https://search.library.wisc.edu/catalog/9910067792502121

Eggers, S., Remington, P. L., Ryan, K., Nieto, F. J., Peppard, P., & Malecki, K. (2016). Obesity prevalence and health consequences: Findings from the Survey of the Health of Wisconsin. *Wisconsin Medical Journal*, *115*(5), 7.

Evenson, K. R., Aytur, S. A., Satinsky, S. B., Kerr, Z. Y., & Rodríguez, D. A. (2011). Planning for pedestrians and bicyclists: Results from a statewide municipal survey. *Journal of Physical Activity and Health*, *8*(s2), S275–S284. https://doi.org/10.1123/jpah.8.s2.s275

Forsyth, A. (2015). What is a walkable place? The walkability debate in urban design. *URBAN DESIGN International*, *20*(4), 274–292. https://doi.org/10.1057/udi.2015.22

Freeman, L., Neckerman, K., Schwartz-Soicher, O., Quinn, J., Richards, C., Bader, M. D. M., Lovasi, G., Jack, D., Weiss, C., Konty, K., Arno, P., Viola, D., Kerker, B., & Rundle, A. G. (2013). Neighborhood walkability and active travel (walking and cycling) in New York City. *Journal of Urban Health*, *90*(4), 575–585. https://doi.org/10.1007/s11524-012-9758-7

Gorber, S. C., Tremblay, M., Moher, D., & Gorber, B. (2007). A comparison of direct vs. self-report measures for assessing height, weight and body mass index: A systematic review. *Obesity Reviews*, *8*(4), 307–326. https://doi.org/10.1111/j.1467-789X.2007.00347.x

Grabow, M. L., Spak, S. N., Holloway, T., Stone, B., Mednick, A. C., & Patz, J. A. (2012). Air quality and exercise-related health benefits from reduced car travel in the Midwestern United States. *Environmental Health Perspectives*, *120*(1), 68–76. https://doi.org/10.1289/ehp.1103440

Gratani, L., Varone, L., & Bonito, A. (2016). Carbon sequestration of four urban parks in Rome. *Urban Forestry & Urban Greening*, *19*, 184–193. https://doi.org/10.1016/j.ufug.2016.07.007

Greenlund, K. J., Lu, H., Wang, Y., Matthews, K. A., LeClercq, J. M., Lee, B., & Carlson, S. A. (2022). PLACES: Local data for better health. *Preventing Chronic Disease*, *19*, 210459. https://doi.org/10.5888/pcd19.210459

Hall, P. (2014). *Cities of tomorrow: An intellectual history of urban planning and design since 1880* (4th ed.). John Wiley & Sons, Incorporated.

Heeringa, S. G., West, B. T., & Berglund, P. A. (2010). *Applied Survey Data Analysis*. Chapman & Hall/CRC.

Hirsch, J. A., Moore, K. A., Evenson, K. R., Rodriguez, D. A., & Roux, A. V. D. (2013). Walk Score® and Transit Score® and walking in the Multi-Ethnic Study of Atherosclerosis. *American Journal of Preventive Medicine*, *45*(2), 158–166. https://doi.org/10.1016/j.amepre.2013.03.018

Hou, J., & Grohmann, D. (2018). Integrating community gardens into urban parks: Lessons in planning, design and partnership from Seattle. *Urban Forestry & Urban Greening*, *33*, 46–55. https://doi.org/10.1016/j.ufug.2018.05.007

Joyner, H., Charron, L., Lindberg, S., Bednarz, L., Gigot, M., Smith, M. A., & Remington, P. (2018). *"One Size Fits All" Doesn't Work for Obesity Prevention: Obesity in Wisconsin, 2015-2016* (p. 22). University of Wisconsin-Madison. https://tinyurl.com/wiobesityreport

Kaplan, M., Maiden, K., Miller, P., Celano, G., & Walling, L. A. (2016). *Healthy Living and Active Design: A Scorecard for Comprehensive Plans*. Cedar Creek Sustainable Planning Services & Nemours Children's Health System. http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf

Konijnendijk, C. C., Annerstedt, M., Busse Nielsen, A., & Maruthaveeran, S. (2013). *Benefits of Urban Parks: A Systematic Review*. International Federation of Parks and Recreation Administration. http://www.worldurbanparks.org/images/Members_Login_Area/IfpraBenefitsOfUrbanParks.pdf

Kumar, S., & Kelly, A. S. (2017). Review of childhood obesity: From epidemiology, etiology, and comorbidities to clinical assessment and treatment. *Mayo Clinic Proceedings*, *92*(2), 251–265. https://doi.org/10.1016/j.mayocp.2016.09.017

Kyle, T. K., Dhurandhar, E. J., & Allison, D. B. (2016). Regarding obesity as a disease: Evolving policies and their implications. *Endocrinology and Metabolism Clinics of North America*, *45*(3), 511–520. https://doi.org/10.1016/j.ecl.2016.04.004

Larson, L. R., Jennings, V., & Cloutier, S. A. (2016). Public parks and wellbeing in urban areas of the United States. *PLoS ONE*, *11*(4), e0153211. https://doi.org/10.1371/journal.pone.0153211

Lopez, R. (2004). Urban sprawl and risk for being overweight or obese. *American Journal of Public Health*, *94*(9), 1574–1579. https://doi.org/10.2105/AJPH.94.9.1574

Ludwig, D. S. (2018). Epidemic childhood obesity: Not yet the end of the beginning. *Pediatrics*, *141*(3). https://doi.org/10.1542/peds.2017-4078

Macmillan, A., Smith, M., Witten, K., Woodward, A., Hosking, J., Wild, K., & Field, A. (2020). Suburb-level changes for active transport to meet the SDGs: Causal theory and a New Zealand case study. *Science of the Total Environment*, *714*, 136678. https://doi.org/10.1016/j.scitotenv.2020.136678

Maiden, K. M., Kaplan, M., Walling, L. A., Miller, P. P., & Crist, G. (2017). A comprehensive scoring system to measure healthy community design in land use plans and regulations. *Preventive Medicine*, *95*, S141–S147. https://doi.org/10.1016/j.ypmed.2016.09.031

Manson, S., Schroeder, J., Van Riper, D., Knowles, K., Kugler, T., Roberts, F., & Ruggles, S. (2023). *IPUMS National Historical Geographic Information System* (18.0) [Dataset]. IPUMS. https://doi.org/10.18128/D050.V18.0

Mensah, C. A., Andres, L., Perera, U., & Roji, A. (2016). Enhancing quality of life through the lens of green spaces: A systematic review approach. *International Journal of Wellbeing*, *6*(1).

Mexia, T., Vieira, J., Príncipe, A., Anjos, A., Silva, P., Lopes, N., Freitas, C., Santos-Reis, M., Correia, O., Branquinho, C., & Pinho, P. (2018). Ecosystem services: Urban parks under a magnifying glass. *Environmental Research*, *160*, 469–478. https://doi.org/10.1016/j.envres.2017.10.023

Mitchell, N., Catenacci, V., Wyatt, H. R., & Hill, J. O. (2011). Obesity: Overview of an epidemic. *The Psychiatric Clinics of North America*, *34*(4), 717–732. https://doi.org/10.1016/j.psc.2011.08.005

Neusel Ussery, E., Yngve, L., Merriam, D., Whitfield, G., Foster, S., Wendel, A., & Boehmer, T. (2016). The National Environmental Public Health Tracking Network access to parks indicator: A national county-level measure of park proximity. *Journal of Park and Recreation Administration*, *34*(3). https://doi.org/10.18666/JPRA-2016-V34-I3-7119

NHTSA. (2023a). *Bicyclists and Other Cyclists* (813484; Traffic Safety Facts: 2021 Data). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/#!/#%2F

NHTSA. (2023b). *Pedestrians* (813458; Traffic Safety Facts: 2021 Data). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/#!/#%2F

Nicholson, L. M., Leider, J., & Chriqui, J. F. (2017). Exploring the linkage between activity-friendly zoning, inactivity, and cancer incidence in the United States. *Cancer Epidemiology Biomarkers & Prevention*, *26*(4), 578–586. https://doi.org/10.1158/1055-9965.EPI-16-0331

Nielsen, A. B., van den Bosch, M., Maruthaveeran, S., & van den Bosch, C. K. (2014). Species richness in urban parks and its drivers: A review of empirical evidence. *Urban Ecosystems*, *17*(1), 305–327. https://doi.org/10.1007/s11252-013-0316-1

Nielsen Consumer LLC. (2024, April 4). *TDLinx*. NIQ. https://nielseniq.com/global/en/solutions/tdlinx/

Nowak, D. J., & Heisler, G. M. (2010). *Air Quality Effects of Urban Trees and Parks* (Research Series). National Recreation and Park Association. https://www.fs.usda.gov/research/treesearch/52881

Payne, G. H., James, S. D., Hawley, L., Corrigan, B., Kramer, R. E., Overton, S. N., Farris, R. P., & Wasilewski, Y. (2015). CDC's Health Equity Resource Toolkit: Disseminating guidance for state practitioners to address obesity disparities. *Health Promotion Practice*, *16*(1), 84–90. https://doi.org/10.1177/1524839914538967

Pérez-Escamilla, R. (2017). Food security and the 2015–2030 Sustainable Development Goals: From human to planetary health. *Current Developments in Nutrition*, *1*(7), e000513. https://doi.org/10.3945/cdn.117.000513

Perry, B., Diprose, K., Taylor Buck, N., & Simon, D. (2021). Localizing the SDGs in England: Challenges and value propositions for local government. *Frontiers in Sustainable Cities*, *3*. https://doi.org/10.3389/frsc.2021.746337

Peterson, E. L., Carlson, S. A., Schmid, T. L., Brown, D. R., & Galuska, D. A. (2019). Supporting active living through community plans: The association of planning documents with design standards and features. *American Journal of Health Promotion*, *33*(2), 191–198. https://doi.org/10.1177/0890117118779011

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environments on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventive Medicine*, *50*, S106–S125. https://doi.org/10.1016/j.ypmed.2009.07.028

Rahmanian, E., Gasevic, D., Vukmirovich, I., & Lear, S. A. (2014). The association between the built environment and dietary intake-a systematic review. *Asia Pacific Journal of Clinical Nutrition*, *23*(2), 183–196. https://doi.org/10.6133/apjcn.2014.23.2.08

Razani, N., Long, D., Hessler, D., Rutherford, G. W., & Gottlieb, L. M. (2020). Screening for park access during a primary care social determinants screen. *International Journal of Environmental Research and Public Health*, *17*(8), Article 8. https://doi.org/10.3390/ijerph17082777

Reuben, A., Rutherford, G. W., James, J., & Razani, N. (2020). Association of neighborhood parks with child health in the United States. *Preventive Medicine*, *141*, 106265. https://doi.org/10.1016/j.ypmed.2020.106265

Rhone, A., Williams, R., & Dicken, C. (2022). *Low-Income and Low-Foodstore-Access Census Tracts, 2015–19* (Economic Information Bulletin 236). U.S. Department of Agriculture, Economic Research Service. https://www.ers.usda.gov/publications/pub-details/?pubid=104157

Riggs, W., & Sethi, S. A. (2020). Multimodal travel behaviour, walkability indices, and social mobility: How neighbourhood walkability, income and household characteristics guide walking, biking & transit decisions. *Local Environment*, *25*(1), 57–68. https://doi.org/10.1080/13549839.2019.1698529

Rigolon, A. (2016). A complex landscape of inequity in access to urban parks: A literature review. *Landscape and Urban Planning*, *153*, 160–169. https://doi.org/10.1016/j.landurbplan.2016.05.017

Rogers, S. H., Halstead, J. M., Gardner, K. H., & Carlson, C. H. (2011). Examining walkability and social capital as indicators of quality of life at the municipal and neighborhood scales. *Applied Research in Quality of Life*, *6*(2), 201–213. https://doi.org/10.1007/s11482-010-9132-4

Rothstein, R. (2017). *The Color of Law: A Forgotten History of How Our Government Segregated America*. Liverlight.

Salvo, D., Garcia, L., Reis, R. S., Stankov, I., Goel, R., Schipperijn, J., Hallal, P. C., Ding, D., & Pratt, M. (2021). Physical activity promotion and the United Nations Sustainable Development Goals: Building synergies to maximize impact. *Journal of Physical Activity and Health*, *18*(10), 1163–1180. https://doi.org/10.1123/jpah.2021-0413

Sawyer, A. D. M., van Lenthe, F., Kamphuis, C. B. M., Terragni, L., Roos, G., Poelman, M. P., Nicolaou, M., Waterlander, W., Djojosoeparto, S. K., Scheidmeir, M., Neumann-Podczaska, A., Stronks, K., & on behalf of the PEN Consortium. (2021). Dynamics of the complex food environment underlying dietary intake in low-income groups: A systems map of associations extracted from a systematic umbrella literature review. *International Journal of Behavioral Nutrition and Physical Activity*, *18*(1), 96. https://doi.org/10.1186/s12966-021-01164-1

Schipperijn, J., Cerin, E., Adams, M. A., Reis, R., Smith, G., Cain, K., Christiansen, L. B., van Dyck, D., Gidlow, C., Frank, L. D., Mitas, J., Pratt, M., Salvo, D., Schofield, G., & Sallis, J. F. (2017). Access to parks and physical activity: An eight country comparison. *Urban Forestry & Urban Greening*, *27*, 253–263. https://doi.org/10.1016/j.ufug.2017.08.010

Shadman, S., Ahanaf Khalid, P., Hanafiah, M. M., Koyande, A. K., Islam, Md. A., Bhuiyan, S. A., Sin Woon, K., & Show, P.-L. (2022). The carbon sequestration potential of urban public parks of densely populated cities to improve environmental sustainability. *Sustainable Energy Technologies and Assessments*, *52*, 102064. https://doi.org/10.1016/j.seta.2022.102064

Simon, D., Arfvidsson, H., Anand, G., Bazaz, A., Fenna, G., Foster, K., Jain, G., Hansson, S., Evans, L. M., Moodley, N., Nyambuga, C., Oloko, M., Ombara, D. C., Patel, Z., Perry, B., Primo, N., Revi, A., Van Niekerk, B., Wharton, A., & Wright, C. (2016). Developing and testing the urban Sustainable Development Goal's targets and indicators – a five-city study. *Environment and Urbanization*, *28*(1), 49–63. https://doi.org/10.1177/0956247815619865

Skinner, A. C., Ravanbakht, S. N., Skelton, J. A., Perrin, E. M., & Armstrong, S. C. (2018). Prevalence of obesity and severe obesity in US children, 1999–2016. *Pediatrics*, *141*(3). https://doi.org/10.1542/peds.2017-3459

Slater, S. J., Nicholson, L., Abu Zayd, H., & Chriqui, J. F. (2016). Does pedestrian danger mediate the relationship between local walkability and active travel to work? *Frontiers in Public Health*, *4*. https://doi.org/10.3389/fpubh.2016.00089

Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., Baas, P., & Mackie, H. (2017). Systematic literature review of built environment effects on physical activity and active transport – an update and new findings on health equity. *International Journal of Behavioral Nutrition and Physical Activity*, *14*, 158. https://doi.org/10.1186/s12966-017-0613-9

StataCorp. (2023). *Stata Statistical Software: Release 18* [Computer software]. StataCorp LLC.

StataCorp LLC. (2021). *Stata Survey Data Reference Manual* (17th ed.). Stata Press. https://www.stata.com/manuals/svy.pdf

Stearns, J. A., Avedzi, H. M., Yim, D., Spence, J. C., Labbaf, F., Lamboglia, C. G., Ko, F., Farmer, C., Lytvyak, E., Kennedy, M., Kim, Y.-B., Ren, H., & Lee, K. K. (2023). An umbrella review of the best and most up-to-date evidence on the built environment and physical activity in older adults ≥60 years. *Public Health Reviews*, *44*, 1605474. https://doi.org/10.3389/phrs.2023.1605474

Stroope, J. (2021). Active transportation and social capital: The association between walking or biking for transportation and community participation. *Preventive Medicine*, *150*, 106666. https://doi.org/10.1016/j.ypmed.2021.106666

Sustainable Mobility for All. (2017). *Global Mobility Report 2017: Tracking Sector Performance*. Sustainable Mobility for All. https://www.sum4all.org/publications/global-mobility-report-2017

Svendsen, E. S., Campbell, L. K., & McMillen, H. L. (2016). Stories, shrines, and symbols: Recognizing psycho-social-spiritual benefits of urban parks and natural areas. *Journal of Ethnobiology*, *36*(4), 881–907. https://doi.org/10.2993/0278-0771-36.4.881

Talen, E. (1996). Do plans get implemented? A review of evaluation in planning. *Journal of Planning Literature*, *10*(3).

TomTom International BV. (2024). *TomTom—Maps and Location Technology*. TomTom. https://www.tomtom.com//

Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental Research*, *166*, 628–637. https://doi.org/10.1016/j.envres.2018.06.030

US Census Bureau. (2016). *American Community Survey and Puerto Rico Community Survey 2016 Subject Definitions*. US Census Bureau. https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.2016.html#list-tab-155790978

US Census Bureau. (2021, October 28). *2010 Census Urban and Rural Classification and Urban Area Criteria*. United States Census Bureau. https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html

US EPA. (2017). *Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement* (841-R-16–112). US Environmental Protection Agency, Office of Water. https://www.epa.gov/nps/green-infrastructure-parks-guide

US EPA. (2023, November 28). *Smart Location Mapping* [Data and Tools]. United States Environmental Protection Agency. https://www.epa.gov/smartgrowth/smart-location-mapping

USDA. (2020). *Privacy Impact Assessment for the Store Tracking and Redemption System (STARS)*. US Department of Agriculture. https://www.usda.gov/sites/default/files/documents/fns-store-tracking-redemption-system-stars-pia.pdf

USDA. (2023, September 27). *Food Access Research Atlas*. USDA Economic Research Service. https://www.ers.usda.gov/data-products/food-access-research-atlas/

USGS Gap Analysis Project. (2020). *Protected Areas Database of the United States (PAD-US)* (2.1: USGS data release) [dataset]. https://doi.org/10.5066/P92QM3NT

Vandegrift, D., & Yoked, T. (2004). Obesity rates, income, and suburban sprawl: An analysis of US states. *Health & Place*, *10*(3), 221–229. https://doi.org/10.1016/j.healthplace.2003.09.003

Venson, E., Grimminger, A., & Kenny, S. (2022). *Dangerous by Design 2022*. Smart Growth America. https://smartgrowthamerica.org/dangerous-by-design/

Walker, R. E., Keane, C. R., & Burke, J. G. (2010). Disparities and access to healthy food in the United States: A review of food deserts literature. *Health & Place*, *16*(5), 876–884. https://doi.org/10.1016/j.healthplace.2010.04.013

Wang, Y., Beydoun, M. A., Min, J., Xue, H., Kaminsky, L. A., & Cheskin, L. J. (2020). Has the prevalence of overweight, obesity and central obesity levelled off in the United States? Trends, patterns, disparities, and future projections for the obesity epidemic. *International Journal of Epidemiology*. https://doi.org/10.1093/ije/dyz273

Warren, M., Beck, S., & Delgado, D. (2019). *The State of Obesity 2019: Better Policies for a Healthier America* (p. 92) [Issue report]. Trust for America's Health & Robert Wood Johnson Foundation. https://www.tfah.org/wp-content/uploads/2019/09/2019ObesityReportFINAL-1.pdf

Whitfield, G. P. (2020). Monitoring state-level changes in walking, biking, and taking public transit to work—American Community Survey, 2006 and 2017. *Preventing Chronic Disease*, *17*. https://doi.org/10.5888/pcd17.200097

WHO. (2013). *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020*. World Health Organization. https://www.who.int/publications/i/item/9789241506236

WHO. (2017). *Tackling NCDs: 'Best Buys' and Other Recommended Interventions for the Prevention and Control of Noncommunicable Diseases*. World Health Organization. https://apps.who.int/iris/handle/10665/259232

Williams, R. (2021). *Analyzing complex survey data: Some key issues to be aware of*. University of Notre Dame. https://www3.nd.edu/~rwilliam/stats3/SvyCautionsX.pdf

Wilson, O. W. A., Bopp, C. M., Papalia, Z., & Bopp, M. (2019). Objective vs self-report assessment of height, weight and body mass index: Relationships with adiposity, aerobic fitness and physical activity. *Clinical Obesity*, *9*(5), e12331. https://doi.org/10.1111/cob.12331

Wisconsin TOPS. (2019). *Wisconsin DT4000 Crash Data User Guide*. Wisconsin Traffic Operations and Safety Laboratory. https://transportal.cee.wisc.edu/documents/

Zhang, X., Lu, H., & Holt, J. B. (2011). Modeling spatial accessibility to parks: A national study. *International Journal of Health Geographics*, *10*(1), 31.

Zhao, Z., & Kaestner, R. (2010). Effects of urban sprawl on obesity. *Journal of Health Economics*, *29*(6), 779–787. https://doi.org/10.1016/j.jhealeco.2010.07.006

Chapter 6: Conclusion

6.1 Summary of findings

In Chapter 2, I found that Wisconsin municipalities incorporate a moderate breadth of healthy eating and active living (HEAL) related goals, objectives, and policies in their local comprehensive plans. However, those items often lacked specific, actionable recommendations. Municipalities score highest in the Parks & Recreation and Health Care Access sections, moderately in the Active Transportation and Community Design sections, and lowest in the Healthy Food Access and Vision & Strategy sections. Furthermore, I found that, after controlling for municipal population, the year the plan was adopted, the primary plan author being a consultant, municipal-level Democratic voting percentage, and having housing and transit identified as a priority area by a local health department is correlated with higher plan scores across most sections. Surprisingly, I found that median household income, percent of the population with a Bachelor's degree or higher, and planning capacity were not consistently associated with higher plan scores once I controlled for population.

In Chapter 3, I found that HEAL-related goals, objectives, and policies are more likely to be included in local comprehensive plans if they are mandated by state statute. I also found that items mandated by state statute with *specific* language are more likely to be included in local plans than those mandated with more *general* language. However, mandating an item in the state statute, even with specific language, does not guarantee that it will be included in local plans; some of these items were included in only about two-thirds of plans. However, one item about intergovernmental collaboration was mandated to be included in local plans as its own chapter or section; this item had near-perfect uptake in local plans.

In Chapter 4, I identified interconnections between all 17 Sustainable Development Goals (SDGs) and planning for HEAL. I found that planning for HEAL could impact all 17 SDGs via reinforcing, enabling, and/or co-benefit interconnections. I also found that all 17 SDGs could impact planning for HEAL initiatives and/or progress on increasing HEAL behaviors, mostly through reinforcing and enabling interconnections. I identified two SDGs as indivisible from planning for HEAL—SDG 3 on good health and well-being and SDG 11 on sustainable cities and communities—as well as eight specific targets within SDGs 2, 3, 6, 9, 10, and 11. The scoping review found that planning for HEAL could impact 28% of SDG targets through reinforcing or enabling interconnections, 37% of SDG targets through co-benefits interconnections, and 15% of SDG targets through potential trade-offs. It also found that 39% of SDG targets could impact HEAL or planning for HEAL via reinforcing or enabling interconnections, 4% via co-benefit interconnections, and 7% through potential trade-offs. Overall, I identified 128 positive and 29 potentially negative HEAL-to-SDG interconnections as well as 81 positive and 12 potentially negative SDG-to-HEAL interconnections.

In Chapter 5, I tested the relationship between comprehensive planning to HEAL in Wisconsin and several SDG targets identified strongly connected to planning for HEAL in Chapter 4. I found that a greater incorporation of HEAL-related goals, objectives, and policies in local comprehensive plans is associated with better park accessibility, food accessibility, and walkability, as well as lower bicycle and pedestrian danger. In addition, I found slight evidence that higher HEAL-related Vision & Strategy scores are associated with lower obesity rates. For other sections of the Scorecard, I found that higher plan scores are associated with higher obesity rates at higher median income levels (i.e. median household income over $70,000).

6.2 Future research directions

6.2.1 Rural and small-town comprehensive plans

This research could be expanded in several directions. Only suburban and urban municipalities were included in my sample; therefore, future studies could focus on how well rural or small-town communities incorporate HEAL-promoting components into their local comprehensive plans. I have created a rural-specific adaptation of the Healthy Living and Active Design Scorecard that could be used in such studies (Charron et al., 2019). Unlike many other states, Wisconsin requires local comprehensive plans for all municipalities, even those with small populations (Charron et al., 2023). Therefore, Wisconsin may be a particularly good state to study rural and small-town comprehensive planning for HEAL.

6.2.2 Expand study to other states

Secondly, the data collection and analysis conducted for this dissertation could be replicated in other states. This would further build the evidence base about the state of comprehensive planning for HEAL in the United States and could potentially verify the findings about municipal-level correlates and SDG-related outcomes (or show differences in these results between states). Lastly, such analysis could test differences in local comprehensive planning for HEAL based on different types of state statutes. In the past, such cross-state comparisons have linked strong state planning mandates to more hazard mitigation and sustainability components included in local comprehensive plans (Berke & French, 1994; Burby & Dalton, 1994; Manta Conroy & Berke, 2004).

6.2.3 Comprehensive plan implementation and impact

The extent to which comprehensive plans are actually implemented, and the factors that influence implementation from one community to the next, is an open question in planning research. Future studies could investigate the implementation and impacts of HEAL-promoting components in comprehensive plans. These studies could investigate if implementation is associated with certain plan attributes, including those evaluated (e.g. strength scores) and those not evaluated (e.g. participatory processes, vision statements) in this dissertation. In addition, they could investigate if plan implementation varies by municipal sociodemographic attributes, planning capacity, plan author (e.g. consultant, municipal planning department), and strength and type of mandates in the corresponding state statute.

Future studies of plan implementation should take into consideration the multiple ways that comprehensive plans are implemented and create impact: conformance to the plan blueprint, influence of the plan vision, and capacity building of the planning process. Conformance can be studied by evaluating how well permitting, design, and land use decisions align with the comprehensive plan. There are several methodological precedents for how this could be accomplished, including:

- Surveys to planning officials to estimate the proportion of policies in the comprehensive plan that have been executed (Lyles et al., 2016; Rudolf & Grădinaru, 2019)
- Content analysis of zoning codes (Chriqui et al., 2016), permits (Berke et al., 2006), or other downstream policies (e.g. via the "Implementation" section of the Healthy Living and Active Design Scorecard (Kaplan et al., 2016)) to determine alignment with the comprehensive plan

- Evaluation of built environment conditions via in-person audits, Google Street View (Slater et al., 2020), or GIS (Brody & Highfield, 2005; Deyle et al., 2008).

Influence and capacity building are more difficult to measure, which may be why fewer studies have attempted to evaluate these types of implementation. Several studies have measured plan influence by surveying planners about the usefulness of their local plan for day-to-day planning decisions (Lyles et al., 2016; Rudolf & Grădinaru, 2019). In-depth case studies of the comprehensive planning process and how it impacts local decision making, including measures of institutional capacity, would likely yield even richer data about these types of plan implementation.

Such case studies could also build upon several other findings presented in this dissertation. For example, to build upon findings from Chapter 2, case studies could further explore how and why HEAL-related components are (or are not) incorporated into comprehensive plans; the role of politics in planning for HEAL; and how local health priorities translate into greater consideration for HEAL in plans. To build upon findings in Chapter 5, case studies could investigate how HEAL-promoting content in comprehensive plans is translated into on-the-ground differences in walkability, park accessibility, food accessibility, and bike/pedestrian danger.

Lastly, the evaluation of HEAL-related plan impact should be expanded. In her seminal work on plan evaluation, Talen argues that while multicausality (and, I would add, systems dynamics) limits the analysis of plan impact, "what can be assessed is whether or not associations can be made between plans and outcomes or between intended goals and goal achievement" (1996, p. 255). Based on the findings of Chapter 4 and the interconnected nature of many global development goals, it may also be appropriate to evaluate associations between

intended goals, achievement of those goals, *and the achievement of other, interconnected goals*. Therefore, future studies of the impact of planning for HEAL (whether of comprehensive plans or other planning policies) should consider including targets from interconnected health and non-health SDGs (e.g. in the realms of sustainability, climate change resilience, or poverty alleviation).

6.2.4 Computational text analysis for comprehensive plan evaluation

We found that hand-coding comprehensive plans in a rigorous manner was very time-intensive, even with a five-person research team. Computational text analysis, natural language processing, and machine learning methods have the potential to make the evaluation of comprehensive plans and other policies much more efficient, allowing for larger sample sizes, more frequent analyses, and the investigation of more topics. Computational text analysis methods have burgeoned over the last few decades in the social sciences (e.g. see Baden et al., 2022; Grimmer et al., 2022; Nelson et al., 2021).

However, the planning field has just started to utilize these methods in the last five years or so (Fu, 2024). So far, these methods have been used to summarize topics covered in plans (Brinkley & Stahmer, 2021; Brinkley & Wagner, 2024; Deslatte et al., 2023; Fu et al., 2023), automate keyword searches (Zhang et al., 2023), create dichotomous variables (present vs. absent) of plan quality criteria (e.g. vision statement, public participation, risk assessment) (Deslatte et al., 2023), and estimate the importance of and attitude towards certain topics (e.g. sea level rise, informal settlements) contained in a corpus of plans (Fu et al., 2023).

While the current computational text analysis methods used in the planning field could not replicate the data collection effort in this dissertation, they may be able to in the future, which could facilitate the many research directions outlined in the sections above. Lastly, in his

review of computational text analysis methods used in planning, Xinyu Fu emphasized the need to validate automated methods against more traditional content analysis methods (2024). The data collected in this dissertation is openly available and could be used in future validation efforts.

6.2.5 Data, code, and materials availability

In order to facilitate any expansion or replication of this work, all data, code, and materials used in these projects are openly available at the following links:

- Chapters 2, 3, and 5: https://osf.io/h48qk/
- Chapter 4: https://osf.io/m3k5p/

6.3 THE NEED FOR BROADER, MORE INTERCONNECTED RESEARCH AND POLICY AGENDAS

> "Instead of asking whether an intervention works to fix a problem, researchers should aim to identify if and how it contributes to reshaping a system in favourable ways." (Rutter et al., 2017, p. 3)

In this dissertation, I have taken the somewhat unorthodox step of framing my research problem as about two different, multifaceted behaviors (healthy eating and active living) instead a long-term outcome (e.g. obesity) or even one singular health behavior (e.g. active transportation). This is uncommon in research in general, and even more uncommon in epidemiological research. We are taught that the best definition of a research problem is simple, linear, and involves one clearly-defined exposure and one clearly-defined outcome (Pineo, 2022; Rutter et al., 2017). While such specificity is necessary to answer certain questions, Rutter argues that it is sufficient for neither understanding modern public health problems nor creating policy-relevant research for addressing them (2017).

Policymakers cannot try to solve one problem at a time, especially when so many of the major challenges we face are interconnected and have similar systems-level drivers (Swinburn et al., 2019). Doing so risks ineffective use of resources, overlooked partnerships, and unintended consequences (Nilsson et al., 2016). Swinburn et al. even argue that such single-mindedness is partially to blame for inaction on such seemingly intractable global problems as obesity and climate change (2019). Big, systems level solutions are required for global problems, and yet those very solutions cannot overcome policy inertia unless they are seen as solutions to not just one, but many, interconnected problems (Swinburn et al., 2019).

This dissertation does not purport to have *the solution* to all global development challenges. However, my focus on HEAL, rather than a singular focus on one HEAL-related health outcome, has allowed me to explore the many health, social, environmental, economic, and other development issues to which planning for HEAL is connected. I hope that this has made the research in this dissertation applicable to a broader array of researchers, policymakers, and practitioners. Moreover, this framing has allowed me to see how planning for HEAL is embedded in the systems that drive global development challenges, and its potential to be a local-level disruptive force in those systems.

Despite many calls to bring together urban planning and public health, the fields have had difficulty convening to draw up integrated policy solutions (Lemon et al., 2015; Li et al., 2015; Rube et al., 2014). Methodological, administrative, and epistemological barriers exist to such reconvening (Corburn, 2004; Hu & Roberts, 2020). Though its roots are closer to urban planning, the field of public health has developed through medical models of health that place individuals and individual diseases as the target of interventions (Corburn, 2004). More emphasis on systems-level models, especially those that target more than one, interconnected issue (e.g.

Macmillan et al., 2020; Pineo, 2022; Swinburn et al., 2019) may help the public health field reconvene not only with the urban planning and built environment professions, but also with the global development community more generally. At the very least, better articulation of the many interconnections between public health issues and non-health issues will aid multisector partnerships and action.

6.4 THE POTENTIAL OF THE COMPREHENSIVE PLAN

Comprehensive plans are widely recognized as a foundational planning document and one of the only local-level policy documents that brings together siloed departments and actions (Godschalk & Anderson, 2012; Rouse & Piro, 2022; Shah & Wong, 2020). David Rouse argues that they are, therefore, uniquely placed to help communities prepare for and adapt to "disruptive and transformational" global changes, including those caused by environmental, economic, social, and technological drivers (2022, pp. 306–308).

Beyond preparing for disruptions and changes, I wonder if comprehensive plans could also be vehicles to *drive* transformational disruptions. We currently live in a system with many economic, policy, and cultural feedback loops that make it difficult for humans and the planet to be healthy (Swinburn et al., 2019). Many comprehensive plans and other planning policies uphold and reinforce that system, but perhaps they can also be disruptive forces in the systems-level drivers of entrenched, "wicked" global problems. As such, they should not be overlooked by the global development community seeking ways to localize the SDGs and act on them in a coherent manner. To bring it back to the topic of this dissertation, I propose that planning for HEAL could be a concrete and easily-communicated entry point into localizing the SDGs through comprehensive plans, especially given its interconnections to each and every one of the goals.

6.5 REFERENCES

Baden, C., Pipal, C., Schoonvelde, M., & van der Velden, M. A. C. G. (2022). Three gaps in computational text analysis methods for social sciences: A research agenda. *Communication Methods and Measures*, *16*(1), 1–18. https://doi.org/10.1080/19312458.2021.2015574

Berke, P. R., Backhurst, M., Day, M., Ericksen, N., Laurian, L., Crawford, J., & Dixon, J. (2006). What makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand. *Environment and Planning B: Planning and Design*, *33*(4), 581–600. https://doi.org/10.1068/b31166

Berke, P. R., & French, S. P. (1994). The influence of state planning mandates on local plan quality. *Journal of Planning Education and Research*, *13*(4), 237–250. https://doi.org/10.1177/0739456X9401300401

Brinkley, C., & Stahmer, C. (2021). What is in a plan? Using natural language processing to read 461 California city general plans. *Journal of Planning Education and Research*, 0739456X21995890. https://doi.org/10.1177/0739456X21995890

Brinkley, C., & Wagner, J. (2024). Who is planning for environmental justice—And how? *Journal of the American Planning Association*, *90*(1), 63–76. https://doi.org/10.1080/01944363.2022.2118155

Brody, S. D., & Highfield, W. E. (2005). Does planning work?: Testing the implementation of local environmental planning in Florida. *Journal of the American Planning Association*, *71*(2), 159–175. https://doi.org/10.1080/01944360508976690

Burby, R. J., & Dalton, L. C. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review*, *54*(3), 229–238. https://doi.org/10.2307/976725

Charron, L. M., Joyner, H. R., LaGro, J., & Gilchrist Walker, J. (2019). Research note: Development of a comprehensive plan scorecard for healthy, active rural communities. *Landscape and Urban Planning*, *190*, 103582. https://doi.org/10.1016/j.landurbplan.2019.05.013

Charron, L. M., Milstein, C., Chriqui, J., Abildso, C., & Moyers, S. I. (2023). *PAPREN State Comprehensive Planning Statutes Dataset* [dataset]. OSF. https://doi.org/10.17605/OSF.IO/XFV5C

Chriqui, J. F., Leider, J., Thrun, E., Nicholson, L. M., & Slater, S. (2016). Communities on the move: Pedestrian-oriented zoning as a facilitator of adult active travel to work in the United States. *Frontiers in Public Health*, *4*. https://doi.org/10.3389/fpubh.2016.00071

Corburn, J. (2004). Confronting the challenges in reconnecting urban planning and public health. *American Journal of Public Health*, *94*(4), 541–546.

Deslatte, A., Chung, J., & Stokan, E. (2023). Structural drivers of sustainability and resilience strategies in small(ish) cities: A text analysis of comprehensive planning in Indiana. *Journal of*

Environmental Planning and Management, *0*(0), 1–22. https://doi.org/10.1080/09640568.2023.2240951

Deyle, R. E., Chapin, T. S., & Baker, E. J. (2008). The proof of the planning is in the platting: An evaluation of Florida's hurricane exposure mitigation planning mandate. *Journal of the American Planning Association*, *74*(3), 349–370. https://doi.org/10.1080/01944360802229612

Fu, X. (2024). Natural language processing in urban planning: A research agenda. *Journal of Planning Literature*, 08854122241229571. https://doi.org/10.1177/08854122241229571

Fu, X., Li, C., & Zhai, W. (2023). Using natural language processing to read plans: A study of 78 resilience plans from the 100 resilient cities network. *Journal of the American Planning Association*, *89*(1), 107–119. https://doi.org/10.1080/01944363.2022.2038659

Godschalk, D., & Anderson, W. (2012). *Sustaining Places: The Role of the Comprehensive Plan* (PAS Report 567; p. 108). American Planning Association. https://www.planning.org/publications/report/9026891/

Grimmer, J., Roberts, M. E., & Stewart, B. M. (2022). *Text as Data: A New Framework for Machine Learning and the Social Sciences*. Princeton University Press.

Hu, M., & Roberts, J. D. (2020). Connections and divergence between public health and built environment—A scoping review. *Urban Science*, *4*(1), 12. https://doi.org/10.3390/urbansci4010012

Kaplan, M., Maiden, K., Miller, P., Celano, G., & Walling, L. A. (2016). *Healthy Living and Active Design: A Scorecard for Comprehensive Plans*. Cedar Creek Sustainable Planning Services & Nemours Children's Health System. http://www.cedarcreekplanners.com/wp-content/uploads/2016/01/Healthy-Living-Scorecard.pdf

Lemon, S. C., Goins, K. V., Schneider, K. L., Brownson, R. C., Valko, C. A., Evenson, K. R., Eyler, A. A., Heinrich, K. M., Litt, J., Lyn, R., Reed, H. L., Tompkins, N. O., & Maddock, J. (2015). Municipal officials' participation in built environment policy development in the United States. *American Journal of Health Promotion*, *30*(1), 42–49. https://doi.org/10.4278/ajhp.131021-QUAN-536

Li, J., Casey, C., & Brewer, L. K. (2015). Exploring opportunities for engaging public health organizations in transportation planning. *Public Works Management & Policy*, *20*(3), 201–225. https://doi.org/10.1177/1087724X14559520

Lyles, W., Berke, P., & Smith, G. (2016). Local plan implementation: Assessing conformance and influence of local plans in the United States. *Environment and Planning B: Planning and Design*, *43*(2), 381–400. https://doi.org/10.1177/0265813515604071

Macmillan, A., Smith, M., Witten, K., Woodward, A., Hosking, J., Wild, K., & Field, A. (2020). Suburb-level changes for active transport to meet the SDGs: Causal theory and a New Zealand case study. *Science of the Total Environment*, *714*, 136678. https://doi.org/10.1016/j.scitotenv.2020.136678

Manta Conroy, M., & Berke, P. R. (2004). What makes a good sustainable development plan? An analysis of factors that influence principles of sustainable development. *Environment and Planning A: Economy and Space*, *36*(8), 1381–1396. https://doi.org/10.1068/a367

Nelson, L. K., Burk, D., Knudsen, M., & McCall, L. (2021). The future of coding: A comparison of hand-coding and three types of computer-assisted text analysis methods. *Sociological Methods & Research*, *50*(1), 202–237. https://doi.org/10.1177/0049124118769114

Nilsson, M., Griggs, D., & Visbeck, M. (2016). Policy: Map the interactions between Sustainable Development Goals. *Nature*, *534*(7607), Article 7607. https://doi.org/10.1038/534320a

Pineo, H. (2022). *Healthy Urbanism: Designing and Planning Equitable, Sustainable and Inclusive Places*. Springer Nature Singapore. https://doi.org/10.1007/978-981-16-9647-3

Rouse, D. (2022). The future of the comprehensive plan. *Journal of Comparative Urban Law and Policy*, *5*(1), 299–326. https://doi.org/10.4324/9781003024170

Rouse, D., & Piro, R. (2022). *The Comprehensive Plan: Sustainable, Resilient, and Equitable Communities for the 21st Century*. Routledge.

Rube, K., Veatch, M., Huang, K., Sacks, R., Lent, M., Goldstein, G. P., & Lee, K. K. (2014). Developing built environment programs in local health departments: Lessons learned from a nationwide mentoring program. *American Journal of Public Health*, *104*(5), e10–e18. https://doi.org/10.2105/AJPH.2013.301863

Rudolf, S. C., & Grădinaru, S. R. (2019). The quality and implementation of local plans: An integrated evaluation. *Environment and Planning B: Urban Analytics and City Science*, *46*(5), 880–896. https://doi.org/10.1177/2399808317737070

Rutter, H., Savona, N., Glonti, K., Bibby, J., Cummins, S., Finegood, D. T., Greaves, F., Harper, L., Hawe, P., Moore, L., Petticrew, M., Rehfuess, E., Shiell, A., Thomas, J., & White, M. (2017). The need for a complex systems model of evidence for public health. *The Lancet*, *390*(10112), 2602–2604. https://doi.org/10.1016/S0140-6736(17)31267-9

Shah, S., & Wong, B. (2020). *Toolkit to Integrate Health and Equity into Comprehensive Plans* (p. 37). American Planning Association. https://www.planning.org/publications/document/9201866/?utm_campaign=2020-08-06+HIP+content+order&utm_medium=email&utm_source=Pew

Slater, S. J., Leider, J., & Chriqui, J. F. (2020). Examining the implementation of activity-friendly zoning and land use policies through the use of Google Street View measures: A pilot study. *Journal of Public Health Management and Practice*, *Publish Ahead of Print*. https://doi.org/10.1097/PHH.0000000000001176

Swinburn, B. A., Kraak, V. I., Allender, S., Atkins, V. J., Baker, P. I., Bogard, J. R., Brinsden, H., Calvillo, A., De Schutter, O., Devarajan, R., Ezzati, M., Friel, S., Goenka, S., Hammond, R. A., Hastings, G., Hawkes, C., Herrero, M., Hovmand, P. S., Howden, M., … Dietz, W. H. (2019). The Global Syndemic of obesity, undernutrition, and climate change: The Lancet

Commission report. *The Lancet*, *393*(10173), 791–846. https://doi.org/10.1016/S0140-6736(18)32822-8

Talen, E. (1996). Do plans get implemented? A review of evaluation in planning. *Journal of Planning Literature*, *10*(3).

Zhang, X., Warner, M. E., Xu, C., & Wang, Y. (2023). Invisible women in comprehensive plans. *Journal of Urban Affairs*, *0*(0), 1–19. https://doi.org/10.1080/07352166.2023.2282561

APPENDIX 1: HEALTHY LIVING AND ACTIVE DESIGN SCORECARD ASSESSMENT ITEMS, SCORING GUIDANCE, AND CODING PROTOCOL

Item language and guidance for scoring a 1 and 2 directly transcribed from the Healthy Living and Active Design Scorecard for Comprehensive Plans. Item name was assigned by the coding team to efficiently discuss items. Notable coding protocol decisions tracks major adjustments, delineations, and specifications that the coding team made and recorded in order to better achieve adequate reliability. Not included: Lists of keywords and comprehensive plan chapters to search, skim, and thoroughly read for each assessment item. These can be found in the full Coding Guide at https://osf.io/h48qk/.

#	Item name	Item language	Score 1	Score 2	Notable coding protocol decisions
A. Vision & Strategy*					
1	Plan4Health	The plan explicitly recognizes the relationship of the built environment to obesity, chronic disease and public health in general.	Mentioned in a general way, perhaps with some national or statewide statistics	Mentioned specifically in conjunction with data relevant to the jurisdiction	• Must make connection obesity or chronic disease. • Must relate built environment to health outcome, not just health behaviors.
2	Collaboration	The plan demonstrates collaboration with public health officials, public health advocates, relevant institutions and stakeholder groups.	Mentions receiving input from these groups via communication or attendance at planning meetings	Details sustained collaboration with these groups and incorporation of many of their recommendations	• Can score if plan engages with content of community health assessment or community health improvement plan
3	Inequities	The plan addresses health inequities among populations within its jurisdiction.	Generally addresses health disparities, vulnerable populations, and/or environmental justice concerns	Specifically, with mapping or other data, demonstrates areas with vulnerable populations and health disparities and the relationship to various land uses	• To score 1, need to reference health disparities and/or disparities in the provision or design of at least one type of built environment resource (e.g. parks, healthy food sources, pollution-emitting sources) • Because there are two other items specifically about mobility as an issue for elderly, disabled, and disadvantaged populations,

					this item should not score for policies concerning transit for vulnerable populations • May score for analysis or policies regarding the provision of affordable housing
4	Health Chapter	The plan contains a stand-alone health chapter or element.	Includes a stand-alone chapter or element with broad statements and non-specific goals	Includes a stand-alone chapter or element with data specific to the jurisdiction, measurable goals, and metrics to gauge progress toward those goals	• To score a 2, does not need metrics to gauge progress
5	HIA	The plan refers to Health Impact Assessments (HIAs).	Health Impact Assessments are mentioned in broad terms as a means of addressing the effects of a development, plan, code requirement or other land-use policy on public health.	The plan sets a specific goal for using HIAs to evaluate developments and/or other land-use plans and policies	
6	Mental/Social	The plan establishes a relationship between land use decisions and social cohesion/mental health.	Mentioned in broad terms, without specific examples or directives	Cites specific examples of how planning for healthy and active living can directly affect social cohesion and mental health	
B1. Active Transportation*					
7	Reduce VMT	The plan mentions reducing car dependency as a means of improving public health	The plan mentions the need to reduce car dependency or vehicle miles traveled (VMT) and ties that need to improved public health	The plan sets a specific, public health-related policy goal of reducing car dependency or VMT through more compact and mixed land uses and improved access to bike routes, sidewalks and trails	• Does not need to tie reduction of VMT to public health goals (could be for other purposes)
8	Mode Share	The plan includes a goal or objective to increase the number of citizens who walk or bike to work and other daily activities.	Mentioned broadly as a goal	Plan includes a specific policy goal for increasing mode share for cycling, walking and transit, including specific objectives	• Can score for goals concerning biking, walking, and/or transit ridership

				for collaboration with transportation agencies, advocacy groups and other stakeholder organizations (e.g., Metropolitan Planning Organizations—MPOs)	
9	Complete Streets	The plan references "Complete Streets" principles.	The plan mentions "Complete Streets" in broad or academic terms without specific goals	The plan lays out a specific policy goal to incorporate "Complete Streets" principles into the planning process, citing techniques such as traffic calming, streetscapes, sidewalks, bike routes, and well-marked crosswalks and signage	• Doesn't need to use the words (Complete Streets), but instead can describe the goal of complete streets (considering all users in road construction). • This is an item about changing processes/policies, not about installing specific design features.
10	Bike/Ped Plan	The plan includes a bicycle/pedestrian plan.	The plan includes a jurisdiction-wide plan for improving point-to-point mobility for bicyclists and pedestrians	The plan also includes targeted and detailed plans for improving bicycle/pedestrian access in specific communities throughout the jurisdiction in collaboration with the Department of Transportation (DOT) and local metropolitan planning organization (MPO)	• Having a standalone bike/ped plan adopted/updated within last ten years automatically scores a 2 • If map of proposed bikeways/trails/lanes is included in an outdoor recreation plan, can consider it a bike/ped plan (and score a 2 because this shows evidence of collaboration with Park & Rec Dept.) • Score a 1 if plan states that they will develop a bike/ped plan
11	Traffic Calming	The plan includes traffic calming goals and measures.	The plan mentions the need for traffic calming measures (such as roundabouts, center islands and raised medians, street narrowing, raised intersections, short block lengths, speed bumps or humps, rumble strips and chicanes)	The plan details efforts to work with the DOT and local MPO to assess the need for and plan, design and fund traffic calming measures	
12	Pedestrian Safety	The plan includes references to measures that	The plan mentions the need for sidewalks or wider	The plan details efforts to work with the DOT and	

		improve pedestrian mobility and safety.	sidewalks, accessible pedestrian signals, frequent and safe crosswalks	local MPO to assess the need for and plan, design and fund improved pedestrian facilities	
13	New Development	The plan requires developers to provide bicycle, pedestrian and wheelchair access in new communities.	The plan makes a general statement about the need to provide such access	The plan mentions a specific policy and/or recommended requirements for such access – including but not limited to sidewalks, bicycle/pedestrian trails, bicycle lanes, bicycle racks, pedestrian crosswalks, and curb cuts	• Score this item with regards to private development (i.e. not public roads or public buildings) • Can score for policies to consider for bikes/peds in site plan review process
14	Trails	The plan seeks the development or extension of off-road greenways and trails for biking and walking.	Mentioned broadly as a goal without specific deliverables or metrics	The plan includes specific goals in terms of the creation or extension of off-road trails and greenways (e.g., lane-miles, facilities, timeline, budget, map)	
15	Parking	The plan recommends reduced parking requirements for developments located near transit stops and/or with bicycle, pedestrian and wheelchair access.	The plan makes a general statement about parking requirements and the relationship to access for transit users, pedestrians, bicyclists and people with physical disabilities	The plan's objectives include a recommended policy regarding parking standards, such as reduced parking requirements, on-street parking and/or shared parking in developments located near transit stops and/or with access for pedestrians, bicyclists, and people with physical disabilities.	• To score, must explicitly recognize the relationship between parking and bike/ped (i.e. cannot score a 1 with good parking measures not explicitly related to improving the bike/ped environment) • Score a 2 if plan references a "parking plan" and there is evidence that the parking plan is centered around increasing bike/ped/transit usage (i.e. not just about increasing available parking for businesses)
16	Senior Mobility	The plan identifies access to health care and mobility as issues of special concern to aging populations.	Mentioned in general terms, but without specific data, goals or metrics	The plan cites local statistics and mentions a specific policy goal relating to the mobility of aging	• Does not need local statistics to score. • Does not have to be related to access to health care to score.

				populations and their access to health care	• Can score this item for the consideration of mobility issues for seniors and/or people with disabilities
17	Disadvantaged Mobility	The plan identifies access to health care and mobility as issues of special concern to disadvantaged populations.	Mentioned in general terms, but without specific data, goals or metrics	The plan cites local statistics and mentions a specific policy goal relating to the mobility of disadvantaged populations and their access to health care	• Does not need local statistics to score. • Does not have to be related to access to health care to score. • Do not score this item for consideration of mobility issues for seniors or people with disabilities.
18	SRTS	The plan supports "Safe Routes to School" for children or other mechanisms that support children walking or riding bikes to schools, including locating schools closer to residential areas.	The plan supports development that enables children to walk or ride their bicycles to school	The plan states policy goals that include working with school districts, and public safety, transportation and education agencies to increase the number of children who walk or ride bicycles to school	• To score a 1, can reference measures to ensure kids can walk and bike to school without specifically mentioning a SRTS program. This includes school siting policies. • To score a 2, need to reference partnership with schools OR reference a SRTS (because SRTS programs include partnership with schools)
19	School Hubs	The plan supports the co-location of community services in school buildings.	The plan broadly mentions the benefits of co-locating community services—such as senior centers, public libraries, wellness centers, and public meeting space—in existing or new school buildings	The plan proactively establishes a goal of working with relevant state agencies and local school districts to co-locate community services in existing or new school buildings	• Shared services must be for community use (e.g. library, health center), not for city administration
B2. Healthy Food Access*					
20	Farmland Preservation	The plan supports the preservation of existing working farms.	The plan generally expresses support for the preservation of farmland and the viability of agriculture as preferable to its development as low-density sprawl	The plan sets specific policy goals for the preservation of working farms; examples include: -right-to-farm and transfer of development rights (TDR) ordinances	• Working with/encouraging other towns to preserve farmland counts as a strategy (to score a 2) • To distinguish from item 21, this item has to do with rural farmland, perhaps at the

				-agribusiness zoning that allows a range of agricultural businesses by right -required buffers between agricultural operations and residential development -appropriate rural zoning (one unit per at least 5 acres) -a purchase of development rights program -objectives for acreage preservation	periphery of the urban boundaries • Policies to support the local sale and consumption of food from local rural farms are not enough to score a 2, they must also have some kind of land use policy or strategy (but see item below--programs to promote local foods can score there)
21	Urban Farms & Local Food	The plan supports the preservation or development of "urban" or specialty farms, which grow products such as vegetables, herbs, honey, eggs, flowers and plants for local distribution and sale (in addition to or instead of commodity crops such as corn and soybeans).	The plan notes the value of local food and plant production in broad terms, without specific policies or goals	The plan sets specific policies, goals and/or objectives intended to encourage more local food and plant production	• To distinguish from item 20, this item has to do with production of food within the urban boundary and integrated into neighborhood fabric (not rural farms at the periphery) • This item can also score for strategies promoting local sale and consumption of locally-grown foods, whether they are grown in urban or rural farms • This item can also score for strategies supporting personal/household gardens. • This item should not score for language solely about community gardens, as there is a separate item specifically for that.
22	Food Access	The plan cites the need to increase access to healthy food, especially in low-income communities where "food deserts" may exist.	This need is mentioned in general terms, with no specific policy goals or actions	The plan cites specific geographic areas of need, including an assessment of "food deserts," and establishes policies for providing these locations	• Analysis to show lack of grocery stores (e.g. from item 25) counts as analysis to show lack of healthy food access

				with more healthy food options	
23	Community Gardens	The plan supports the creation and sustainability of community gardens.	Mentioned in aspirational terms without specific policy goals or actions	The plan takes specific steps to support the creation and success of community gardens, including numerical goals and suggested actions such as allowing them by right in most zoning categories, allowing them in parks and vacant lots and on surplus lands, providing mini-grants, and formally collaborating with Cooperative Extension and other organizations	
24	Farmers' Markets	The plan addresses the creation and sustainability of farmer's markets.	Mentioned in aspirational terms without specific policy goals or actions	The plan takes specific steps to support the creation and success of farmer's markets, including numerical goals and suggested actions such as allowing them by right in most zoning categories, allowing them in parks and vacant lots and on surplus lands, providing mini-grants, and formally collaborating with Cooperative Extension and other organizations	
25	Grocery Stores	The plan includes an objective to increase the number of full-service grocery stores in underserved areas.	Mentioned as an aspirational or broad goal, but without local data or specific objectives	The plan includes data to identify areas not served by supermarkets and establishes strategies for increasing their number	• This item is concerned specifically with grocery stores and supermarkets (i.e. not corner stores, gas stations, community gardens, or other strategies for healthy food access; those strategies can score for item 22). • Could score a 2 with a concrete plan to assess areas underserved by grocery stores.

					• Analyses concluding that there is no need for more grocery stores in the area would have to be very in-depth and consider geographic access and access, in particular, for low-income residents, in order to score for this item.
26	Healthy Retail	The plan supports businesses that provide healthier food and drink options, especially in documented underserved areas.	The plan makes aspirational or general statements about providing healthier food and drink options for its citizens	The plan recommends specific actions that would promote healthier and more diverse alternatives to convenience and fast foods– especially in areas where these options are underrepresented	• This item concerns already-prepared healthy foods and drinks (as opposed to groceries). • Can score for strategies to increase the number of healthy options or limiting the number of unhealthy options (e.g. fast food, pubs and bars) • Can score for strategies to increase healthy foods sold or served at schools
27	Drinking Water	The plan addresses access to drinking water and/or promotes installation of water fountains.	The plan generally mentions or alludes to the value of available drinking water to its citizens	The plan sets policy goals for making safe drinking water available to its citizens through recommended actions such as requiring installation of public water fountains in parks, public spaces, and commercial areas where the public is present	• This item not about the safety and quality of drinking water, but about drinking water access in public and semi-public spaces (i.e. does not refer to the provision of water piping for homes).
B3. Parks & Recreation*					
28	Park Access	The plan sets goals for access to open space, parks and recreational facilities.	The plan makes aspirational or general statements about the need to improve access to open space, parks and recreational facilities	The plan uses data to identify where additional open space, parks and recreational facilities are needed and sets definite goals to improve access	• Can score for analysis and recommendations based on future park deficiencies (e.g. based on future growth projections). • Plans for future parks should be based on the need to increase access (i.e. not just planning

					parks in areas where residents already have access based on land availability) • If they have a concrete plan to analyze geographic access to parks with specific metrics or action items, it scores a 2. • If they specifically state that a standalone plan contains specific plans for where new parks should be located, and it is clear that those plans are based on a geographical need for park access, then this can score a 2, as long as the standalone plan is up to date (within 5 years of comprehensive plan adoption) •
29	SCORP	The plan refers to the latest Statewide Comprehensive Outdoor Recreation Plan (SCORP).	Mentioned in broad terms, without applying specific data and findings	The plan uses SCORP data to define and target recreational needs and set goals and objectives	• Score a 2 if the plan mentions that the municipality has their own comprehensive outdoor recreation plan (CORP) and it is up-to-date (with 5 years of comprehensive plan adoption). In Wisconsin, CORPs must refer to the latest SCORP. • Score a 1 if the plan mentions that the municipality has an out-of-date CORP (beyond 5 years from comprehensive plan's adoption) or if they have a goal of creating and outdoor recreation plan or updating an out-of-date plan. • Can score if the plan references a county or regional recreation plan
30	Park Maintenance	The plan establishes a high level of service for parks –	The plan mentions the importance of making parks	The plan sets standards for a high level of service within	• "Level of service" here means that the parks are safe,

		for factors such as lighting, cleanliness, safety.	and recreational areas attractive and safe	parks and recreational facilities and establishes metrics for tracking it	attractive, well-maintained. You may see "level of service" used in plans to mean acreage per person or other metrics of access, but that is not what this item is about. • If the plan explicitly states that facility standards or maintenance standards are in a standalone recreation plan, then this item scores a 2.
31	Parks New Development	The plan establishes standards for developer-provided open space within developments.	The plan cites the need for functional, usable open space within residential developments	The plan sets clear guidelines for how open space is to be designed for and used by the community	• The focus of this item is land that private developers provide for parks and/or develop into parks in subdivisions or other residential developments (i.e. not land that the city provides for parks in residential areas). • Use the following to score instead of the guidelines to the left: o Score a 1 if weakly worded, vague, or aspirational goal about developers contributing towards residential parks system; or if option to pay fee in lieu of or impact fees if they *might* be used for parks o Score a 2 if strongly worded, specific, actionable goal/policy about developers contributing towards residential parks system; or if option to pay fee in lieu of or impact fee that

					explicitly must go to parks
32	Promote Physical Activity	The plan identifies geographic areas with the greatest need for more physical activity.	The plan makes aspirational statements about the importance of facilitating physical activity	The plan identifies communities or areas that do not have sufficient opportunity for physical activity	• This item is different from item 28 because the plan must explicitly talk about promotion of physical activity, fitness, active recreation, sports, or active play.
B3: Health Care Access*					
33	Health Care Distribution	The plan includes data on the number of health and human service outlets available to populations in need in the jurisdiction.	General health care data nonspecific to communities within the jurisdiction is included	The plan includes maps and/or data that clearly identify where there is a gap in access to health care	• Can score a 2 if there is a concrete plan to map or otherwise analyze data on gaps in health care access • Can score a 2 if mapping or other data is used to show that there are no gaps in health care access • Should not score for descriptions of emergency service provision
34	Health Care Access	The plan includes policies to work with relevant state agencies to improve access of all citizens to health care and wellness services.	The plan generally mentions potential partners and/or broad goals relative to improving access to health care and wellness services	The plan clearly identifies specific partners and a planned collaboration and goals to improve access to health care and wellness services	• Can score if plan mentions collaboration with other county, federal, city, or other agencies or organizations. • Can score a 1 if the plan states that health services are being offered in a central location not in a health clinic • Should not score for strategies to improve emergency service provision
35	Aging in Place	The plan supports policies that enable aging in place.	The plan generally mentions the need to maintain mobility and access to services as citizens age, without including specific goals or measures	The plan includes specific goals, policies and/or measures to maintain older citizens' mobility and access to services	• Does not need particular phrase "aging in place," as long as the plan address seniors' access to community activities and amenities in some way • Should not score for general references to the provision of senior housing, unless it is clear

					that such housing provides mobility and access to community services/amenities
C. Community Design*					
36	Mixed Use	The plan supports walkable, mixed-use development.	Mixed-use development is mentioned in aspirational terms, but without specific policy goals	The plan specifically promotes mixed-use development by recommending actions that make it attractive to pursue – for example, incentives such as density bonuses and location-efficient mortgages, by-right development categories and collaboration with transportation agencies	• To score a 2, recommended action could include removing barriers to mixed use development • Score a 2 if they have an existing or proposed mixed-use zoning district
37	Pedestrian Streetscape	The plan identifies the need to plan and build connected street networks in mixed-use areas that are pedestrian-friendly.	Mentioned in general terms as important but without specific policy goals	The plan specifically sets policy goals for well-connected street networks built to a human scale with one or more of the following features: • Design appropriate block lengths that promote safe walking • Place principal functional building entries on front façades that face a public space, such as a street, park or plaza • Place building entries at frequent intervals along streets and sidewalks • Include ground-floor retail in nonresidential and mixed-use projects • Install clear glass façades for ground-level	• Strategies must be explicitly connected to creating a pedestrian-friendly environment in the plan in order to score • This item can apply to all areas, not just mixed-use areas • Can score for discussion of pedestrian-oriented furniture (e.g. benches, human-scale lighting), if it is connected explicitly to making a better pedestrian environment.

				retail, service, or trade uses • Limit blank walls along building façades • Keep ground-level retail, service, and trade windows visible and unshuttered at night • Establish covenants, conditions, and restrictions, or other deed restrictions, to ensure the maintenance of visible/unshuttered windows along ground-level retail, service or trade uses in perpetuity • Build elevated finished floors for ground-floor residential units • Minimize exposure to parking lots • Minimize exposure to active driveways • Require wider sidewalks in mixed-use areas • Eliminate or reduce building setbacks to create a sense of enclosure for pedestrians • Require active uses at ground floor • Require a building-height to street-width ratio that maintains a walkable/streetscape	

				• Require buildings to be oriented to face the street or civic spaces	
38	Compact Development	The plan promotes compact development to promote livability, walkability and transportation efficiency.	Compact development (higher density) is mentioned in general terms but without specific policy goals or discussion of appropriate density	The plan sets specific goals and locations for appropriately promoting compact development, such as increased density for mixed-use development where infrastructure is in place and/or transfer of development rights with designated receiving areas	• Can score even if promoting compact development for other reasons than "promoting livability, walkability, and transportation efficiency" (or they could not state why they're promoting compact development at all). • Can score a 2 with strategy to create a boundary outside which they won't extend key services (e.g. sewer systems, city water lines).
39	TOD	The plan addresses transit-oriented design.	Mentioned in aspirational or broad terms without specific goals or locations identified	Details appropriate locations and standards for transit-oriented design in collaboration with the DOT and/or provides incentives such as density bonuses for development in these locations	• Does not need to use term "transit-oriented development," as long as the plan discusses compact, mixed use development clustered near transit lines or stops
40	TND	The plan supports Traditional Neighborhood Development, or village-style development.	Mentioned in aspirational or broad terms without specific goals or locations	The plan recommends identifying ideal locations, setting standards for TND or village-style development and/or providing incentives such as density bonuses for development in these locations	• Score a 2 if they have an existing or proposed zoning category for TND
41	Infill	The plan supports infill and redevelopment of greyfields in areas already served by public infrastructure.	Mentioned aspirationally as a general goal, without specifics	The plan sets specific goals for infill and redevelopment of greyfields – for example, inventorying targeted areas and providing incentives for their development or redevelopment	• A concrete plan to identify sites can score a 2. • Sites identified can be broad like a corridor or district. • To distinguish from item 42, this item has to do with developing vacant land or specifically

					demolishing old, unusable buildings and rebuilding on the lot.
42	Adaptive Reuse	The plan supports repurposing, adaptation and reuse of older buildings rather than demolition and new construction on greenfields.	Mentioned aspirationally as a general goal, without specifics	The plan sets specific goals for repurposing, adaptation and reuse of older buildings, including identifying targeted areas for these efforts	• A concrete plan to identify sites can score a 2. • Sites identified can be broad like a corridor or district. • To distinguish from item 41, this item concerns the repurposing of old or underutilized buildings. Therefore potential scoring language should specifically use strategies that don't involve demolition and re-building. • Be careful with the word "rehabilitation." It can mean aesthetic fixes, rather than repurposing and reuse.
43	Connectivity	The plan supports connectivity between developments.	Connectivity between residential and neighborhood-style commercial development is encouraged to promote walking and bicycling and discourage vehicle use	Connectivity between residential and neighborhood-style commercial development is required	• Connections between residential areas and institutional uses or mixed use centers can also score • "Connectivity" can be achieved through gridded easy-to-walk street patterns or trails/paths
44	ADUs	The plan supports accessory dwelling units in appropriate locations to create affordable options in existing communities and foster social cohesion for older citizens, young people just starting out, and others who can't afford or don't want to live in a single-family dwelling.	Mentioned in aspirational or broad terms as a goal, without specifics	The plan sets specific policies, goals and/or standards for permitting accessory dwelling units in appropriate locations	• Can talk about ADUs without using that exact terminology • If ADUs are listed as a permitted use in any of the land use categories, this item should score a 2, as that indicates that they are allowed by right in at least some areas.
45	Public Spaces	The plan promotes "third places" and public spaces.	Generally recognizes the value of places for people to	The plan sets specific goals for the creation of public spaces and so-called "third	

			congregate besides work and home	places" – such as walkable main streets, coffee houses, plazas, promenades, play fountains, outdoor cafes, pubs, bookstores and other public gathering spots with seating	
46	Street Trees	The plan addresses the use of street trees for shade and to enhance walkability.	The plan generally promotes the installation and maintenance of street trees in new and existing developments	The plan recommends specific goals for street trees, including size, spacing and species	• Can score with references to the urban forest more generally, including trees in public places other than streets (e.g. commercial developments). Cannot score for references of trees solely in parks. • Can score a 2 with specific guidelines or strategies to accomplish urban forest goals (i.e. does not specifically have to include size, spacing, and species guidelines) • Score a 2 for intention to continue as or pursue a Tree City certification • Do not score for heritage tree ordinances
47	Natural Surveillance	The plan supports the orientation of buildings to face the street or include windows that face the street (promoting "natural surveillance" and making walking safer).	Mentioned aspirationally or in general terms, without specific guidelines or requirements	The plan recommends specific guidelines or requirements for the orientation of buildings and placement of windows.	
48	Healthy Building Design	The plan supports recognized third-party standards for healthy building design and operations, such as Leadership in Energy and	Mentioned in encouraging, aspirational terms without specific goals or incentives	The plan suggests incentives for specific building rating systems that promote such healthy building measures as clean indoor air, active occupants, daylighting, and healthy food options.	• Doesn't necessarily have to be LEED certification, but does have to be some kind of certification system (i.e. not just the City supporting healthy building design principle)

		Environmental Design (LEED).			• Should not score if the plan just mentions that these certifications exist
49	Healthy Community Design	The plan supports recognized third-party standards for sustainable, healthy mixed-use communities such as STAR Communities or LEED for Neighborhood Development.	Mentioned in encouraging, aspirational terms without specific goals or incentives	The plan suggests incentives for specific community rating systems that promote healthy eating and active living such as walkability, bicycle facilities, connectivity, access to outdoor recreation, social cohesion, safety, healthy food access, and indoor air quality.	
50	Intergovernmental Collaboration	The plan supports intergovernmental coordination that ensures mobility and seamless access to services between jurisdictions.	Mentioned in encouraging, aspirational terms without specific goals or incentives	The plan specifically mentions collaborative measures including Memoranda of Agreement with municipal and state entities	• To score a 2, doesn't necessarily need an MOA. Could instead have a specific strategy or formal agreement to ensure intrjurisdictional collaboration on mobility and/or access to services. • This item does not concern working with other municipalities about expansion/annexation. Instead it concerns providing services and mobility. • Can score for sharing services with a county or regional authority.

*This table uses adapted section titles, not the original section titles from the Scorecard.

APPENDIX 2: RESULTS OF REGRESSION ANALYSIS, MUNICIPAL-LEVEL FACTORS ASSOCIATED WITH PERCENTAGE POINT DIFFERENCES IN PLAN SCORES

Table A2.1: Unadjusted univariate regression coefficients for each municipal-level factor, comprehensiveness scores (as percentages).

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall	n
Population (ln)	**5.56**	**9.35**	**8.47**	**7.03**	**5.44**	**10.55**	**8.65**	116
	[4.11,7.01]	[7.30,11.40]	[6.97,9.97]	[4.56,9.50]	[2.55,8.32]	[8.53,12.58]	[7.06,10.24]	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Population density†	**3.64**	**5.19**	**7.38**	2.18	2.63	**8.49**	**5.89**	116
	[1.40,5.87]	[1.37,9.02]	[4.86,9.89]	[-1.92,6.27]	[-1.17,6.44]	[4.95,12.03]	[2.81,8.97]	
	(0.002)	(0.008)	(0.000)	(0.294)	(0.173)	(0.000)	(0.000)	
Population change†	-0.16	1.38	-1.79	**3.87**	3.53	3.00	1.55	115
	[-2.17,1.85]	[-2.56,5.31]	[-4.84,1.26]	[0.87,6.87]	[-0.78,7.83]	[-0.30,6.31]	[-1.15,4.25]	
	(0.874)	(0.490)	(0.247)	(0.012)	(0.107)	(0.074)	(0.257)	
Village/town v. city	**-8.52**	**-11.63**	**-13.59**	**-7.94**	**-9.55**	**-8.20**	**-10.05**	116
	[-12.94,-4.10]	[-18.18,-5.09]	[-18.70,-8.48]	[-14.69,-1.19]	[-18.25,-0.84]	[-14.55,-1.84]	[-15.00,-5.09]	
	(0.000)	(0.001)	(0.000)	(0.022)	(0.032)	(0.012)	(0.000)	
Education†	-1.11	-2.03	**-3.43**	-3.88	-4.32	0.41	-1.73	115
	[-3.72,1.51]	[-5.88,1.82]	[-5.62,-1.23]	[-7.98,0.22]	[-9.05,0.41]	[-3.20,4.02]	[-4.57,1.10]	
	(0.403)	(0.299)	(0.003)	(0.063)	(0.073)	(0.822)	(0.228)	
Median household income†	**-3.46**	**-5.18**	**-5.54**	**-5.83**	**-4.64**	-1.69	**-4.02**	115
	[-5.80,-1.13]	[-8.67,-1.69]	[-7.41,-3.67]	[-9.94,-1.72]	[-9.34,0.06]	[-5.71,2.34]	[-6.61,-1.42]	
	(0.004)	(0.004)	(0.000)	(0.006)	(0.053)	(0.407)	(0.003)	
Democrat vote†	**2.78**	**2.92**	**4.16**	2.56	**3.42**	**3.24**	**3.19**	116
	[1.08,4.48]	[0.56,5.28]	[2.33,5.98]	[-0.07,5.19]	[0.58,6.25]	[0.45,6.03]	[1.37,5.01]	
	(0.002)	(0.016)	(0.000)	(0.056)	(0.019)	(0.023)	(0.001)	
Consultant as primary plan author	**-4.83**	1.92	2.91	4.33	-1.13	**7.27**	2.93	116
	[-9.16,-0.51]	[-4.20,8.04]	[-2.09,7.91]	[-1.90,10.57]	[-9.15,6.89]	[1.55,12.98]	[-1.62,7.48]	
	(0.029)	(0.536)	(0.250)	(0.171)	(0.781)	(0.013)	(0.204)	
≥ 1 staff planner	**6.32**	**13.54**	**11.65**	**12.46**	7.34	**17.71**	**13.14**	116

	[2.17,10.48] (0.003)	[7.47,19.61] (0.000)	[6.91,16.40] (0.000)	[6.53,18.39] (0.000)	[-0.29,14.96] (0.059)	[12.00,23.42] (0.000)	[8.63,17.66] (0.000)	
Staff planners per 10,000 population†	2.44 [-0.70,5.58] (0.126)	**5.68** [1.14,10.22] (0.015)	4.01 [-0.17,8.19] (0.060)	**7.74** [3.90,11.57] (0.000)	2.21 [-3.53,7.95] (0.447)	**7.50** [2.38,12.62] (0.005)	**5.57** [1.97,9.17] (0.003)	115
Year plan adopted†	**4.19** [2.10,6.28] (0.000)	**6.12** [3.67,8.56] (0.000)	**5.00** [2.20,7.79] (0.001)	**3.96** [1.68,6.25] (0.001)	**3.83** [0.14,7.52] (0.042)	**3.19** [0.98,5.40] (0.005)	**4.48** [2.81,6.14] (0.000)	116
Diet & exercise as local health priority	0.08 [-8.57,8.73] (0.986)	8.39 [-1.26,18.05] (0.088)	**7.59** [2.12,13.07] (0.007)	**11.70** [1.15,22.25] (0.030)	3.14 [-10.27,16.55] (0.643)	**10.17** [1.75,18.60] (0.018)	**7.82** [0.68,14.95] (0.032)	116
Housing & transit as local health priority	1.61 [-3.35,6.57] (0.521)	**10.26** [4.33,16.19] (0.001)	**7.09** [1.75,12.42] (0.010)	**12.37** [6.97,17.77] (0.000)	6.36 [-1.27,13.99] (0.101)	**11.56** [5.40,17.72] (0.000)	**9.08** [4.82,13.34] (0.000)	116

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

Table A2.2: Unadjusted univariate regression coefficients for each municipal-level factor, strength scores (as percentages).

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall	n
Population (ln)	**4.53** [3.17,5.89] (0.000)	**8.24** [6.56,9.92] (0.000)	**6.83** [5.53,8.12] (0.000)	**7.60** [5.94,9.26] (0.000)	**5.17** [3.04,7.30] (0.000)	**10.10** [8.56,11.64] (0.000)	**7.88** [6.63,9.13] (0.000)	116
Population density†	**2.93** [0.96,4.90] (0.004)	**5.70** [2.61,8.80] (0.000)	**5.76** [3.67,7.84] (0.000)	**3.11** [0.07,6.15] (0.045)	**4.02** [1.24,6.80] (0.005)	**8.43** [5.50,11.36] (0.000)	**5.84** [3.34,8.34] (0.000)	116
Population change†	-0.35 [-2.18,1.47] (0.701)	1.98 [-1.57,5.53] (0.271)	-1.61 [-4.32,1.10] (0.241)	**3.21** [0.44,5.99] (0.024)	1.26 [-1.82,4.33] (0.419)	2.38 [-0.83,5.59] (0.144)	1.33 [-1.16,3.81] (0.292)	115
Village/town v. city	**-6.53** [-10.61,-2.45] (0.002)	**-8.35** [-13.94,-2.77] (0.004)	**-11.94** [-16.39,-7.50] (0.000)	**-9.89** [-15.07,-4.71] (0.000)	-5.82 [-12.60,0.97] (0.092)	**-9.08** [-14.20,-3.95] (0.001)	**-8.93** [-13.00,-4.85] (0.000)	116

Education†	-0.66	-1.16	**-3.02**	**-3.46**	-2.44	0.10	-1.33	115
	[-3.10,1.78]	[-4.47,2.14]	[-4.75,-1.30]	[-6.56,-0.35]	[-5.94,1.07]	[-2.75,2.96]	[-3.63,0.98]	
	(0.594)	(0.487)	(0.001)	(0.029)	(0.171)	(0.944)	(0.257)	
Median household income†	**-2.40**	**-4.31**	**-4.92**	**-5.24**	**-3.63**	-2.29	**-3.63**	115
	[-4.64,-0.17]	[-7.17,-1.46]	[-6.53,-3.31]	[-7.90,-2.57]	[-6.60,-0.66]	[-5.06,0.48]	[-5.57,-1.68]	
	(0.036)	(0.003)	(0.000)	(0.000)	(0.017)	(0.104)	(0.000)	
Democrat vote†	1.43	**3.68**	**3.86**	**3.23**	2.09	**4.23**	**3.46**	116
	[-0.23,3.09]	[1.85,5.51]	[2.27,5.45]	[0.99,5.47]	[-0.23,4.41]	[2.12,6.33]	[2.01,4.91]	
	(0.091)	(0.000)	(0.000)	(0.005)	(0.077)	(0.000)	(0.000)	
Consultant as primary plan author	**-4.88**	2.45	3.42	**4.90**	-5.91	**7.87**	3.10	116
	[-8.87,-0.89]	[-2.59,7.49]	[-0.99,7.84]	[0.05,9.75]	[-12.32,0.51]	[3.38,12.36]	[-0.60,6.79]	
	(0.017)	(0.338)	(0.127)	(0.048)	(0.071)	(0.001)	(0.100)	
≥ 1 staff planner	**4.87**	**13.84**	**9.64**	**13.14**	**8.19**	**16.14**	**12.37**	116
	[1.09,8.65]	[8.54,19.15]	[5.42,13.86]	[8.39,17.89]	[2.12,14.27]	[11.30,20.98]	[8.50,16.25]	
	(0.012)	(0.000)	(0.000)	(0.000)	(0.009)	(0.000)	(0.000)	
Staff planners per 10,000 population†	1.60	**6.43**	3.15	**8.85**	2.62	**6.97**	**5.50**	115
	[-1.04,4.24]	[2.23,10.62]	[-0.49,6.80]	[5.61,12.09]	[-1.88,7.11]	[2.31,11.63]	[2.13,8.87]	
	(0.231)	(0.003)	(0.089)	(0.000)	(0.251)	(0.004)	(0.002)	
Year plan adopted†	**3.95**	**4.92**	**4.31**	**2.99**	**2.95**	**3.61**	**4.00**	116
	[2.09,5.81]	[2.79,7.05]	[1.68,6.93]	[1.15,4.83]	[0.01,5.90]	[1.52,5.69]	[2.45,5.55]	
	(0.000)	(0.000)	(0.002)	(0.002)	(0.049)	(0.001)	(0.000)	
Diet & exercise as local health priority	-0.19	6.91	**6.60**	**11.29**	4.91	**11.25**	**7.63**	116
	[-8.02,7.64]	[-0.98,14.79]	[1.85,11.34]	[2.98,19.60]	[-6.37,16.19]	[4.72,17.77]	[2.09,13.16]	
	(0.962)	(0.085)	(0.007)	(0.008)	(0.389)	(0.001)	(0.007)	
Housing & transit as local health priority	0.77	**9.88**	**6.03**	**9.23**	**6.12**	**11.74**	**8.44**	116
	[-3.62,5.16]	[4.28,15.49]	[1.06,11.00]	[4.66,13.81]	[0.04,12.19]	[6.67,16.81]	[4.59,12.29]	
	(0.729)	(0.001)	(0.018)	(0.000)	(0.048)	(0.000)	(0.000)	

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses.

Table A2.3: Regression coefficients for each municipal-level factor, comprehensiveness scores (as percentages), adjusted for municipal population.

	Vision & strategy	Active transportation	Healthy food access	Parks & recreation	Health care access	Community design	Overall	n
Population density†	-0.72	-2.49	1.48	-4.30	-1.99	0.86	-0.79	116
	[-3.16,1.73]	[-6.10,1.11]	[-0.92,3.87]	[-9.07,0.48]	[-7.47,3.49]	[-2.64,4.37]	[-3.82,2.25]	
	(0.563)	(0.174)	(0.224)	(0.077)	(0.473)	(0.627)	(0.608)	
Population change†	0.46	2.40	-0.88	**4.66**	4.15	**4.18**	2.51	115
	[-1.70,2.63]	[-1.39,6.20]	[-3.89,2.13]	[1.60,7.72]	[-0.46,8.76]	[0.96,7.39]	[-0.16,5.18]	
	(0.673)	(0.212)	(0.564)	(0.003)	(0.077)	(0.011)	(0.065)	
Village/town v. city	-2.45	-0.49	-4.56	0.72	-4.03	**6.09**	0.51	116
	[-7.52,2.62]	[-7.35,6.37]	[-10.37,1.26]	[-6.65,8.09]	[-14.10,6.03]	[0.13,12.06]	[-4.40,5.42]	
	(0.341)	(0.888)	(0.123)	(0.846)	(0.428)	(0.045)	(0.838)	
Education†	-0.70	-1.36	**-2.83**	-3.39	-3.95	1.17	-1.11	115
	[-3.12,1.72]	[-4.87,2.15]	[-4.76,-0.90]	[-7.29,0.51]	[-8.72,0.82]	[-1.93,4.28]	[-3.59,1.36]	
	(0.568)	(0.444)	(0.004)	(0.087)	(0.103)	(0.455)	(0.374)	
Median household income†	-1.74	-2.33	**-3.02**	-3.85	-3.11	1.86	-1.31	115
	[-4.18,0.70]	[-6.19,1.53]	[-4.90,-1.14]	[-8.32,0.62]	[-7.69,1.47]	[-2.50,6.22]	[-4.17,1.55]	
	(0.161)	(0.234)	(0.002)	(0.090)	(0.181)	(0.399)	(0.366)	
Democrat vote†	**1.88**	1.35	**2.78**	1.39	2.55	1.47	**1.75**	116
	[0.18,3.58]	[-0.78,3.49]	[1.22,4.33]	[-1.12,3.90]	[-0.26,5.37]	[-1.28,4.21]	[0.12,3.39]	
	(0.031)	(0.212)	(0.001)	(0.274)	(0.075)	(0.291)	(0.036)	
Consultant as primary plan author	-3.13	4.96	**5.69**	**6.68**	0.60	**10.80**	**5.77**	116
	[-7.28,1.02]	[-0.83,10.75]	[1.13,10.26]	[0.71,12.64]	[-7.72,8.92]	[5.64,15.95]	[1.65,9.89]	
	(0.137)	(0.092)	(0.015)	(0.029)	(0.887)	(0.000)	(0.007)	
≥ 1 staff planner	**-6.70**	-5.26	-6.03	0.75	-4.15	-0.92	-3.58	116
	[-13.27,-0.13]	[-15.00,4.49]	[-14.06,2.01]	[-7.86,9.35]	[-17.08,8.77]	[-10.08,8.24]	[-10.89,3.72]	
	(0.046)	(0.287)	(0.140)	(0.863)	(0.525)	(0.843)	(0.333)	
Staff planners per 10,000 population†	-3.32	-3.67	**-4.72**	2.01	-3.84	-2.64	-2.93	115
	[-7.73,1.10]	[-8.44,1.10]	[-8.72,-0.72]	[-2.00,6.02]	[-11.42,3.74]	[-7.69,2.42]	[-6.65,0.80]	
	(0.139)	(0.130)	(0.021)	(0.322)	(0.318)	(0.303)	(0.122)	
Year plan adopted†	**2.94**	**4.00**	**2.79**	**2.57**	2.91	0.44	**2.40**	116
	[0.95,4.94]	[1.61,6.39]	[0.00,5.58]	[0.30,4.85]	[-0.70,6.53]	[-1.51,2.39]	[0.85,3.96]	

	(0.004)	(0.001)	(0.050)	(0.027)	(0.113)	(0.657)	(0.003)	
Diet & exercise as local health priority	-2.72	3.86	3.49	8.41	0.47	5.07	3.63	116
	[-10.73,5.30]	[-3.89,11.62]	[-1.80,8.78]	[-0.67,17.48]	[-12.61,13.56]	[-1.69,11.84]	[-1.74,9.00]	
	(0.503)	(0.326)	(0.194)	(0.069)	(0.943)	(0.140)	(0.183)	
Housing & transit as local health priority	-0.37	**7.07**	4.15	**10.05**	4.51	**7.95**	**6.12**	116
	[-5.17,4.43]	[2.03,12.10]	[-1.02,9.33]	[4.95,15.15]	[-3.31,12.33]	[1.86,14.04]	[2.39,9.85]	
	(0.879)	(0.006)	(0.115)	(0.000)	(0.255)	(0.011)	(0.002)	

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

Table A2.4: Regression coefficients for each municipal-level factor, strength scores (as percentages), adjusted for municipal population.

	Vision & strategy	Active transportation	Healthy food access	Parks & recreation	Health care access	Community design	Overall	n
Population density†	-0.63	-0.62	0.93	**-3.58**	0.22	1.26	-0.06	116
	[-2.75,1.49]	[-3.61,2.37]	[-1.18,3.04]	[-6.71,-0.46]	[-3.60,4.04]	[-1.40,3.91]	[-2.38,2.26]	
	(0.557)	(0.681)	(0.385)	(0.025)	(0.908)	(0.351)	(0.961)	
Population change†	0.15	2.89	-0.88	**4.06**	1.84	**3.49**	2.19	115
	[-1.74,2.04]	[-0.58,6.36]	[-3.60,1.85]	[1.52,6.61]	[-1.49,5.17]	[0.44,6.54]	[-0.22,4.61]	
	(0.875)	(0.101)	(0.524)	(0.002)	(0.276)	(0.025)	(0.074)	
Village/town v. city	-1.44	2.12	-5.01	-0.98	0.56	4.17	0.77	116
	[-5.96,3.09]	[-4.02,8.27]	[-10.17,0.15]	[-6.74,4.79]	[-7.36,8.49]	[-0.81,9.15]	[-3.46,5.00]	
	(0.530)	(0.494)	(0.057)	(0.737)	(0.888)	(0.099)	(0.720)	
Education†	-0.32	-0.57	**-2.54**	**-2.92**	-2.06	0.83	-0.76	115
	[-2.60,1.96]	[-3.57,2.42]	[-4.09,-1.00]	[-5.83,-0.02]	[-5.58,1.46]	[-1.46,3.11]	[-2.71,1.18]	
	(0.778)	(0.705)	(0.001)	(0.049)	(0.247)	(0.474)	(0.438)	
Median household income†	-0.97	-1.79	**-2.93**	**-3.01**	-2.08	1.03	-1.17	115
	[-3.29,1.36]	[-4.94,1.36]	[-4.54,-1.32]	[-5.96,-0.06]	[-5.01,0.85]	[-1.99,4.06]	[-3.33,1.00]	
	(0.412)	(0.263)	(0.000)	(0.046)	(0.162)	(0.500)	(0.288)	
Democrat vote†	0.67	**2.33**	**2.77**	1.98	1.24	**2.56**	**2.17**	116
	[-0.99,2.33]	[0.53,4.14]	[1.38,4.15]	[-0.06,4.03]	[-1.03,3.50]	[0.56,4.57]	[0.86,3.48]	
	(0.426)	(0.012)	(0.000)	(0.057)	(0.281)	(0.013)	(0.001)	

Consultant as primary plan author	-3.51 [-7.40,0.37] (0.076)	**5.15** [0.33,9.97] (0.037)	**5.68** [1.55,9.82] (0.008)	**7.44** [3.13,11.75] (0.001)	-4.35 [-11.12,2.42] (0.205)	**11.27** [7.43,15.10] (0.000)	**5.69** [2.41,8.96] (0.001)	116
≥ 1 staff planner	**-6.04** [-11.57,-0.51] (0.033)	-0.68 [-9.39,8.02] (0.876)	-4.34 [-11.74,3.06] (0.247)	0.12 [-6.49,6.73] (0.970)	-1.46 [-12.38,9.47] (0.792)	-2.56 [-9.88,4.77] (0.490)	-2.44 [-8.60,3.72] (0.434)	116
Staff planners per 10,000 population†	**-3.28** [-6.00,-0.55] (0.019)	-1.32 [-5.52,2.89] (0.536)	**-3.98** [-7.51,-0.45] (0.027)	3.05 [-0.06,6.15] (0.054)	-3.01 [-8.91,2.89] (0.314)	-2.62 [-7.17,1.93] (0.256)	-2.03 [-5.29,1.22] (0.217)	115
Year plan adopted†	**2.98** [1.21,4.75] (0.001)	**2.96** [0.88,5.04] (0.006)	2.55 [-0.10,5.19] (0.059)	1.14 [-0.70,2.99] (0.220)	1.85 [-1.15,4.85] (0.223)	0.93 [-1.01,2.86] (0.344)	**2.04** [0.56,3.51] (0.007)	116
Diet & exercise as local health priority	-2.47 [-9.80,4.86] (0.505)	2.90 [-3.48,9.28] (0.369)	3.30 [-1.43,8.03] (0.170)	**7.70** [0.72,14.67] (0.031)	2.41 [-8.91,13.74] (0.673)	**6.40** [1.28,11.52] (0.015)	3.82 [-0.31,7.95] (0.069)	116
Housing & transit as local health priority	-0.85 [-5.01,3.30] (0.684)	**7.08** [2.07,12.09] (0.006)	3.67 [-1.19,8.53] (0.137)	**6.65** [2.75,10.55] (0.001)	4.36 [-1.94,10.65] (0.173)	**8.30** [3.74,12.85] (0.000)	**5.74** [2.52,8.97] (0.001)	116

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

APPENDIX 3: RESULTS OF REGRESSION ANALYSIS, MUNICIPAL-LEVEL FACTORS ASSOCIATED WITH DIFFERENCES IN ITEMS (COMPREHENSIVENESS) AND POINTS (STRENGTH) SCORED

Table A3.1: Unadjusted univariate regression coefficients for each municipal-level factor, comprehensiveness scores (as items scored).

	Vision & Strategy (6 items)	Active Transportation (13 items)	Healthy Food Access (8 items)	Parks & Recreation (5 items)	Health Care Access (3 items)	Community Design (15 items)	Overall (50 items)	n
Population (ln)	**0.33** [0.25,0.42] (0.000)	**1.22** [0.95,1.48] (0.000)	**0.68** [0.56,0.80] (0.000)	**0.35** [0.23,0.48] (0.000)	**0.16** [0.08,0.25] (0.000)	**1.58** [1.28,1.89] (0.000)	**4.32** [3.53,5.12] (0.000)	116
Population density†	**0.22** [0.08,0.35] (0.002)	**0.68** [0.18,1.17] (0.008)	**0.59** [0.39,0.79] (0.000)	0.11 [-0.10,0.31] (0.294)	0.08 [-0.04,0.19] (0.173)	**1.27** [0.74,1.80] (0.000)	**2.94** [1.40,4.49] (0.000)	116
Population change†	-0.01 [-0.13,0.11] (0.874)	0.18 [-0.33,0.69] (0.490)	-0.14 [-0.39,0.10] (0.247)	**0.19** [0.04,0.34] (0.012)	0.11 [-0.02,0.24] (0.107)	0.45 [-0.05,0.95] (0.074)	0.78 [-0.57,2.13] (0.257)	115
Village/town v. city	**-0.51** [-0.78,-0.25] (0.000)	**-1.51** [-2.36,-0.66] (0.001)	**-1.09** [-1.50,-0.68] (0.000)	**-0.40** [-0.73,-0.06] (0.022)	**-0.29** [-0.55,-0.03] (0.032)	**-1.23** [-2.18,-0.28] (0.012)	**-5.02** [-7.50,-2.55] (0.000)	116
Education†	-0.07 [-0.22,0.09] (0.403)	-0.26 [-0.76,0.24] (0.299)	**-0.27** [-0.45,-0.10] (0.003)	-0.19 [-0.40,0.01] (0.063)	-0.13 [-0.27,0.01] (0.073)	0.06 [-0.48,0.60] (0.822)	-0.87 [-2.28,0.55] (0.228)	115
Median household income†	**-0.21** [-0.35,-0.07] (0.004)	**-0.67** [-1.13,-0.22] (0.004)	**-0.44** [-0.59,-0.29] (0.000)	**-0.29** [-0.50,-0.09] (0.006)	-0.14 [-0.28,0.00] (0.053)	-0.25 [-0.86,0.35] (0.407)	**-2.01** [-3.31,-0.71] (0.003)	115
Democrat vote†	**0.17** [0.06,0.27] (0.002)	**0.38** [0.07,0.69] (0.016)	**0.33** [0.19,0.48] (0.000)	0.13 [-0.00,0.26] (0.056)	**0.10** [0.02,0.19] (0.019)	**0.49** [0.07,0.90] (0.023)	**1.60** [0.68,2.51] (0.001)	116
Consultant as primary plan author	**-0.29** [-0.55,-0.03] (0.029)	0.25 [-0.55,1.04] (0.536)	0.23 [-0.17,0.63] (0.250)	0.22 [-0.10,0.53] (0.171)	-0.03 [-0.27,0.21] (0.781)	**1.09** [0.23,1.95] (0.013)	1.46 [-0.81,3.74] (0.204)	116

≥ 1 staff planner	**0.38**	**1.76**	**0.93**	**0.62**	0.22	**2.66**	**6.57**	116
	[0.13,0.63]	[0.97,2.55]	[0.55,1.31]	[0.33,0.92]	[-0.01,0.45]	[1.80,3.51]	[4.32,8.83]	
	(0.003)	(0.000)	(0.000)	(0.000)	(0.059)	(0.000)	(0.000)	
Staff planners per 10,000 population†	0.15	**0.74**	0.32	**0.39**	0.07	**1.12**	**2.78**	115
	[-0.04,0.34]	[0.15,1.33]	[-0.01,0.66]	[0.20,0.58]	[-0.11,0.24]	[0.36,1.89]	[0.98,4.58]	
	(0.126)	(0.015)	(0.060)	(0.000)	(0.447)	(0.005)	(0.003)	
Year plan adopted†	**0.25**	**0.80**	**0.40**	**0.20**	**0.11**	**0.48**	**2.24**	116
	[0.13,0.38]	[0.48,1.11]	[0.18,0.62]	[0.08,0.31]	[0.00,0.23]	[0.15,0.81]	[1.41,3.07]	
	(0.000)	(0.000)	(0.001)	(0.001)	(0.042)	(0.005)	(0.000)	
Diet & exercise as local health priority	0.00	1.09	**0.61**	**0.59**	0.09	**1.53**	**3.91**	116
	[-0.51,0.52]	[-0.16,2.35]	[0.17,1.05]	[0.06,1.11]	[-0.31,0.50]	[0.26,2.79]	[0.34,7.47]	
	(0.986)	(0.088)	(0.007)	(0.030)	(0.643)	(0.018)	(0.032)	
Housing & transit as local health priority	0.10	**1.33**	**0.57**	**0.62**	0.19	**1.73**	**4.54**	116
	[-0.20,0.39]	[0.56,2.10]	[0.14,0.99]	[0.35,0.89]	[-0.04,0.42]	[0.81,2.66]	[2.41,6.67]	
	(0.521)	(0.001)	(0.010)	(0.000)	(0.101)	(0.000)	(0.000)	

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

Table A3.2: Unadjusted univariate regression coefficients for each municipal-level factor, strength scores (as points scored).

	Vision & Strategy (12 points)	Active Transportation (26 points)	Healthy Food Access (16 points)	Parks & Recreation (10 points)	Health Care Access (6 points)	Community Design (30 points)	Overall (100 points)	n
Population (ln)	**0.54**	**2.14**	**1.09**	**0.76**	**0.31**	**3.03**	**7.88**	116
	[0.38,0.71]	[1.71,2.58]	[0.88,1.30]	[0.59,0.93]	[0.18,0.44]	[2.57,3.49]	[6.63,9.13]	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Population density†	**0.35**	**1.48**	**0.92**	**0.31**	**0.24**	**2.53**	**5.84**	116
	[0.12,0.59]	[0.68,2.29]	[0.59,1.25]	[0.01,0.61]	[0.07,0.41]	[1.65,3.41]	[3.34,8.34]	
	(0.004)	(0.000)	(0.000)	(0.045)	(0.005)	(0.000)	(0.000)	
Population change†	-0.04	0.52	-0.26	**0.32**	0.08	0.71	1.33	115
	[-0.26,0.18]	[-0.41,1.44]	[-0.69,0.18]	[0.04,0.60]	[-0.11,0.26]	[-0.25,1.68]	[-1.16,3.81]	
	(0.701)	(0.271)	(0.241)	(0.024)	(0.419)	(0.144)	(0.292)	
Village/town v. city	**-0.78**	**-2.17**	**-1.91**	**-0.99**	-0.35	**-2.72**	**-8.93**	116

	[-1.27,-0.29] (0.002)	[-3.62,-0.72] (0.004)	[-2.62,-1.20] (0.000)	[-1.51,-0.47] (0.000)	[-0.76,0.06] (0.092)	[-4.26,-1.19] (0.001)	[-13.00,-4.85] (0.000)	
Education†	-0.08	-0.30	**-0.48**	**-0.35**	-0.15	0.03	-1.33	115
	[-0.37,0.21] (0.594)	[-1.16,0.56] (0.487)	[-0.76,-0.21] (0.001)	[-0.66,-0.04] (0.029)	[-0.36,0.06] (0.171)	[-0.83,0.89] (0.944)	[-3.63,0.98] (0.257)	
Median household income†	**-0.29**	**-1.12**	**-0.79**	**-0.52**	**-0.22**	-0.69	**-3.63**	115
	[-0.56,-0.02] (0.036)	[-1.86,-0.38] (0.003)	[-1.05,-0.53] (0.000)	[-0.79,-0.26] (0.000)	[-0.40,-0.04] (0.017)	[-1.52,0.14] (0.104)	[-5.57,-1.68] (0.000)	
Democrat vote†	0.17	**0.96**	**0.62**	**0.32**	0.13	**1.27**	**3.46**	116
	[-0.03,0.37] (0.091)	[0.48,1.43] (0.000)	[0.36,0.87] (0.000)	[0.10,0.55] (0.005)	[-0.01,0.26] (0.077)	[0.64,1.90] (0.000)	[2.01,4.91] (0.000)	
Consultant as primary plan author	**-0.59**	0.64	0.55	**0.49**	-0.35	**2.36**	3.10	116
	[-1.06,-0.11] (0.017)	[-0.67,1.95] (0.338)	[-0.16,1.25] (0.127)	[0.01,0.98] (0.048)	[-0.74,0.03] (0.071)	[1.01,3.71] (0.001)	[-0.60,6.79] (0.100)	
≥ 1 staff planner	**0.58**	**3.60**	**1.54**	**1.31**	**0.49**	**4.84**	**12.37**	116
	[0.13,1.04] (0.012)	[2.22,4.98] (0.000)	[0.87,2.22] (0.000)	[0.84,1.79] (0.000)	[0.13,0.86] (0.009)	[3.39,6.29] (0.000)	[8.50,16.25] (0.000)	
Staff planners per 10,000 population†	0.19	**1.67**	0.50	**0.89**	0.16	**2.09**	**5.50**	115
	[-0.12,0.51] (0.231)	[0.58,2.76] (0.003)	[-0.08,1.09] (0.089)	[0.56,1.21] (0.000)	[-0.11,0.43] (0.251)	[0.69,3.49] (0.004)	[2.13,8.87] (0.002)	
Year plan adopted†	**0.47**	**1.28**	**0.69**	**0.30**	**0.18**	**1.08**	**4.00**	116
	[0.25,0.70] (0.000)	[0.72,1.83] (0.000)	[0.27,1.11] (0.002)	[0.12,0.48] (0.002)	[0.00,0.35] (0.049)	[0.46,1.71] (0.001)	[2.45,5.55] (0.000)	
Diet & exercise as local health priority	-0.02	1.80	**1.06**	**1.13**	0.29	**3.37**	**7.63**	116
	[-0.96,0.92] (0.962)	[-0.25,3.84] (0.085)	[0.30,1.82] (0.007)	[0.30,1.96] (0.008)	[-0.38,0.97] (0.389)	[1.42,5.33] (0.001)	[2.09,13.16] (0.007)	
Housing & transit as local health priority	0.09	**2.57**	**0.96**	**0.92**	**0.37**	**3.52**	**8.44**	116
	[-0.43,0.62] (0.729)	[1.11,4.03] (0.001)	[0.17,1.76] (0.018)	[0.47,1.38] (0.000)	[0.00,0.73] (0.048)	[2.00,5.04] (0.000)	[4.59,12.29] (0.000)	

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

Table A3.3: Regression coefficients for each municipal-level factor, comprehensiveness score (as items scored), adjusted for municipal population.

	Vision & Strategy (6 items)	Active Transportation (13 items)	Healthy Food Access (8 items)	Parks & Recreation (5 items)	Health Care Access (3 items)	Community Design (15 items)	Overall (50 items)	n
Population density†	-0.04	-0.32	0.12	-0.21	-0.06	0.13	-0.39	116
	[-0.19,0.10]	[-0.79,0.14]	[-0.07,0.31]	[-0.45,0.02]	[-0.22,0.10]	[-0.40,0.66]	[-1.91,1.12]	
	(0.563)	(0.174)	(0.224)	(0.077)	(0.473)	(0.627)	(0.608)	
Population change†	0.03	0.31	-0.07	**0.23**	0.12	**0.63**	1.25	115
	[-0.10,0.16]	[-0.18,0.81]	[-0.31,0.17]	[0.08,0.39]	[-0.01,0.26]	[0.14,1.11]	[-0.08,2.59]	
	(0.673)	(0.212)	(0.564)	(0.003)	(0.077)	(0.011)	(0.065)	
Village/town v. city	-0.15	-0.06	-0.36	0.04	-0.12	**0.91**	0.25	116
	[-0.45,0.16]	[-0.95,0.83]	[-0.83,0.10]	[-0.33,0.40]	[-0.42,0.18]	[0.02,1.81]	[-2.20,2.71]	
	(0.341)	(0.888)	(0.123)	(0.846)	(0.428)	(0.045)	(0.838)	
Education†	-0.04	-0.18	**-0.23**	-0.17	-0.12	0.18	-0.56	115
	[-0.19,0.10]	[-0.63,0.28]	[-0.38,-0.07]	[-0.36,0.03]	[-0.26,0.02]	[-0.29,0.64]	[-1.79,0.68]	
	(0.568)	(0.444)	(0.004)	(0.087)	(0.103)	(0.455)	(0.374)	
Median household income†	-0.10	-0.30	**-0.24**	-0.19	-0.09	0.28	-0.66	115
	[-0.25,0.04]	[-0.80,0.20]	[-0.39,-0.09]	[-0.42,0.03]	[-0.23,0.04]	[-0.37,0.93]	[-2.09,0.78]	
	(0.161)	(0.234)	(0.002)	(0.090)	(0.181)	(0.399)	(0.366)	
Democrat vote†	**0.11**	0.18	**0.22**	0.07	0.08	0.22	**0.88**	116
	[0.01,0.21]	[-0.10,0.45]	[0.10,0.35]	[-0.06,0.19]	[-0.01,0.16]	[-0.19,0.63]	[0.06,1.70]	
	(0.031)	(0.212)	(0.001)	(0.274)	(0.075)	(0.291)	(0.036)	
Consultant as primary plan author	-0.19	0.65	**0.46**	**0.33**	0.02	**1.62**	**2.88**	116
	[-0.44,0.06]	[-0.11,1.40]	[0.09,0.82]	[0.04,0.63]	[-0.23,0.27]	[0.85,2.39]	[0.82,4.94]	
	(0.137)	(0.092)	(0.015)	(0.029)	(0.887)	(0.000)	(0.007)	
≥ 1 staff planner	**-0.40**	-0.68	-0.48	0.04	-0.12	-0.14	-1.79	116
	[-0.80,-0.01]	[-1.95,0.58]	[-1.13,0.16]	[-0.39,0.47]	[-0.51,0.26]	[-1.51,1.24]	[-5.45,1.86]	
	(0.046)	(0.287)	(0.140)	(0.863)	(0.525)	(0.843)	(0.333)	
Staff planners per 10,000 population†	-0.20	-0.48	**-0.38**	0.10	-0.12	-0.40	-1.46	115
	[-0.46,0.07]	[-1.10,0.14]	[-0.70,-0.06]	[-0.10,0.30]	[-0.34,0.11]	[-1.15,0.36]	[-3.33,0.40]	
	(0.139)	(0.130)	(0.021)	(0.322)	(0.318)	(0.303)	(0.122)	
Year plan adopted†	**0.18**	**0.52**	**0.22**	**0.13**	0.09	0.07	**1.20**	116

	[0.06,0.30] (0.004)	[0.21,0.83] (0.001)	[0.00,0.45] (0.050)	[0.01,0.24] (0.027)	[-0.02,0.20] (0.113)	[-0.23,0.36] (0.657)	[0.42,1.98] (0.003)	
Diet & exercise as local health priority	-0.16 [-0.64,0.32] (0.503)	0.50 [-0.51,1.51] (0.326)	0.28 [-0.14,0.70] (0.194)	0.42 [-0.03,0.87] (0.069)	0.01 [-0.38,0.41] (0.943)	0.76 [-0.25,1.78] (0.140)	1.81 [-0.87,4.50] (0.183)	116
Housing & transit as local health priority	-0.02 [-0.31,0.27] (0.879)	**0.92** [0.26,1.57] (0.006)	0.33 [-0.08,0.75] (0.115)	**0.50** [0.25,0.76] (0.000)	0.14 [-0.10,0.37] (0.255)	**1.19** [0.28,2.11] (0.011)	**3.06** [1.19,4.92] (0.002)	116

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

Table A3.4: Regression coefficients for each municipal-level factor, strength scores (as points scored), adjusted for municipal population.

	Vision & Strategy (12 points)	Active Transportation (26 points)	Healthy Food Access (16 points)	Parks & Recreation (10 points)	Health Care Access (6 points)	Community Design (30 points)	Overall (100 points)	n
Population density†	-0.08 [-0.33,0.18] (0.557)	-0.16 [-0.94,0.62] (0.681)	0.15 [-0.19,0.49] (0.385)	**-0.36** [-0.67,-0.05] (0.025)	0.01 [-0.22,0.24] (0.908)	0.38 [-0.42,1.17] (0.351)	-0.06 [-2.38,2.26] (0.961)	116
Population change†	0.02 [-0.21,0.25] (0.875)	0.75 [-0.15,1.65] (0.101)	-0.14 [-0.58,0.30] (0.524)	**0.41** [0.15,0.66] (0.002)	0.11 [-0.09,0.31] (0.276)	**1.05** [0.13,1.96] (0.025)	2.19 [-0.22,4.61] (0.074)	115
Village/town v. city	-0.17 [-0.72,0.37] (0.530)	0.55 [-1.05,2.15] (0.494)	-0.80 [-1.63,0.02] (0.057)	-0.10 [-0.67,0.48] (0.737)	0.03 [-0.44,0.51] (0.888)	1.25 [-0.24,2.75] (0.099)	0.77 [-3.46,5.00] (0.720)	116
Education†	-0.04 [-0.31,0.23] (0.778)	-0.15 [-0.93,0.63] (0.705)	**-0.41** [-0.65,-0.16] (0.001)	**-0.29** [-0.58,-0.00] (0.049)	-0.12 [-0.34,0.09] (0.247)	0.25 [-0.44,0.93] (0.474)	-0.76 [-2.71,1.18] (0.438)	115
Median household income†	-0.12 [-0.40,0.16] (0.412)	-0.46 [-1.28,0.35] (0.263)	**-0.47** [-0.73,-0.21] (0.000)	**-0.30** [-0.60,-0.01] (0.046)	-0.12 [-0.30,0.05] (0.162)	0.31 [-0.60,1.22] (0.500)	-1.17 [-3.33,1.00] (0.288)	115
Democrat vote†	0.08 [-0.12,0.28]	**0.61** [0.14,1.08]	**0.44** [0.22,0.66]	0.20 [-0.01,0.40]	0.07 [-0.06,0.21]	**0.77** [0.17,1.37]	**2.17** [0.86,3.48]	116

	(0.426)	(0.012)	(0.000)	(0.057)	(0.281)	(0.013)	(0.001)	
Consultant as primary plan author	-0.42	**1.34**	**0.91**	**0.74**	-0.26	**3.38**	**5.69**	116
	[-0.89,0.04]	[0.08,2.59]	[0.25,1.57]	[0.31,1.18]	[-0.67,0.15]	[2.23,4.53]	[2.41,8.96]	
	(0.076)	(0.037)	(0.008)	(0.001)	(0.205)	(0.000)	(0.001)	
≥ 1 staff planner	**-0.72**	-0.18	-0.69	0.01	-0.09	-0.77	-2.44	116
	[-1.39,-0.06]	[-2.44,2.09]	[-1.88,0.49]	[-0.65,0.67]	[-0.74,0.57]	[-2.96,1.43]	[-8.60,3.72]	
	(0.033)	(0.876)	(0.247)	(0.970)	(0.792)	(0.490)	(0.434)	
Staff planners per 10,000 population†	**-0.39**	-0.34	**-0.64**	0.30	-0.18	-0.79	-2.03	115
	[-0.72,-0.07]	[-1.43,0.75]	[-1.20,-0.07]	[-0.01,0.61]	[-0.53,0.17]	[-2.15,0.58]	[-5.29,1.22]	
	(0.019)	(0.536)	(0.027)	(0.054)	(0.314)	(0.256)	(0.217)	
Year plan adopted†	**0.36**	**0.77**	0.41	0.11	0.11	0.28	**2.04**	116
	[0.15,0.57]	[0.23,1.31]	[-0.02,0.83]	[-0.07,0.30]	[-0.07,0.29]	[-0.30,0.86]	[0.56,3.51]	
	(0.001)	(0.006)	(0.059)	(0.220)	(0.223)	(0.344)	(0.007)	
Diet & exercise as local health priority	-0.30	0.75	0.53	**0.77**	0.14	**1.92**	3.82	116
	[-1.18,0.58]	[-0.90,2.41]	[-0.23,1.29]	[0.07,1.47]	[-0.53,0.82]	[0.38,3.46]	[-0.31,7.95]	
	(0.505)	(0.369)	(0.170)	(0.031)	(0.673)	(0.015)	(0.069)	
Housing & transit as local health priority	-0.10	**1.84**	0.59	**0.67**	0.26	**2.49**	**5.74**	116
	[-0.60,0.40]	[0.54,3.14]	[-0.19,1.37]	[0.28,1.05]	[-0.12,0.64]	[1.12,3.86]	[2.52,8.97]	
	(0.684)	(0.006)	(0.137)	(0.001)	(0.173)	(0.000)	(0.001)	

†Municipal-level factors with this mark have been scaled to near their standard deviation. Exact scaling can be found in Table 2.11.
95% confidence intervals in brackets; *p*-values in parentheses

APPENDIX 4: MARGINAL DIFFERENCES IN PLAN SCORES FOR EACH DOUBLING OF MUNICIPAL POPULATION

	Vision & Strategy (6 items)	Active Transportation (13 items)	Healthy Food Access (8 items)	Parks & Recreation (5 items)	Health Care Access (3 items)	Community Design (15 items)	Overall (50 items)
Comprehensiveness score	**3.85**	**6.48**	**5.87**	**4.87**	**3.77**	**7.31**	**6.00**
	[2.85,4.86]	[5.06,7.9]	[4.83,6.91]	[3.16,6.58]	[1.77,5.77]	[5.91,8.72]	[4.89,7.1]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Strength score	**3.14**	**5.71**	**4.73**	**5.27**	**3.58**	**7.00**	**5.46**
	[2.2,4.08]	[4.55,6.88]	[3.83,5.63]	[4.12,6.42]	[2.11,5.06]	[5.93,8.07]	[4.6,6.33]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Count score	**0.23**	**0.85**	**0.47**	**0.24**	**0.11**	**1.10**	**2.99**
	[0.17,0.29]	[0.66,1.03]	[0.39,0.55]	[0.16,0.33]	[0.06,0.17]	[0.89,1.31]	[2.45,3.55]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sum score	**0.37**	**1.48**	**0.76**	**0.53**	**0.21**	**2.10**	**5.46**
	[0.26,0.49]	[1.19,1.79]	[0.61,0.9]	[0.41,0.64]	[0.12,0.3]	[1.78,2.42]	[4.6,6.33]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

95% confidence intervals in brackets; *p*-values in parentheses

Comprehensiveness and strength scores reflect percentage point differences. Count score reflects differences in items scored. Sum score reflects differences in points scored.

Effect sizes and 95% CIs calculated using $\beta * \ln(2.0)$

APPENDIX 5: STATEWIDE WEIGHTED SCORING PERCENTAGES AND STATE STATUTE MANDATES FOR EACH ITEM IN SCORECARD

Item number	Item name	% scoring 0	% scoring 1	% scoring 3	State statute mandate
Vision & Strategy					
Item 1	Plan4Health	88.6 (2.7) [82.1, 93.0]	9.3 (2.5) [5.3, 15.6]	2.1 (1.1) [0.7, 5.9]	Not mandated
Item 2	Collaboration with PH	84.4 (2.9) [77.8, 89.3]	6.8 (1.9) [3.9, 11.6]	8.8 (2.3) [5.2, 14.5]	Not mandated
Item 3	Inequities	13.2 (3.1) [8.2, 20.6]	30.6 (3.7) [23.8, 38.3]	56.2 (4.1) [48.0, 64.0]	Mandated, general
Item 4	Health Chapter	100 (0) [100, 100]	0 (0) [0, 0]	0 (0) [0, 0]	Not mandated
Item 5	HIA	98.3 (0.8) [95.8, 99.4]	1.7 (0.8) [0.6, 4.2]	0 (0) [0, 0]	Not mandated
Item 6	Mental/Social Health	18.5 (3.4) [12.6, 26.3]	7.7 (2.2) [4.2, 13.5]	73.9 (3.7) [65.9, 80.5]	Mandated, general
Active Transportation					
Item 8	Mode Share	47.8 (4.2) [39.6, 56.2]	31.3 (4.0) [24.0, 39.7]	20.8 (3.6) [14.5, 29.0]	Mandated, general
Item 9	Complete Streets	41.3 (4.4)	30.1 (3.8)	28.6 (3.8)	Mandated, general

		[32.9, 50.3]	[23.2, 38.0]	[21.7, 36.7]	
Item 10	Bike/Ped Plan	39	27.5	33.5	Mandated, general
		(4.2)	(4.0)	(4.0)	
		[31.0, 47.6]	[20.3, 36.1]	[25.9, 42.0]	
Item 11	Traffic Calming	45.7	36.2	18.1	Not mandated
		(4.3)	(4.1)	(3.2)	
		[37.3, 54.3]	[28.4, 44.8]	[12.7, 25.3]	
Item 12	Pedestrian Safety	12.4	43.1	44.5	Mandated, general
		(2.7)	(4.3)	(4.2)	
		[8.0, 18.9]	[34.8, 51.8]	[36.4, 53.0]	
Item 13	Bike/Ped New Dev	42.3	12.9	44.8	Mandated, general
		(4.4)	(2.5)	(4.3)	
		[33.9, 51.2]	[8.7, 18.7]	[36.5, 53.3]	
Item 14	Trails	14.3	29.2	56.6	Mandated, general
		(3.2)	(3.8)	(4.2)	
		[9.0, 21.8	[22.3, 37.2]	[48.0, 64.7]	
Item 15	Parking	54.9	25.5	19.6	Not mandated
		(4.3)	(3.6)	(3.3)	
		[46.3, 63.2]	[19.1, 33.2]	[13.9, 26.9]	
Item 16	Senior Mobility	19.2	19.6	61.2	Mandated, general
		(3.5)	(3.3)	(4.1)	
		[13.2, 27.1]	[13.9, 27.0]	[52.8, 69.0]	
Item 17	Disadvantaged Mobility	57.8	19	23.2	Mandated, general
		(4.5)	(3.6)	(3.6)	
		[48.8, 66.3]	[12.9, 27.1]	[16.8, 31.2]	
Item 18	SRTS	27.4	29	43.6	Mandated, general
		(3.8)	(4.1)	(4.1)	
		[20.5, 35.6]	[21.6, 37.7]	[35.7, 51.9]	
Item 19	School Hubs	78.3	11.7	10	Not mandated
		(3.6)	(2.7)	(2.6)	
		[70.4, 84.5]	[7.4, 18.1]	[5.8, 16.6]	
Healthy Food Access					
Item 20	Farmland Preservation	32.8	17.4	49.8	Mandated, specific
		(4.2)	(3.3)	(4.2)	

		[25.0, 41.7]	[11.8, 25.0]	[41.5, 58.2]	
Item 21	Urban Farms/Local Food	55.1	11.6	33.3	Mandated, general
		(4.1)	(2.7)	(3.7)	
		[47.0, 63.0]	[7.3, 18.1]	[26.4, 40.9]	
Item 22	Food Access	93.4	4.1	2.5	Not mandated
		(1.3)	(1.1)	(0.7)	
		[90.3, 95.5]	[2.5, 6.8]	[1.4, 4.5]	
Item 23	Community Gardens	70.1	16.2	13.7	Not mandated
		(3.6)	(2.9)	(2.4)	
		[62.5, 76.8]	[11.2, 22.8]	[9.6, 19.2]	
Item 24	Farmers' Markets	63.4	21.3	15.4	Not mandated
		(3.8)	(3.1)	(3.0)	
		[55.6, 70.5]	[15.7, 28.2]	[10.3, 22.3]	
Item 25	Grocery Stores	91.4	7.5	1.1	Not mandated
		(2.2)	(2.1)	(0.8)	
		[85.8, 95.0]	[4.3, 12.9]	[0.2, 4.6]	
Item 26	Healthy Retail	88.7	0.7	10.6	Not mandated
		(2.5)	(0.4)	(2.5)	
		[82.8, 92.8]	[0.2, 2.1]	[6.6, 16.5]	
Item 27	Drinking Water	94	5	1	Not mandated
		(2.0)	(1.9)	(0.7)	
		[88.5, 97.0]	[2.3, 10.5]	[0.2, 3.9]	
Parks & Recreation					
Item 28	Park Access	12.4	51.2	36.4	Mandated, specific
		(2.9)	(4.1)	(3.4)	
		[7.7, 19.4]	[43.1, 59.3]	[29.9, 43.4]	
Item 29	SCORP	16.7	46	37.3	Mandated, general
		(3.4)	(4.4)	(4.0)	
		[11.0, 24.5]	[37.5, 54.9]	[29.6, 45.6]	
Item 30	Park Maintenance	50.5	41.7	7.8	Mandated, general
		(4.4)	(4.4)	(2.1)	
		[41.9, 59.1]	[33.3, 50.6]	[4.6, 13.0]	
Item 31	Parks New Development	34.6	29.4	36	Mandated, general
		(3.9)	(3.8)	(4.0)	

		[27.4, 42.7]	[22.3, 37.5]	[28.6, 44.2]	
Item 32	Promote Phys. Activity	60.9	26.2	12.8	Not mandated
		(4.2)	(3.8)	(2.2)	
		[52.4, 68.8]	[19.4, 34.5]	[9.1, 17.8]	
Health Care Access					
Item 33	Health Care Distribution	13.2	80.7	6.1	Mandated, specific
		(3.0)	(3.5)	(2.1)	
		[8.3, 20.4]	[72.8, 86.7]	[3.0, 11.8]	
Item 34	Health Care Access	59.4	28.2	12.4	Mandated, general
		(4.1)	(4.0)	(2.6)	
		[51.1, 67.2]	[20.9, 36.8]	[8.1, 18.6]	
Item 35	Aging in Place	35.7	18.3	46	Mandated, general
		(4.1)	(3.2)	(4.3)	
		[28.0, 44.3]	[12.8, 25.5]	[37.6, 54.6]	
Community Design					
Item 36	Mixed Use	16.8	17.6	65.6	Not mandated
		(3.4)	(3.4)	(4.2)	
		[11.1, 24.8]	[11.8, 25.5]	[56.7, 73.4]	
Item 37	Pedestrian Streetscape	40.6	19.2	40.2	Mandated, general
		(4.2)	(3.6)	(3.8)	
		[32.6, 49.0]	[13.1, 27.3]	[32.9, 48.1]	
Item 38	Compact Development	34.8	14.6	50.7	Not mandated
		(4.3)	(3.3)	(4.3)	
		[26.9, 43.6]	[9.2, 22.3]	[42.2, 59.2]	
Item 39	TOD	72	20.4	7.7	Not mandated
		(3.4)	(3.4)	(1.6)	
		[64.8, 78.2]	[14.4, 27.9]	[5.1, 11.4]	
Item 40	TND	47.9	24.3	27.8	Not mandated
		(4.2)	(3.4)	(3.2)	
		[39.7, 56.2]	[18.2, 31.8]	[21.8, 34.6]	
Item 41	Infill	16.7	25.8	57.5	Mandated, specific
		(3.5)	(3.9)	(4.3)	
		[10.8, 24.9]	[18.9, 34.2]	[48.8, 65.7]	

Item 42	Adaptive Reuse	35.5	28.8	35.7	Mandated, specific
		(4.2)	(4.0)	(4.0)	
		[27.6, 44.3]	[21.5, 37.4]	[28.2, 43.9]	
Item 43	Connectivity	31.9	38.4	29.8	Not mandated
		(4.1)	(4.2)	(4.1)	
		[24.3, 40.5]	[30.3, 47.1]	[22.4, 38.4]	
Item 45	Public Spaces	49	13.1	37.9	Not mandated
		(4.3)	(2.9)	(3.9)	
		[40.5, 57.6]	[8.3, 20.0]	[30.6, 45.8]	
Item 46	Street Trees	42.4	27.7	30	Not mandated
		(4.3)	(3.8)	(3.6)	
		[34.1, 51.1]	[20.8, 35.9]	[23.0, 37.6]	
Item 47	Natural Surveillance	86.6	4.1	9.4	Not mandated
		(2.4)	(1.7)	(1.8)	
		[81.1, 90.6]	[1.8, 9.0]	[6.4, 13.7]	
Item 48	Healthy Building Design	73.6	22.1	4.3	Not mandated
		(3.7)	(3.5)	(1.1)	
		[65.7, 80.2]	[15.9, 30.0]	[2.5, 7.2]	
Item 49	Healthy Comm. Design	96.4	3.1	0.5	Not mandated
		(1.4)	(1.4)	(0)	
		[92.1, 98.4]	[1.2, 7.7]	[0.5, 0.5]	
Item 50	Inter'gov't Collaboration	3.9	10	86.2	Mandated, specific
		(1.8)	(2.7)	(3.1)	
		[1.5, 9.3]	[5.8, 16.7]	[78.7, 91.4]	

Standard errors in parentheses. 95% confidence interval in brackets.
Items 7 and 44 excluded due to inadequate interrater reliability levels.

APPENDIX 6: WEIGHTED MEAN SCORING PERCENTAGES FOR ITEMS WITH DIFFERENT TYPES OF MANDATES IN THE WISCONSIN STATE STATUTE

	Score 0	Score 1	Score 2
Item is mandated with specific language	19.1 [10.4, 27.7]	33.4 [14.7, 52.1]	47.5 [28.5, 66.6]
Item is mandated with general language	35.7 [27.8, 43.5]	26.8 [21.4, 32.1]	37.6 [29.5, 45.6]
Item is not mandated	69.3 [59.4, 79.2]	14.9 [10.3, 19.5]	15.8 [8.8, 22.8]

95% confidence interval in brackets

APPENDIX 7: SUSTAINABLE DEVELOPMENT GOAL TARGETS

Target	Short description*	Full description
1.1	Eradicate extreme poverty	By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day
1.2	Halve relative poverty	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3	Social protection systems	Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable
1.4	Access to resources	By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance
1.5	Reduce vulnerability to shocks	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
1.a	Resources for developing countries	Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions

1.b	Policy frameworks for poverty eradication	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions
2.1	Food security	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
2.2	End malnutrition	By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
2.3	Productivity of small scale producers	By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment
2.4	Sustainable agriculture	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
2.5	Genetic diversity in agriculture	By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits

		arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed
2.a	Investment in ag in developing countries	Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
2.b	Correct trade restrictions	Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round
2.c	Regulate commodity markets	Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility
3.1	Maternal mortality	By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births
3.2	Newborn and child mortality	By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
3.3	Communicable disease	By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4	Noncommunicable disease	By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
3.5	Substance abuse	Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol
3.6	Road traffic injuries	By 2020, halve the number of global deaths and injuries from road traffic accidents
3.7	Reproductive health care	By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
3.8	Universal health coverage	Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
3.9	Toxic pollution	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
3.a	Tobacco control	Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate
3.b	Medicine and vaccines in developing countries	Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding

		flexibilities to protect public health, and, in particular, provide access to medicines for all
3.c	Health workforce in developing countries	Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States
3.d	Epidemic preparedness	Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks
4.1	Primary and secondary education	By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
4.2	Early childhood education	By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education
4.3	Tertiary education	By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university
4.4	Technical and vocational skills	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
4.5	Education disparities	By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

4.6	Literacy and numeracy	By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy
4.7	Education for sustainable development	By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development
4.a	Education facilities	Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all
4.b	Scholarships to developing countries	By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries
4.c	Qualified teachers	By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States
5.1	End gender discrimination	End all forms of discrimination against all women and girls everywhere
5.2	End gender violence	Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation

5.3	End harmful gendered practices	Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation
5.4	Disparities in unpaid labor	Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate
5.5	Women in leadership	Ensure women have full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life
5.6	Sexual and reproductive rights	Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences
5.a	Equal rights to economic resources	Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws
5.b	Tech for empowerment	Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women
5.c	Policies for equality	Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels
6.1	Safe drinking water	By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2	Sanitation	By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3	Water pollution	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	Water efficiency	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	Water resources management	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	Water-related ecosystems	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.a	Water capacity building for developing countries	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.b	Local community involvement	Support and strengthen the participation of local communities in improving water and sanitation management
7.1	Energy access	By 2030, ensure universal access to affordable, reliable and modern energy services

7.2	Renewable energy	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	Energy efficiency	By 2030, double the global rate of improvement in energy efficiency
7.a	International cooperation for clean energy	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.b	Modern energy for developing countries	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support
8.1	Economic growth	Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries
8.2	Economic productivity	Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
8.3	Development-oriented policies	Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
8.4	Improve resource efficiency	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental

		degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead
8.5	Full employment	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
8.6	Youth employment	By 2020, substantially reduce the proportion of youth not in employment, education or training
8.7	End forced employment	Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms
8.8	Labor rights and safe working conditions	Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment
8.9	Tourism	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products
8.10	Access to banking	Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all
8.a	Aid for Trade assistance	Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries

8.b	Global Jobs Pact	By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization
9.1	Quality infrastructure	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.2	Industrialization	Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
9.3	Small industry access	Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets
9.4	Sustainable industry and infrastructure	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
9.5	Research and development	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.a	Infrastructure support to developing countries	Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b	R&D in developing countries	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
9.c	Information technology in developing countries	Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020
10.1	Income growth for the poor	By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average
10.2	Inclusion for all	By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status
10.3	Equality of outcomes	Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard
10.4	Policies for equality	Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality
10.5	Regulate financial markets	Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations
10.6	Developing countries' representation	Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions

10.7	Safe migration	Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies
10.a	Special treatment for developing countries	Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements
10.b	Development assistance	Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes
10.c	Reduce migrant remittance costs	By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent
11.1	Safe, affordable housing	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
11.2	Accessible, sustainable transportation	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
11.3	Inclusive, integrated, sustainable urban planning	By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4	Cultural and natural heritage	Strengthen efforts to protect and safeguard the world's cultural and natural heritage
11.5	Disaster resilience	By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
11.6	Environmental impact of cities	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
11.7	Accessible parks and green spaces	By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities
11.a	Urban-rural linkages	Support positive economic, social and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning
11.b	Integrated climate change planning	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels
11.c	Resilient buildings in developing countries	Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials
12.1	10-year framework programs	Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2	Efficient use of natural resources	By 2030, achieve the sustainable management and efficient use of natural resources
12.3	Halve food waste	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
12.4	Chemical waste	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
12.5	Reduce, recycle, reuse	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
12.6	Company sustainability reporting	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
12.7	Sustainable public procurement	Promote public procurement practices that are sustainable, in accordance with national policies and priorities
12.8	Education for sustainable consumption	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
12.a	Science and technology for sustainable consumption	Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b	Sustainable tourism	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products
12.c	Rationalize fossil-fuel subsidies	Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities
13.1	Climate change resilience	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
13.2	National policies for climate change	Integrate climate change measures into national policies, strategies and planning
13.3	Climate change education	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
13.a	The Green Fund	Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
13.b	Climate change capacity in developing countries	Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

14.1	Reduce marine pollution	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
14.2	Protect marine ecosystems	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
14.3	Ocean acidification	Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels
14.4	End overfishing	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
14.5	Conserve coastal areas	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information
14.6	Correct fishery subsidies	By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation
14.7	Increase aid to marine-dependent countries	By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

14.a	Ocean health science and technology	Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries
14.b	Support small scale fishers	Provide access for small-scale artisanal fishers to marine resources and markets
14.c	Implement international ocean law	Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want
15.1	Conserve terrestrial and inland water ecosystems	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.2	Halt deforestation	By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally
15.3	Combat desertification and degraded soil	By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world
15.4	Conserve mountain ecosystems	By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

15.5	Halt biodiversity loss	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
15.6	Appropriate use of genetic resources	Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed
15.7	End poaching	Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products
15.8	Reduce invasive species	By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species
15.9	Ecosystem values in planning and development	By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts
15.a	Increase funding for ecosystems and biodiversity	Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems
15.b	Increase funding to forest management	Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation
15.c	Increase local capacity to combat poaching	Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

16.1	Reduce violence	Significantly reduce all forms of violence and related death rates everywhere
16.2	End abuse of children	End abuse, exploitation, trafficking and all forms of violence against and torture of children
16.3	Promote rule of law	Promote the rule of law at the national and international levels and ensure equal access to justice for all
16.4	Reduce illegal arms flow and organized crime	By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime
16.5	Reduce corruption	Substantially reduce corruption and bribery in all their forms
16.6	Transparent institutions	Develop effective, accountable and transparent institutions at all levels
16.7	Inclusive decision-making	Ensure responsive, inclusive, participatory and representative decision-making at all levels
16.8	Strengthen participation of developing countries	Broaden and strengthen the participation of developing countries in the institutions of global governance
16.9	Legal identity for all	By 2030, provide legal identity for all, including birth registration
16.10	Access to information	Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements
16.a	Strengthen national institutions for violence prevention	Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime

16.b	Non-discriminatory laws	Promote and enforce non-discriminatory laws and policies for sustainable development
17.1	Support capacity for tax collection	Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection
17.2	Provide development assistance to developing countries	Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of ODA/GNI to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries
17.3	Funding to developing countries	Mobilize additional financial resources for developing countries from multiple sources
17.4	Debt relief in developing countries	Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress
17.5	Invest in developing countries	Adopt and implement investment promotion regimes for least developed countries
17.6	Global science and technology cooperation	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7	Transfer sustainable technologies to developing countries	Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed
17.8	Technology bank for developing countries	Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology
17.9	Capacity building for developing countries	Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation
17.10	Fair global trading	Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda
17.11	Increase exports from developing countries	Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020
17.12	Facilitate market access for least developed countries	Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access
17.13	Global macroeconomic stability	Enhance global macroeconomic stability, including through policy coordination and policy coherence

17.14	Policy coherence	Enhance policy coherence for sustainable development
17.15	Respect country policy agency	Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development
17.16	Global multistakeholder partnerships	Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries
17.17	Public, private, civil society partnerships	Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships
17.18	Data for developing countries	By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts
17.19	Measure progress on SDGs	By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries

Source: https://sdgs.un.org/goals
*Short descriptions are author's own.

APPENDIX 8: METHODOLOGICAL DETAILS FOR SCOPING REVIEW

Phase two Boolean search strings

Web of Science

TS=(*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access" or "physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*" or obesity or "chronic disease*" or "non-communicable disease*" or ((urban or city) and (health or liveability))) AND TS=(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND TI=("sustainable development goals" or "sdgs")

PubMed

(("sustainable development goals"[Title] OR "sdgs"[Title]) AND ((*nutrition[Title/Abstract] OR "healthy diet"[Title/Abstract] OR "healthy eating"[Title/Abstract] OR "food security"[Title/Abstract] OR "food access"[Title/Abstract] OR "physical activity"[Title/Abstract] OR "active living"[Title/Abstract] OR exercis*[Title/Abstract] OR "active transportation"[Title/Abstract] OR recreation*[Title/Abstract] OR "active play*"[Title/Abstract] OR obesity[Title/Abstract] OR "chronic disease*"[Title/Abstract] OR "non-communicable disease*"[Title/Abstract] OR ((urban[Title/Abstract] OR city[Title/Abstract]) AND (health[Title/Abstract] OR liveability[Title/Abstract]))) OR (*nutrition[Other Term] OR "healthy diet"[Other Term] OR "healthy eating"[Other Term] OR "food security"[Other Term] OR "food access"[Other Term] OR "physical activity"[Other Term] OR "active living"[Other Term] OR exercis*[Other Term] OR "active transportation"[Other Term] OR recreation*[Other Term] OR "active play*"[Other Term] OR obesity[Other Term] OR "chronic disease*"[Other Term] OR "non-communicable disease*"[Other Term] OR ((urban[Other Term] OR city[Other Term]) AND (health[Other Term] OR liveability[Other Term])))) AND ((((urban[Title/Abstract] OR city[Title/Abstract] OR community[Title/Abstract] OR regional[Title/Abstract]) AND (planning[Title/Abstract] OR design[Title/Abstract] OR policy[Title/Abstract])) OR "built environment*"[Title/Abstract]) OR (((urban[Other Term] OR city[Other Term] OR community[Other Term] OR regional[Other Term]) AND (planning[Other Term] OR design[Other Term] OR policy[Other Term])) OR "built environment*"[Other Term]))

ProQuest

title("sustainable development goals" or "sdgs") AND (summary(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") or title(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") or if(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")) AND (summary((nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active

transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))) or title((nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))) or if((nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))))

EBSCOhost

Options: Boolean/Phrase search mode; Unselect “Apply equivalent subjects”

TI (("sustainable development goals" OR "sdgs")) AND (AB (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") OR TI (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") OR KW (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")) AND (AB ((*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))) OR TI ((*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))) OR KW ((*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") OR ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") OR (obesity or "chronic disease*" or "non-communicable disease*") OR ((urban or city) and (health or liveability))))

Scopus

(TITLE ("sustainable development goals" OR "sdgs") AND TITLE-ABS-KEY (*nutrition OR "healthy diet" OR "healthy eating" OR "food security" OR "food access" OR "physical activity" OR "active living" OR exercis* OR "active transportation" OR recreation* OR "active play*" OR obesity OR "chronic disease*" OR "non-communicable disease*" OR ((urban OR city) AND (health OR liveability))) AND TITLE-ABS-KEY (((urban OR city OR community OR regional) AND (planning OR design OR policy)) OR "built environment*"))

Google Scholar

Healthy eating: (intitle:"sdgs" or intitle:"sustainable development goals") AND (*nutrition or "healthy diet" or "healthy eating" or "food security" or "food access") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")

Active living: (intitle:"sdgs" or intitle:"sustainable development goals") AND ("physical activity" or "active living" or exercis* or "active transportation" or recreation* or "active play*") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")

Obesity and chronic disease: (intitle:"sdgs" or intitle:"sustainable development goals") AND (obesity or "chronic disease*" or "non-communicable disease*") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")

Urban health and liveability: (intitle:"sdgs" or intitle:"sustainable development goals") AND ((urban or city) and (health or liveability)) AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")

Phase three Boolean search strings

Web of Science

((TS=(“bik*” OR “walk*” OR “bicycl*” OR “pedestrian*” OR “transit” OR “public transport*” OR “complete street*” OR “traffic calm*” OR “safe routes to schools” OR “farm* preserv*” OR ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*)) OR “local food*” OR “food desert*” OR “food swamp*” OR “healthy food access” OR “community garden*” OR “farmer* market*” OR “parks*” OR “recreat*” OR “open space*” OR “green space*” OR “playground*” OR “health care access” OR (“access to” and (“health care” or “health service*”)) OR “aging in place” OR “age-friendly” OR “mixed use*” OR “compact development*” OR “smart growth” OR “transit-oriented development*” OR “transit-oriented design*” or “traditional neighborhood development*” OR “new urbanis*” OR “infill” OR “adaptive reuse” OR “third place*” OR “third space*” OR “public space*” OR “street tree*” OR “urban canop*” OR “tree city” OR “natural surveillance” OR “eyes on the street” OR “healthy building design” OR “healthy community design” OR “activity hub*” OR “Main Street*” OR “town center” OR “historic downtown” OR “designated growth area*” OR “conservation subdivision*” OR “rural home cluster*” OR “sprawl*”)) AND TS=(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")) AND TI=("sustainable development goals" or "sdgs")

PubMed

(((((("bike*"[Title/Abstract] OR "biking*"[Title/Abstract] OR "walk*"[Title/Abstract] OR "bicycl*"[Title/Abstract] OR "pedestrian*"[Title/Abstract] OR "transit"[Title/Abstract] OR "public transport*"[Title/Abstract] OR "complete street*"[Title/Abstract] OR "traffic calm*"[Title/Abstract] OR "safe routes to schools"[Title/Abstract] OR "farm* preserv*"[Title/Abstract] OR (("urban"[Title/Abstract] OR "specialty"[Title/Abstract] OR "non-commodity"[Title/Abstract]) AND (agri*[Title/Abstract] OR farm*[Title/Abstract] OR garden*[Title/Abstract])) OR "local food*"[Title/Abstract] OR "food desert*"[Title/Abstract] OR "food swamp*"[Title/Abstract] OR "healthy food access"[Title/Abstract] OR "community

garden*"[Title/Abstract] OR "farmer* market*"[Title/Abstract] OR "parks*"[Title/Abstract] OR "recreat*"[Title/Abstract] OR "open space*"[Title/Abstract] OR "green space*"[Title/Abstract] OR "playground*"[Title/Abstract] OR "health care access"[Title/Abstract] OR ("access to"[Title/Abstract] AND ("health care"[Title/Abstract] OR "health service*"[Title/Abstract])) OR "aging in place"[Title/Abstract] OR "age-friendly"[Title/Abstract] OR "mixed use*"[Title/Abstract] OR "compact development*"[Title/Abstract] OR "smart growth"[Title/Abstract] OR "transit-oriented development*"[Title/Abstract] OR "transit-oriented design*"[Title/Abstract] OR "traditional neighborhood development*"[Title/Abstract] OR "new urbanis*"[Title/Abstract] OR "infill"[Title/Abstract] OR "adaptive reuse"[Title/Abstract] OR "third place*"[Title/Abstract] OR "third space*"[Title/Abstract] OR "public space*"[Title/Abstract] OR "street tree*"[Title/Abstract] OR "urban canop*"[Title/Abstract] OR "tree city"[Title/Abstract] OR "natural surveillance"[Title/Abstract] OR "eyes on the street"[Title/Abstract] OR "healthy building design"[Title/Abstract] OR "healthy community design"[Title/Abstract] OR "activity hub*"[Title/Abstract] OR "Main Street*"[Title/Abstract] OR "town center"[Title/Abstract] OR "historic downtown"[Title/Abstract] OR "designated growth area*"[Title/Abstract] OR "conservation subdivision*"[Title/Abstract] OR "rural home cluster*"[Title/Abstract] OR "sprawl*"[Title/Abstract]) OR ("bike*"[Other Term] OR "biking*"[Other Term] OR "walk*"[Other Term] OR "bicycl*"[Other Term] OR "pedestrian*"[Other Term] OR "transit"[Other Term] OR "public transport*"[Other Term] OR "complete street*"[Other Term] OR "traffic calm*"[Other Term] OR "safe routes to schools"[Other Term] OR "farm* preserv*"[Other Term] OR (("urban"[Other Term] OR "specialty"[Other Term] OR "non-commodity"[Other Term]) AND (agri*[Other Term] OR farm*[Other Term] OR garden*[Other Term])) OR "local food*"[Other Term] OR "food desert*"[Other Term] OR "food swamp*"[Other Term] OR "healthy food access"[Other Term] OR "community garden*"[Other Term] OR "farmer* market*"[Other Term] OR "parks*"[Other Term] OR "recreat*"[Other Term] OR "open space*"[Other Term] OR "green space*"[Other Term] OR "playground*"[Other Term] OR "health care access"[Other Term] OR ("access to"[Other Term] AND ("health care"[Other Term] OR "health service*"[Other Term])) OR "aging in place"[Other Term] OR "age-friendly"[Other Term] OR "mixed use*"[Other Term] OR "compact development*"[Other Term] OR "smart growth"[Other Term] OR "transit-oriented development*"[Other Term] OR "transit-oriented design*"[Other Term] OR "traditional neighborhood development*"[Other Term] OR "new urbanis*"[Other Term] OR "infill"[Other Term] OR "adaptive reuse"[Other Term] OR "third place*"[Other Term] OR "third space*"[Other Term] OR "public space*"[Other Term] OR "street tree*"[Other Term] OR "urban canop*"[Other Term] OR "tree city"[Other Term] OR "natural surveillance"[Other Term] OR "eyes on the street"[Other Term] OR "healthy building design"[Other Term] OR "healthy community design"[Other Term] OR "activity hub*"[Other Term] OR "Main Street*"[Other Term] OR "town center"[Other Term] OR "historic downtown"[Other Term] OR "designated growth area*"[Other Term] OR "conservation subdivision*"[Other Term] OR "rural home cluster*"[Other Term] OR "sprawl*"[Other Term]))) AND ((((urban[Title/Abstract] OR city[Title/Abstract] OR community[Title/Abstract] OR regional[Title/Abstract]) AND (planning[Title/Abstract] OR design[Title/Abstract] OR policy[Title/Abstract])) OR "built environment*"[Title/Abstract])) OR (((urban[Other Term] OR city[Other Term] OR community[Other Term] OR regional[Other Term]) AND (planning[Other Term] OR design[Other Term] OR policy[Other Term])) OR "built environment*"[Other Term]))) AND ("sustainable development goals"[Title] OR "sdgs"[Title])

ProQuest

(summary("bik*" OR "walk*" OR "bicycl*" OR "pedestrian*" OR "transit" OR "public transport*" OR "complete street*" OR "traffic calm*" OR "safe routes to schools" OR "farm* preserv*" OR (("urban" OR "specialty" OR "non-commodity") AND (agri* OR farm* OR garden*)) OR "local food*" OR "food desert*" OR "food swamp*" OR "healthy food access" OR "community garden*" OR "farmer* market*" OR "parks*" OR "recreat*" OR "open space*" OR "green space*" OR "playground*" OR "health care access" OR ("access to" AND ("health care" OR "health service*")) OR "aging in place" OR "age-friendly" OR "mixed use*" OR "compact development*" OR "smart growth" OR "transit-oriented development*" OR "transit-oriented design*" OR "traditional neighborhood development*" OR "new urbanis*" OR "infill" OR "adaptive reuse" OR "third place*" OR "third space*" OR "public space*" OR "street tree*" OR "urban canop*" OR "tree city" OR "natural surveillance" OR "eyes on the street" OR "healthy building design" OR "healthy community design" OR "activity hub*" OR "Main Street*" OR "town center" OR "historic downtown" OR "designated growth area*" OR "conservation subdivision*" OR "rural home cluster*" OR "sprawl*") OR title("bik*" OR "walk*" OR "bicycl*" OR "pedestrian*" OR "transit" OR "public transport*" OR "complete street*" OR "traffic calm*" OR "safe routes to schools" OR "farm* preserv*" OR (("urban" OR "specialty" OR "non-commodity") AND (agri* OR farm* OR garden*)) OR "local food*" OR "food desert*" OR "food swamp*" OR "healthy food access" OR "community garden*" OR "farmer* market*" OR "parks*" OR "recreat*" OR "open space*" OR "green space*" OR "playground*" OR "health care access" OR ("access to" AND ("health care" OR "health service*")) OR "aging in place" OR "age-friendly" OR "mixed use*" OR "compact development*" OR "smart growth" OR "transit-oriented development*" OR "transit-oriented design*" OR "traditional neighborhood development*" OR "new urbanis*" OR "infill" OR "adaptive reuse" OR "third place*" OR "third space*" OR "public space*" OR "street tree*" OR "urban canop*" OR "tree city" OR "natural surveillance" OR "eyes on the street" OR "healthy building design" OR "healthy community design" OR "activity hub*" OR "Main Street*" OR "town center" OR "historic downtown" OR "designated growth area*" OR "conservation subdivision*" OR "rural home cluster*" OR "sprawl*") OR if("bik*" OR "walk*" OR "bicycl*" OR "pedestrian*" OR "transit" OR "public transport*" OR "complete street*" OR "traffic calm*" OR "safe routes to schools" OR "farm* preserv*" OR (("urban" OR "specialty" OR "non-commodity") AND (agri* OR farm* OR garden*)) OR "local food*" OR "food desert*" OR "food swamp*" OR "healthy food access" OR "community garden*" OR "farmer* market*" OR "parks*" OR "recreat*" OR "open space*" OR "green space*" OR "playground*" OR "health care access" OR ("access to" AND ("health care" OR "health service*")) OR "aging in place" OR "age-friendly" OR "mixed use*" OR "compact development*" OR "smart growth" OR "transit-oriented development*" OR "transit-oriented design*" OR "traditional neighborhood development*" OR "new urbanis*" OR "infill" OR "adaptive reuse" OR "third place*" OR "third space*" OR "public space*" OR "street tree*" OR "urban canop*" OR "tree city" OR "natural surveillance" OR "eyes on the street" OR "healthy building design" OR "healthy community design" OR "activity hub*" OR "Main Street*" OR "town center" OR "historic downtown" OR "designated growth area*" OR "conservation subdivision*" OR "rural home cluster*" OR "sprawl*")) AND (summary(((urban OR city OR community OR regional) AND (planning OR design OR policy)) OR "built environment*") OR title(((urban OR city OR community OR regional) AND (planning OR design OR policy)) OR "built environment*") OR if(((urban OR

city OR community OR regional) AND (planning OR design OR policy)) OR "built environment*")) AND title("sustainable development goals" OR "sdgs")

EBSCOhost

Options: Boolean/Phrase search mode; Unselect “Apply equivalent subjects”

(TI (“bik*” OR “walk*” OR “bicycl*” OR “pedestrian*” OR “transit” OR “public transport*” OR “complete street*” OR “traffic calm*” OR “safe routes to schools” OR “farm* preserv*” OR ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*)) OR “local food*” OR “food desert*” OR “food swamp*” OR “healthy food access” OR “community garden*” OR “farmer* market*” OR “parks*” OR “recreat*” OR “open space*” OR “green space*” OR “playground*” OR “health care access” OR (“access to” and (“health care” or “health service*”)) OR “aging in place” OR “age-friendly” OR “mixed use*” OR “compact development*” OR “smart growth” OR “transit-oriented development*” OR “transit-oriented design*” or “traditional neighborhood development*” OR “new urbanis*” OR “infill” OR “adaptive reuse” OR “third place*” OR “third space*” OR “public space*” OR “street tree*” OR “urban canop*” OR “tree city” OR “natural surveillance” OR “eyes on the street” OR “healthy building design” OR “healthy community design” OR “activity hub*” OR “Main Street*” OR “town center” OR “historic downtown” OR “designated growth area*” OR “conservation subdivision*” OR “rural home cluster*” OR “sprawl*”) OR AB (“bik*” OR “walk*” OR “bicycl*” OR “pedestrian*” OR “transit” OR “public transport*” OR “complete street*” OR “traffic calm*” OR “safe routes to schools” OR “farm* preserv*” OR ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*)) OR “local food*” OR “food desert*” OR “food swamp*” OR “healthy food access” OR “community garden*” OR “farmer* market*” OR “parks*” OR “recreat*” OR “open space*” OR “green space*” OR “playground*” OR “health care access” OR (“access to” and (“health care” or “health service*”)) OR “aging in place” OR “age-friendly” OR “mixed use*” OR “compact development*” OR “smart growth” OR “transit-oriented development*” OR “transit-oriented design*” or “traditional neighborhood development*” OR “new urbanis*” OR “infill” OR “adaptive reuse” OR “third place*” OR “third space*” OR “public space*” OR “street tree*” OR “urban canop*” OR “tree city” OR “natural surveillance” OR “eyes on the street” OR “healthy building design” OR “healthy community design” OR “activity hub*” OR “Main Street*” OR “town center” OR “historic downtown” OR “designated growth area*” OR “conservation subdivision*” OR “rural home cluster*” OR “sprawl*”) OR KW (“bik*” OR “walk*” OR “bicycl*” OR “pedestrian*” OR “transit” OR “public transport*” OR “complete street*” OR “traffic calm*” OR “safe routes to schools” OR “farm* preserv*” OR ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*)) OR “local food*” OR “food desert*” OR “food swamp*” OR “healthy food access” OR “community garden*” OR “farmer* market*” OR “parks*” OR “recreat*” OR “open space*” OR “green space*” OR “playground*” OR “health care access” OR (“access to” and (“health care” or “health service*”)) OR “aging in place” OR “age-friendly” OR “mixed use*” OR “compact development*” OR “smart growth” OR “transit-oriented development*” OR “transit-oriented design*” or “traditional neighborhood development*” OR “new urbanis*” OR “infill” OR “adaptive reuse” OR “third place*” OR “third space*” OR “public space*” OR “street tree*” OR “urban canop*” OR “tree city” OR “natural surveillance” OR “eyes on the street” OR “healthy building design” OR “healthy community design” OR “activity hub*” OR

“Main Street*” OR “town center” OR “historic downtown” OR “designated growth area*” OR “conservation subdivision*” OR “rural home cluster*” OR “sprawl*”)) AND (TI (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") OR AB (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") OR KW (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*")) AND (TI ("sustainable development goals" or "sdgs")

Scopus

TITLE-ABS-KEY("bik*" OR "walk*" OR "bicycl*" OR "pedestrian*" OR "transit" OR "public transport*" OR "complete street*" OR "traffic calm*" OR "safe routes to schools" OR "farm* preserv*" OR (("urban" or "specialty" or "non-commodity") and (agri* or farm* or garden*)) OR "local food*" OR "food desert*" OR "food swamp*" OR "healthy food access" OR "community garden*" OR "farmer* market*" OR "parks*" OR "recreat*" OR "open space*" OR "green space*" OR "playground*" OR "health care access" OR ("access to" and ("health care" or "health service*")) OR "aging in place" OR "age-friendly" OR "mixed use*" OR "compact development*" OR "smart growth" OR "transit-oriented development*" OR "transit-oriented design*" or "traditional neighborhood development*" OR "new urbanis*" OR "infill" OR "adaptive reuse" OR "third place*" OR "third space*" OR "public space*" OR "street tree*" OR "urban canop*" OR "tree city" OR "natural surveillance" OR "eyes on the street" OR "healthy building design" OR "healthy community design" OR "activity hub*" OR "Main Street*" OR "town center" OR "historic downtown" OR "designated growth area*" OR "conservation subdivision*" OR "rural home cluster*" OR "sprawl*") AND TITLE-ABS-KEY(((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND TITLE("sustainable development goals" or "sdgs")

Google Scholar

Exceeded limits for exporting citation information from Google Scholar, so instead I reviewed the titles for each search and saved to my Google Library those that seem relevant. From my Google Library, exported citation information to Zotero.

Active transportation1: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“bike” OR “biking” OR “walk” OR “walking” OR “bicycle” OR “bicycling” OR “pedestrian*”)

Active transportation2: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“transit” OR “public transport*” OR “complete street*” OR “traffic calm*” OR “safe routes to schools”)

Healthy food access1: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND ((“urban” or “specialty” or “non-commodity”) and (agri* or farm* or garden*))

Healthy food access2: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“farmland preservation” OR “local food*” OR “food desert*” OR “food swamp*” OR “healthy food access” OR “community garden*” OR “farmer* market*”)

Parks and recreation: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“parks*” OR “recreat*” OR “open space*” OR “green space*” OR “playground*”)

Health care access: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“health care access” OR (“access to” and (“health care” or “health service*”)) OR “aging in place” OR “age-friendly”)

Community design1: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“mixed use*” OR “compact development*” OR “smart growth” OR “transit-oriented development*” OR “transit-oriented design*” or “traditional neighborhood development*”)

Community design2: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“new urbanis*” OR “infill” OR “adaptive reuse” OR “third place*” OR “third space*” OR “public space*”)

Community design3: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“street tree*” OR “urban canop*” OR “tree city” OR “natural surveillance” OR “eyes on the street”)

Community design4: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“healthy building design” OR “healthy community design” OR “activity hub*” OR “Main Street*” OR “town center” OR “historic downtown”)

Community design5: (intitle:"sdgs" or intitle:"sustainable development goals") AND (((urban or city or community or regional) and (planning or design or policy)) OR "built environment*") AND (“designated growth area*” OR “conservation subdivision*” OR “rural home cluster*” OR “sprawl*”)

Database-specific search results

Table A8.1: Phase two search results

Database name	Platform	Date of search	# of results
Web of Science Core Collection	Clarivate	12/1/2023	140
Scopus	Elsevier	12/1/2023	188
PubMed	NIH	12/1/2023	27
PAIS	ProQuest	12/4/2023	15
Sustainability Science Abstracts	ProQuest	12/4/2023	5
Worldwide Political Science Abstracts	ProQuest	12/4/2023	0
ProQuest Dissertations & Theses Global	ProQuest	12/4/2023	2
SocIndex	EBSCOhost	12/1/2023	3
GreenFile	EBSCOhost	12/1/2023	7
Google Scholar		12/1/2023	25
Total			413
Total after removing duplicates			267

Table A8.2: Phase three search results

Database name	Platform	Date of search	# of results
Web of Science Core Collection	Clarivate	12/11/2023	58
Scopus	Elsevier	12/11/2023	95
PubMed	NIH	12/11/2023	18
PAIS	ProQuest	12/11/2023	5
Sustainability Science Abstracts	ProQuest	12/11/2023	0
Worldwide Political Science Abstracts	ProQuest	12/11/2023	0
ProQuest Dissertations & Theses Global	ProQuest	12/11/2023	1
SocIndex	EBSCOhost	12/11/2023	2
GreenFile	EBSCOhost	12/11/2023	3
Google Scholar		12/11/2023	31
Total			213
Total after removing duplicates			151
Total after removing duplicates from phase two			99

Description of tags for data charting

Table A8.3: Description of tags applied in Zotero for data charting and extraction

Code	Description
author-affiliations	Institutional affiliations of author(s)
topic	Topic author(s) is linking to the SDGs
methods	Methods used in research
geo-pop-focus	Geographic and/or population focus
conceptual-framework-sdg	Any conceptual framework regarding the SDGs, sustainability, or SDG interconnections broadly speaking
conceptual-framework-topic	Any conceptual framework regarding the topic or the connection between the topic and the SDGs
visualization	Any type of visualization used to show the connection between the topic and the SDGs
sdg1, sdg2, sdg3…	An instance relating the topic to the SDG
target1.1, target1.2, target2.1, target2.2…	An instance relating the topic to an SDG target
sdg-interconnections	Background information, quotes, or resources about interconnections among SDGs or between SDGs and related topics
sdg-localization	Background information, quotes, or resources about the process of localizing the SDGs

APPENDIX 9: DETAILED INFORMATION ABOUT ULTRA-HIGH-INCOME MUNICIPALITIES

The three municipalities excluded from some regression models due to their ultra-high incomes are River Hills village in Milwaukee County, Maple Bluff village in Dane County, and Shorewood Hills in Dane County. These three municipalities' plan scores and values for dependent variables and covariates can be found in Tables A9.1 and A9.2.

Table A9.1: Plan scores for ultra-high-income municipalities.

	River Hills village		**Maple Bluff village**		**Shorewood Hills village**		**Statewide mean**	
	Compr	Stren	Compr	Stren	Compr	Stren	Compr	Stren
Vision & Strategy	0	0	0	0	33.3	25.0	31.2	26.6
Active Transportation	0	0	38.5	19.2	53.8	50.0	56.2	43.2
Healthy Food Access	0	0	0	0	12.5	6.3	27.0	21.5
Parks & Recreation	0	0	80.0	60.0	40.0	20.0	65.3	45.8
Health Care Access	66.7	33.3	0	0	66.7	33.3	61.2	40.2
Community Design	6.7	6.7	20.0	13.3	66.7	50.0	51.5	41.7
Overall	6.0	4.0	24.0	15.0	48.0	36.0	48.3	37.4

Table A9.2: Dependent variable and covariate values for ultra-high-income municipalities.

	River Hills village	**Maple Bluff village**	**Shorewood Hills village**	**Statewide mean**
Dependent variables (%)				
Park accessibility	46.2	94.4	93.8	56.6
Food accessibility	15.3	1.67	77.3††	21.7
Walkability	0†	100††	100††	19.6
Active commuting	2.28	10.6	31.0††	4.62
Bike/ped danger	0.13	0.08	0.82	0.12
Obesity	25.6	37.7	22.2†	40.8
Covariates				
Median income	$161,719††	$152,750	$123,200	$67,258
Median age	50.9	50.1	40.3	39.5
% Black	13.6	0.93	2.24	2.74
% Urban	100††	100††	100††	75.3
% Bike/ped commute	2.31	4.87	29.3††	3.49

† indicates minimum in dataset
†† indicates maximum in dataset

River Hills village is a North Shore community approximately 11 miles north of Milwaukee. The center of the community is the Milwaukee Country Club, which relocated from Shorewood to the area that is now River Hills in 1911 (Nelson, 2016). The village incorporated in 1930 and strives to maintain a rural character. It is zoned completely residential and requires large lots for houses (Village of River Hills Plan Commission, 2019). Eighty-five percent of homes are on lots of five acres or more, with the remaining 15 percent on lots of one acre or

more (Nelson, 2016). The population was 1,602 at the 2020 Census and the total land area in the village is 5.5 square miles.

Maple Bluff village is about 0.7 square miles along the shore of Lake Mendota, embedded in the north side of Madison. Several prominent Madison families owned land in what is now Maple Bluff since the mid-1800s and the area officially incorporated as the Village of Maple Bluff in 1931 (McLean, 1995). The Maple Bluff Golf Course was established in 1899 and, now the Maple Bluff Country Club, is still central to the village and one of the only commercial properties in the municipality (McLean, 1995; Schreiber/Anderson Associates, Inc., 2003). The population of Maple Bluff was 1,368 at the 2020 Census.

Shorewood Hills village is about 0.8 square miles directly to the west of the University of Wisconsin-Madison, embedded in the west side of Madison and occupying some of the Lake Mendota shoreline. What is now the village was first developed by John C. McKenna from former agricultural land as two purpose-built residential neighborhoods: College Hills in 1912 and Shorewood in 1915 (Cass, 1927; MSA Professional Services, Inc., 2021). As the neighborhoods were developing, the adjacent Blackhawk Country Club was established as well in 1921 (Wierwill, 2016). In 1927, the Village of Shorewood Hills was officially incorporated and in 1932 the village annexed the land of the country club (Village of Shorewood Hills, 2014; Wierwill, 2016). The village is primarily zoned as single-family residential with a small area of commercially zoned land along University Avenue, as well as the commercially zoned country club and several areas zoned as public, institutional, or university (MSA Professional Services, Inc., 2021). The population of Shorewood Hills was 2,169 at the 2020 Census.

References

Cass, B. (1927, July 27). He Built A Village of Dreams. *The Wisconsin State Journal*, 23.

McLean, D. (1995). Maple Bluff: Madison's beautiful north shore suburb. *Historic Madison: The Journal of the Four Lakes Region*, *12*.

MSA Professional Services, Inc. (2021). *Village of Shorewood Hills 2021 Comprehensive Plan*. Village of Shorewood Hills. https://www.shorewood-hills.org/index.asp?SEC=D24FE231-0E53-48F1-A51C-FAC937EE17B2&Type=B_BASIC

Nelson, J. K. (2016). Village of River Hills. In *Encyclopedia of Milwaukee*. University of Wisconsin-Milwaukee. https://emke.uwm.edu/entry/village-of-river-hills/

Schreiber/Anderson Associates, Inc. (2003). *Comprehensive Plan 2025: Village of Maple Bluff, Wisconsin*. Village of Maple Bluff. https://villageofmaplebluff.com/plan-commission/

Village of River Hills Plan Commission. (2019). *Village of River Hills Comprehensive Plan*. Village of River Hills. https://riverhillswi.com/

Village of Shorewood Hills. (2014). *Village Heritage*. The Village of Shorewood Hills Wisconsin. https://www.shorewood-hills.org/?SEC=9167A934-66D5-43AC-BE54-E34B625D271D

Wierwill, B. (2016). *A History of Blackhawk Country Club*. Blackhawk Country Club. www.blackhawkcc.com

APPENDIX 10: REGRESSION RESULTS FOR COMPREHENSIVE PLAN SCORES AND SDG-RELATED OUTCOMES

Table A10.1: Odds ratios of park accessibility.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. income outliers)
Vision & Strategy	**1.33***	1.23	**1.31***	**1.35****	1.32	1.28	**1.39****	**1.45****
	[1.04,1.71]	[0.97,1.56]	[1.06,1.62]	[1.09,1.68]	[0.99,1.76]	[0.99,1.65]	[1.11,1.74]	[1.15,1.82]
	(0.024)	(0.084)	(0.013)	(0.007)	(0.058)	(0.064)	(0.005)	(0.002)
Active Transportation	**1.26***	**1.26***	**1.30****	**1.31****	**1.38***	**1.30***	**1.33***	**1.35***
	[1.02,1.54]	[1.04,1.52]	[1.11,1.54]	[1.11,1.54]	[1.08,1.76]	[1.01,1.67]	[1.06,1.67]	[1.07,1.70]
	(0.029)	(0.018)	(0.002)	(0.001)	(0.011)	(0.041)	(0.016)	(0.012)
Healthy Food Access	**1.46*****	**1.44*****	**1.40*****	**1.42*****	**1.45*****	**1.44*****	**1.38*****	**1.41*****
	[1.22,1.75]	[1.23,1.68]	[1.20,1.65]	[1.20,1.69]	[1.19,1.77]	[1.21,1.72]	[1.15,1.65]	[1.17,1.70]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Parks & Recreation	1.04	**1.29*****	**1.31*****	**1.29*****	1.11	**1.39****	**1.40*****	**1.40*****
	[0.89,1.21]	[1.13,1.48]	[1.16,1.48]	[1.14,1.47]	[0.91,1.36]	[1.14,1.70]	[1.16,1.69]	[1.16,1.69]
	(0.641)	(0.000)	(0.000)	(0.000)	(0.296)	(0.001)	(0.001)	(0.001)
Health Care Access	0.98	0.96	0.93	0.94	1.13	1.05	1.01	1.03
	[0.85,1.12]	[0.86,1.09]	[0.82,1.05]	[0.83,1.07]	[0.95,1.34]	[0.91,1.22]	[0.87,1.18]	[0.88,1.21]
	(0.737)	(0.548)	(0.219)	(0.371)	(0.161)	(0.479)	(0.862)	(0.719)
Community Design	**1.48*****	**1.39*****	**1.46*****	**1.52*****	**1.70*****	**1.59*****	**1.58*****	**1.79*****
	[1.21,1.81]	[1.18,1.64]	[1.26,1.70]	[1.30,1.77]	[1.37,2.11]	[1.33,1.90]	[1.34,1.87]	[1.52,2.10]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Overall	**1.50****	**1.52*****	**1.58*****	**1.64*****	**1.72*****	**1.69*****	**1.76*****	**1.85*****
	[1.17,1.94]	[1.26,1.83]	[1.34,1.87]	[1.38,1.95]	[1.29,2.28]	[1.33,2.13]	[1.42,2.17]	[1.50,2.28]
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
n	115	114	114	111	115	114	114	111

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

Table A10.2: Odds ratios of food accessibility.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)
Vision & Strategy	**1.69****	**1.64***	**1.59***	**1.53***	**1.58***	**1.58***	1.53	1.47
	[1.17,2.44]	[1.08,2.47]	[1.08,2.33]	[1.03,2.27]	[1.03,2.43]	[1.00,2.50]	[0.99,2.36]	[0.95,2.27]
	(0.006)	(0.019)	(0.018)	(0.034)	(0.038)	(0.049)	(0.054)	(0.086)
Active Transportation	1.31	**1.43***	**1.35***	**1.37***	1.35	**1.46***	1.37	1.34
	[0.98,1.74]	[1.04,1.96]	[1.01,1.82]	[1.02,1.84]	[0.98,1.86]	[1.01,2.13]	[0.96,1.95]	[0.94,1.91]
	(0.069)	(0.029)	(0.045)	(0.039)	(0.070)	(0.047)	(0.080)	(0.100)
Healthy Food Access	**1.37***	**1.40***	**1.38***	**1.39***	**1.51****	**1.59****	**1.56****	**1.58****
	[1.08,1.74]	[1.08,1.83]	[1.07,1.79]	[1.07,1.79]	[1.15,1.98]	[1.18,2.14]	[1.17,2.06]	[1.19,2.09]
	(0.011)	(0.013)	(0.013)	(0.013)	(0.004)	(0.002)	(0.002)	(0.002)
Parks & Recreation	0.90	1.05	1.02	1.07	1.13	1.34	1.23	1.37
	[0.69,1.18]	[0.78,1.41]	[0.77,1.35]	[0.81,1.42]	[0.83,1.54]	[0.94,1.90]	[0.87,1.74]	[0.99,1.91]
	(0.435)	(0.741)	(0.911)	(0.623)	(0.424)	(0.103)	(0.234)	(0.061)
Health Care Access	1.11	1.19	1.13	1.08	1.13	1.19	1.20	1.16
	[0.86,1.44]	[0.91,1.55]	[0.86,1.48]	[0.82,1.43]	[0.85,1.50]	[0.88,1.60]	[0.88,1.62]	[0.85,1.58]
	(0.415)	(0.209)	(0.366)	(0.572)	(0.381)	(0.257)	(0.242)	(0.332)
Community Design	1.18	1.23	1.25	1.19	1.32	1.34	1.35	1.30
	[0.87,1.58]	[0.88,1.71]	[0.88,1.76]	[0.83,1.70]	[0.96,1.83]	[0.92,1.95]	[0.91,2.02]	[0.87,1.95]
	(0.279)	(0.222)	(0.206)	(0.329)	(0.087)	(0.124)	(0.137)	(0.199)
Overall	1.37	**1.54***	1.50	1.49	**1.55***	**1.73***	**1.68***	**1.67***
	[0.94,2.00]	[1.01,2.37]	[0.99,2.27]	[0.98,2.27]	[1.04,2.33]	[1.07,2.79]	[1.05,2.69]	[1.05,2.67]
	(0.097)	(0.047)	(0.055)	(0.065)	(0.033)	(0.025)	(0.030)	(0.031)
n	115	114	114	111	115	114	114	111

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

Table A10.3: Odds ratios of walkability.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)
Vision & Strategy	1.66	1.42	1.39	**1.80***	1.60	1.52	1.45	**2.01***
	[0.78,3.55]	[0.73,2.77]	[0.76,2.52]	[1.04,3.12]	[0.68,3.76]	[0.73,3.17]	[0.75,2.81]	[1.09,3.70]
	(0.186)	(0.302)	(0.279)	(0.036)	(0.278)	(0.265)	(0.268)	(0.025)
Active Transportation	1.35	1.39	1.28	1.40	1.59	1.47	1.30	1.52
	[0.78,2.33]	[0.92,2.12]	[0.85,1.92]	[0.93,2.09]	[0.88,2.87]	[0.91,2.37]	[0.80,2.11]	[0.95,2.42]
	(0.287)	(0.117)	(0.230)	(0.103)	(0.122)	(0.116)	(0.292)	(0.079)
Healthy Food Access	**1.91****	**1.88*****	**1.65****	**1.87*****	**1.88***	**1.93****	**1.66***	**1.98****
	[1.22,3.00]	[1.32,2.68]	[1.14,2.38]	[1.33,2.65]	[1.13,3.13]	[1.28,2.90]	[1.08,2.56]	[1.31,2.99]
	(0.005)	(0.001)	(0.008)	(0.000)	(0.016)	(0.002)	(0.022)	(0.001)
Parks & Recreation	0.82	1.22	1.25	1.21	1.29	**2.00***	**2.01***	**2.22*****
	[0.47,1.41]	[0.74,2.02]	[0.80,1.96]	[0.81,1.81]	[0.67,2.49]	[1.10,3.62]	[1.18,3.44]	[1.44,3.44]
	(0.463)	(0.440)	(0.323)	(0.348)	(0.448)	(0.023)	(0.011)	(0.000)
Health Care Access	0.83	0.83	0.83	0.94	0.92	0.83	0.82	0.93
	[0.51,1.36]	[0.55,1.26]	[0.57,1.21]	[0.66,1.34]	[0.53,1.58]	[0.52,1.34]	[0.53,1.25]	[0.61,1.42]
	(0.458)	(0.387)	(0.322)	(0.721)	(0.754)	(0.449)	(0.349)	(0.727)
Community Design	**1.84***	**1.69***	**1.77***	**2.17****	**2.29****	**1.97***	**1.98***	**2.63*****
	[1.05,3.22]	[1.06,2.68]	[1.06,2.94]	[1.36,3.46]	[1.23,4.27]	[1.17,3.31]	[1.09,3.59]	[1.56,4.43]
	(0.035)	(0.028)	(0.028)	(0.001)	(0.009)	(0.011)	(0.025)	(0.000)
Overall	1.75	1.84	1.75	**2.20***	2.27	**2.22***	2.03	**2.85****
	[0.80,3.83]	[0.99,3.41]	[0.94,3.26]	[1.21,4.01]	[0.98,5.27]	[1.12,4.42]	[0.98,4.19]	[1.46,5.59]
	(0.159)	(0.053)	(0.077)	(0.010)	(0.056)	(0.023)	(0.056)	(0.003)
n	115	114	114	111	115	114	114	111

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

Table A10.4: Odds ratios of active commuting.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)
Vision & Strategy	1.10	0.98	0.98	1.11	1.10	1.00	1.02	**1.19****
	[0.95,1.28]	[0.85,1.13]	[0.86,1.11]	[0.99,1.24]	[0.93,1.30]	[0.85,1.17]	[0.90,1.17]	[1.06,1.34]
	(0.190)	(0.771)	(0.714)	(0.087)	(0.254)	(0.992)	(0.723)	(0.003)
Active Transportation	1.02	0.91	**0.91***	0.99	1.10	0.96	0.94	1.05
	[0.92,1.12]	[0.83,1.00]	[0.83,1.00]	[0.89,1.09]	[0.99,1.23]	[0.86,1.07]	[0.84,1.06]	[0.93,1.18]
	(0.760)	(0.053)	(0.049)	(0.784)	(0.080)	(0.427)	(0.328)	(0.422)
Healthy Food Access	1.06	0.95	0.94	0.99	1.08	0.95	0.93	0.99
	[0.92,1.22]	[0.83,1.08]	[0.83,1.06]	[0.88,1.11]	[0.92,1.26]	[0.82,1.11]	[0.81,1.07]	[0.87,1.12]
	(0.429)	(0.411)	(0.325)	(0.881)	(0.347)	(0.516)	(0.322)	(0.882)
Parks & Recreation	1.01	0.95	0.96	1.02	1.06	0.97	0.95	1.03
	[0.91,1.12]	[0.85,1.06]	[0.87,1.06]	[0.94,1.12]	[0.94,1.21]	[0.84,1.13]	[0.83,1.08]	[0.93,1.14]
	(0.823)	(0.371)	(0.420)	(0.604)	(0.334)	(0.699)	(0.436)	(0.583)
Health Care Access	1.11	1.04	1.04	1.08	**1.13***	1.04	1.06	**1.11***
	[1.00,1.22]	[0.93,1.16]	[0.95,1.15]	[0.98,1.18]	[1.01,1.27]	[0.93,1.16]	[0.96,1.17]	[1.01,1.23]
	(0.051)	(0.488)	(0.374)	(0.112)	(0.034)	(0.449)	(0.219)	(0.037)
Community Design	0.97	**0.89***	0.91	1.00	1.02	0.90	0.89	1.00
	[0.88,1.06]	[0.80,0.98]	[0.82,1.01]	[0.90,1.12]	[0.92,1.12]	[0.80,1.00]	[0.79,1.01]	[0.88,1.12]
	(0.513)	(0.019)	(0.086)	(0.965)	(0.758)	(0.050)	(0.068)	(0.957)
Overall	1.03	0.89	0.90	1.02	1.11	0.92	0.91	1.06
	[0.91,1.17]	[0.78,1.01]	[0.79,1.02]	[0.90,1.16]	[0.97,1.27]	[0.80,1.06]	[0.79,1.05]	[0.93,1.23]
	(0.605)	(0.062)	(0.087)	(0.738)	(0.138)	(0.234)	(0.192)	(0.377)
n	114	114	114	111	114	114	114	111

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

Table A10.5: Odds ratios of bicycle/pedestrian danger.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)
Vision & Strategy	0.93	**0.90****	**0.89*****	**0.93***	**0.89***	**0.88****	**0.87*****	**0.92***
	[0.85,1.01]	[0.83,0.97]	[0.83,0.95]	[0.87,1.00]	[0.81,0.98]	[0.80,0.95]	[0.81,0.94]	[0.85,1.00]
	(0.070)	(0.005)	(0.001)	(0.041)	(0.018)	(0.003)	(0.001)	(0.042)
Active Transportation	**0.90*****	**0.91*****	**0.89*****	**0.91****	**0.91****	**0.90*****	**0.87*****	**0.90****
	[0.86,0.95]	[0.86,0.96]	[0.84,0.95]	[0.85,0.97]	[0.86,0.96]	[0.85,0.96]	[0.81,0.94]	[0.83,0.97]
	(0.000)	(0.000)	(0.000)	(0.004)	(0.001)	(0.001)	(0.000)	(0.004)
Healthy Food Access	0.96	0.97	0.95	0.97	0.96	0.96	0.94	0.95
	[0.91,1.02]	[0.92,1.02]	[0.89,1.01]	[0.91,1.03]	[0.90,1.03]	[0.91,1.02]	[0.87,1.00]	[0.89,1.02]
	(0.227)	(0.203)	(0.085)	(0.246)	(0.217)	(0.182)	(0.057)	(0.176)
Parks & Recreation	**0.90*****	**0.94***	**0.93***	0.95	**0.89****	0.94	**0.92****	**0.94***
	[0.85,0.96]	[0.88,1.00]	[0.88,0.99]	[0.89,1.00]	[0.83,0.96]	[0.88,1.00]	[0.87,0.98]	[0.88,0.99]
	(0.001)	(0.049)	(0.014)	(0.064)	(0.003)	(0.058)	(0.008)	(0.025)
Health Care Access	0.97	0.97	0.96	0.96	0.98	0.97	0.96	0.98
	[0.93,1.02]	[0.93,1.01]	[0.92,1.00]	[0.92,1.00]	[0.93,1.03]	[0.93,1.02]	[0.92,1.01]	[0.93,1.03]
	(0.205)	(0.124)	(0.052)	(0.067)	(0.421)	(0.231)	(0.150)	(0.352)
Community Design	**0.91****	**0.94***	**0.91****	**0.93***	**0.92***	**0.93****	**0.91***	**0.93**
	[0.85,0.97]	[0.88,1.00]	[0.85,0.98]	[0.86,0.99]	[0.86,0.98]	[0.88,0.98]	[0.84,0.98]	[0.86,1.01]
	(0.003)	(0.039)	(0.008)	(0.035)	(0.014)	(0.007)	(0.017)	(0.074)
Overall	**0.88*****	**0.89****	**0.86*****	**0.89****	**0.88****	**0.89****	**0.85*****	**0.89***
	[0.82,0.94]	[0.83,0.96]	[0.80,0.94]	[0.82,0.97]	[0.81,0.96]	[0.82,0.96]	[0.78,0.93]	[0.80,0.98]
	(0.001)	(0.002)	(0.000)	(0.009)	(0.003)	(0.004)	(0.001)	(0.015)
n	115	114	114	111	115	114	114	111

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, percent of land area in an Urban Area, and bicycle/pedestrian commute mode share.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

Table A10.6: Odds ratios of obesity.

	Comprehensiveness scores				Strength scores			
	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)	Unadjusted	Adjusted	Adjusted + RPC	Adjusted + RPC (Excl. high-income)
Vision & Strategy	1.01	0.98	**0.97***	0.98	0.99	0.97	**0.96***	**0.97***
	[0.95,1.08]	[0.95,1.01]	[0.94,1.00]	[0.96,1.01]	[0.92,1.06]	[0.93,1.00]	[0.93,0.99]	[0.94,1.00]
	(0.690)	(0.199)	(0.044)	(0.167)	(0.784)	(0.073)	(0.016)	(0.039)
Active Transportation	1.04	1.02	1.01	1.01	1.04	1.01	1.00	1.01
	[0.99,1.09]	[0.99,1.04]	[0.98,1.04]	[0.98,1.05]	[0.98,1.09]	[0.98,1.04]	[0.97,1.04]	[0.97,1.05]
	(0.147)	(0.239)	(0.403)	(0.413)	(0.183)	(0.571)	(0.952)	(0.719)
Healthy Food Access	**1.06****	1.02	1.01	1.01	**1.07****	1.02	1.01	1.01
	[1.02,1.11]	[0.99,1.04]	[0.99,1.04]	[0.99,1.04]	[1.03,1.12]	[1.00,1.05]	[0.99,1.04]	[0.99,1.04]
	(0.004)	(0.148)	(0.324)	(0.319)	(0.001)	(0.059)	(0.277)	(0.307)
Parks & Recreation	1.05	1.02	1.01	1.00	**1.06***	1.02	1.01	1.00
	[0.99,1.10]	[0.99,1.04]	[0.99,1.03]	[0.97,1.02]	[1.00,1.12]	[1.00,1.05]	[0.99,1.04]	[0.97,1.02]
	(0.090)	(0.132)	(0.378)	(0.864)	(0.046)	(0.104)	(0.284)	(0.848)
Health Care Access	**1.03***	1.00	0.99	1.00	1.03	1.00	0.99	1.00
	[1.00,1.07]	[0.98,1.03]	[0.97,1.02]	[0.98,1.03]	[0.99,1.07]	[0.96,1.03]	[0.96,1.02]	[0.97,1.03]
	(0.035)	(0.764)	(0.662)	(0.720)	(0.106)	(0.766)	(0.443)	(0.749)
Community Design	0.99	1.00	0.99	1.00	1.00	0.99	0.98	0.99
	[0.95,1.03]	[0.97,1.02]	[0.97,1.02]	[0.97,1.04]	[0.96,1.04]	[0.96,1.02]	[0.96,1.01]	[0.96,1.02]
	(0.682)	(0.782)	(0.677)	(0.793)	(0.892)	(0.442)	(0.263)	(0.650)
Overall	1.04	1.01	1.00	1.01	1.04	1.00	0.99	1.00
	[0.98,1.11]	[0.98,1.04]	[0.97,1.04]	[0.97,1.05]	[0.98,1.11]	[0.97,1.04]	[0.96,1.03]	[0.96,1.04]
	(0.194)	(0.474)	(0.844)	(0.607)	(0.190)	(0.842)	(0.665)	(0.950)
n	95	95	95	92	95	95	95	92

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Adjusted model: Adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area.
Adjusted model + RPC: Clustered on regional planning commission.
Adjusted + RPC, excluding high-income: Three municipalities with median household incomes greater than $120,000 excluded from analysis.

APPENDIX 11: REGRESSION RESULTS FOR OBESITY WITH PLAN SCORE-INCOME INTERACTION TERM

Table A11.1: Odds ratios of obesity, comprehensiveness scores, fully adjusted models.

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall
Comprehensiveness Score	**0.97***	1.01	1.02	1.01	1.00	1.00	1.00
	[0.95,1.00]	[0.98,1.04]	[0.99,1.05]	[0.99,1.03]	[0.97,1.02]	[0.97,1.02]	[0.97,1.04]
	(0.029)	(0.451)	(0.184)	(0.556)	(0.746)	(0.738)	(0.850)
Income	**0.91*****	**0.87*****	**0.88*****	**0.85*****	0.92	**0.90*****	**0.88*****
	[0.86,0.96]	[0.83,0.91]	[0.83,0.92]	[0.82,0.89]	[0.84,1.01]	[0.85,0.95]	[0.84,0.92]
	(0.001)	(0.000)	(0.000)	(0.000)	(0.080)	(0.000)	(0.000)
Score x Income	0.97	1.01	1.02	1.02	0.99	0.99	1.00
	[0.94,1.00]	[1.00,1.03]	[0.99,1.06]	[1.00,1.04]	[0.96,1.01]	[0.97,1.01]	[0.98,1.03]
	(0.055)	(0.091)	(0.171)	(0.052)	(0.305)	(0.486)	(0.688)
Median age	0.99	0.99	1.00	0.99	0.99	0.99	0.99
	[0.92,1.07]	[0.92,1.07]	[0.93,1.07]	[0.93,1.06]	[0.91,1.07]	[0.92,1.07]	[0.92,1.07]
	(0.867)	(0.880)	(0.933)	(0.778)	(0.783)	(0.767)	(0.840)
% Black	1.05	**1.08****	**1.08***	**1.08****	**1.07***	1.06	**1.07***
	[0.97,1.13]	[1.02,1.14]	[1.02,1.14]	[1.02,1.15]	[1.01,1.14]	[0.99,1.14]	[1.00,1.14]
	(0.226)	(0.009)	(0.013)	(0.007)	(0.032)	(0.090)	(0.040)
Urbanicity	0.97	0.97	0.97	0.97	0.97	0.97	0.97
	[0.94,1.01]	[0.93,1.01]	[0.94,1.01]	[0.94,1.01]	[0.94,1.01]	[0.93,1.01]	[0.93,1.01]
	(0.152)	(0.096)	(0.123)	(0.154)	(0.110)	(0.172)	(0.149)
Wald test for joint effect of Score and Score x Income	(0.065)	(0.190)	(0.319)	(0.153)	(0.584)	(0.770)	(0.919)
n	95	95	95	95	95	95	95

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Models adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area and clustered on regional planning commission.

Table A11.2: Odds ratios of obesity, strength scores, fully adjusted models.

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall
Strength Score	**0.96***	1.00	1.02	1.01	0.99	0.98	0.99
	[0.93,0.99]	[0.97,1.03]	[0.99,1.06]	[0.99,1.04]	[0.96,1.02]	[0.96,1.01]	[0.96,1.03]
	(0.013)	(0.989)	(0.129)	(0.357)	(0.446)	(0.262)	(0.679)
Income	**0.90*****	**0.88*****	**0.88*****	**0.85*****	**0.90***	**0.89*****	**0.88*****
	[0.86,0.96]	[0.84,0.92]	[0.83,0.92]	[0.81,0.89]	[0.82,0.98]	[0.84,0.94]	[0.84,0.93]
	(0.001)	(0.000)	(0.000)	(0.000)	(0.017)	(0.000)	(0.000)
Score x Income	0.96	1.01	1.03	**1.03***	0.99	1.00	1.01
	[0.93,1.00]	[0.99,1.03]	[0.99,1.08]	[1.01,1.06]	[0.95,1.04]	[0.97,1.02]	[0.98,1.04]
	(0.067)	(0.464)	(0.126)	(0.010)	(0.712)	(0.728)	(0.668)
Median age	0.99	0.99	1.00	0.99	0.99	0.98	0.99
	[0.92,1.07]	[0.92,1.07]	[0.93,1.06]	[0.93,1.06]	[0.91,1.06]	[0.91,1.06]	[0.92,1.06]
	(0.876)	(0.789)	(0.918)	(0.798)	(0.729)	(0.651)	(0.729)
% Black	1.04	**1.07***	**1.08***	**1.09****	**1.07***	1.06	**1.07***
	[0.97,1.13]	[1.01,1.14]	[1.02,1.14]	[1.03,1.15]	[1.00,1.14]	[0.99,1.13]	[1.00,1.14]
	(0.260)	(0.029)	(0.011)	(0.004)	(0.045)	(0.084)	(0.047)
Urbanicity	0.98	0.97	0.97	0.97	0.97	0.98	0.97
	[0.94,1.01]	[0.94,1.01]	[0.94,1.01]	[0.94,1.01]	[0.94,1.01]	[0.94,1.02]	[0.94,1.01]
	(0.156)	(0.144)	(0.123)	(0.153)	(0.133)	(0.223)	(0.181)
Wald test for joint effect of Score and Score x Income	**(0.041)**	(0.760)	(0.255)	**(0.038)**	(0.749)	(0.535)	(0.762)
n	95	95	95	95	95	95	95

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Models adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area and clustered on regional planning commission.

Table A11.3: Odds ratios of obesity, comprehensiveness scores, fully adjusted models excluding ultra-high-income municipalities.

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall
Comprehensiveness Score	0.98	1.02	**1.04***	1.00	1.01	1.01	1.03
	[0.95,1.01]	[0.99,1.05]	[1.01,1.07]	[0.97,1.03]	[0.98,1.03]	[0.98,1.05]	[0.99,1.07]
	(0.116)	(0.181)	(0.016)	(0.864)	(0.567)	(0.488)	(0.160)
Income	**0.91****	**0.80*****	**0.81*****	**0.83****	**0.81*****	**0.81*****	**0.77*****
	[0.85,0.97]	[0.74,0.86]	[0.77,0.87]	[0.75,0.93]	[0.75,0.88]	[0.72,0.90]	[0.70,0.86]
	(0.005)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Score x Income	0.98	**1.04****	**1.07*****	1.02	**1.03***	1.03	**1.05****
	[0.95,1.02]	[1.01,1.06]	[1.03,1.11]	[0.99,1.05]	[1.00,1.06]	[1.00,1.07]	[1.02,1.09]
	(0.276)	(0.002)	(0.000)	(0.285)	(0.022)	(0.071)	(0.003)
Median age	0.98	0.98	0.99	0.98	0.98	0.98	0.99
	[0.91,1.05]	[0.91,1.06]	[0.92,1.06]	[0.91,1.05]	[0.90,1.06]	[0.91,1.06]	[0.91,1.07]
	(0.596)	(0.648)	(0.714)	(0.562)	(0.560)	(0.684)	(0.717)
% Black	1.07	**1.07***	**1.08***	1.06	**1.07***	1.06	**1.07***
	[1.00,1.14]	[1.01,1.13]	[1.02,1.14]	[1.00,1.14]	[1.01,1.14]	[0.99,1.14]	[1.00,1.13]
	(0.056)	(0.032)	(0.010)	(0.062)	(0.031)	(0.076)	(0.044)
Urbanicity	0.98	**0.97***	**0.97***	0.97	0.97	0.97	0.97
	[0.94,1.01]	[0.94,1.00]	[0.94,1.00]	[0.94,1.01]	[0.94,1.00]	[0.94,1.01]	[0.94,1.00]
	(0.155)	(0.030)	(0.029)	(0.119)	(0.091)	(0.146)	(0.074)
Wald test for joint effect of Score and Score x Income	(0.291)	**(0.006)**	**(0.001)**	(0.426)	(0.073)	(0.180)	**(0.012)**
n	92	92	92	92	92	92	92

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Models adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area; clustered on regional planning commission; and excluding three municipalities with median household incomes greater than $120,000.

Table A11.4: Odds ratios of obesity, strength scores, fully adjusted models excluding ultra-high-income municipalities.

	Vision & Strategy	Active Transportation	Healthy Food Access	Parks & Recreation	Health Care Access	Community Design	Overall
Strength Score	**0.96***	1.02	**1.04****	1.00	1.00	1.01	1.02
	[0.92,1.00]	[0.98,1.05]	[1.01,1.08]	[0.98,1.03]	[0.97,1.03]	[0.97,1.04]	[0.98,1.07]
	(0.043)	(0.358)	(0.009)	(0.837)	(0.942)	(0.749)	(0.312)
Income	**0.92**	**0.80*****	**0.82*****	**0.83*****	**0.81*****	**0.80*****	**0.78*****
	[0.85,1.00]	[0.74,0.86]	[0.78,0.88]	[0.76,0.91]	[0.75,0.88]	[0.73,0.89]	[0.71,0.86]
	(0.053)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Score x Income	0.97	**1.05*****	**1.08*****	1.03	**1.04****	**1.05***	**1.07****
	[0.92,1.02]	[1.02,1.08]	[1.04,1.13]	[0.99,1.06]	[1.01,1.08]	[1.01,1.08]	[1.02,1.11]
	(0.185)	(0.001)	(0.000)	(0.159)	(0.009)	(0.020)	(0.003)
Median age	0.98	0.97	0.99	0.98	0.97	0.98	0.98
	[0.92,1.05]	[0.90,1.05]	[0.92,1.05]	[0.91,1.05]	[0.90,1.05]	[0.91,1.05]	[0.91,1.05]
	(0.619)	(0.517)	(0.673)	(0.578)	(0.440)	(0.499)	(0.558)
% Black	**1.06**	**1.07***	**1.07***	**1.06**	**1.08***	**1.06**	**1.07***
	[1.00,1.14]	[1.01,1.13]	[1.01,1.13]	[1.00,1.14]	[1.02,1.15]	[0.99,1.14]	[1.00,1.13]
	(0.065)	(0.032)	(0.027)	(0.066)	(0.014)	(0.070)	(0.043)
Urbanicity	0.98	**0.97***	**0.97***	0.97	**0.97**	0.98	**0.97**
	[0.94,1.01]	[0.94,1.00]	[0.94,1.00]	[0.94,1.01]	[0.94,1.00]	[0.94,1.01]	[0.94,1.00]
	(0.174)	(0.037)	(0.035)	(0.129)	(0.055)	(0.179)	(0.085)
Wald test for joint effect of Score and Score x Income	(0.124)	**(0.003)**	**(0.001)**	(0.212)	**(0.016)**	**(0.039)**	**(0.011)**
n	92	92	92	92	92	92	92

Comprehensive plan scores scaled to 20 percentage points. 95% confidence intervals in brackets. P-values in parentheses.
Models adjusted for median household income, median age, percent Black population, and percent of land area in an Urban Area; clustered on regional planning commission; and excluding three municipalities with median household incomes greater than $120,000.