A Meta-Analysis Exploring the Utility of Cognitive Behavioral-Based Treatments to Decrease Symptoms of Depression in Autistic Individuals

By

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ABSTRACT

One in 36 children and 2.4% of adults in the United States are diagnosed with autism spectrum disorder (ASD). Additionally, the lifetime prevalence of a major depressive episode for autistic individuals is 40%. While cognitive behavioral therapy (CBT) is an evidence-based treatment for depression symptoms, few studies have explored CBT's effect on symptoms of depression in autistic individuals. Thus, a systematic review and meta-analysis was completed to estimate the overall effect size of CBT on depression symptoms for autistic individuals. After screening 4,291 studies, 28 studies with a total of 631 treatment group participants were included for analysis. The meta-analysis results indicate that CBT results in significantly decreased symptoms of depression, as compared to pre-treatment depression symptoms and pre/post-treatment depression symptoms of participants within the treatment control group (SMD=-0.33, SE=0.05, 95% CI -0.44, -0.23, p-value<0.0001). Thus, the results of this meta-analysis indicate that CBT is a promising treatment for depression symptoms in autistic individuals. However, there was considerable heterogeneity between the effect sizes of the included studies, even after controlling for moderators, including pre-treatment depression levels, presence of a control group, presence of non-depression-related CBT elements, number of included CBT core elements, presence of modifications to CBT for ASD, treatment dosage, and participant characteristics. Thus, the effect size data should be interpreted with caution, and additional research is needed to fully understand the different factors which impact depression treatment outcomes. Qualitative content analyses were also completed to describe modifications for CBT programs for ASD, descriptions of autism symptom severity at pre-treatment, and descriptions of adverse events.

Keywords: autism, depression, cognitive behavioral therapy, review, meta-analysis

CHAPTER 1: INTRODCUTION & LITERATURE REVIEW

Introduction

The purpose of this chapter is to describe (1) background information regarding depressive disorders and autism spectrum disorder (ASD), (2) background data regarding cognitive behavioral therapy (CBT) for depression, and (3) studies detailing the efficacy of cognitive behavioral-based treatments in treating depressive symptoms for autistic individuals.

Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a developmental disorder characterized by deficits in social communication and the presence of restricted and repetitive behaviors (American Psychiatric Association, 2022). Deficits in social communication may include poor eye contact, difficulty maintaining back and forth conversations, flat affect, and poor insight into relationships. Additionally, examples of restricted and repetitive behaviors include stereotyped motor movements, inflexibility with routines, trouble with transitions, fixated interests, hypersensitivity to sensory input, or hyposensitivity to sensory input (American Psychiatric Association 2022). See Figure 1 for the diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR)*.

Figure 1.
Diagnostic Criteria for Autism Spectrum Disorder

A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by all of the following, currently or by history (examples are illustrative, not exhaustive; see text):
    1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
    2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.

3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text):
    1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
    2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat same food every day).
    3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).
    4. Hyper- or hypo reactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).
C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or they may be masked by learned strategies in later life).
D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.
E. These disturbances are not better explained by intellectual developmental disorder (intellectual disability) or global developmental delay. Intellectual developmental disorder and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual developmental disorder, social communication should be below that expected for general developmental level.

In addition to the criteria described above, clinicians must designate among three levels of support that each individual needs in the areas of social communication and in restricted, repetitive behavior (American Psychiatric Association, 2022). Individuals may be classified as level 1 “requiring support,” level 2 “requiring substantial support,” or level 3 “requiring very substantial support.” For social communication, individuals who require support have difficulty initiating social interactions, responding typically to social overtures of others, and making friends without support in place. Regarding restricted, repetitive behaviors, an individual who

requires support has inflexible behaviors, difficulty switching between activities, and problems with executive functioning (ex. organization, planning, flexibility, self-monitoring), which cause impairment and hamper independence without support (American Psychiatric Association, 2022). In *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition (DSM-IV)* individuals with this presentation of autism spectrum disorder (ASD) were previously classified as having Asperger's Syndrome (American Psychiatric Association, 1994). This presentation of ASD is also sometimes referred to as "high-functioning autism."

Individuals who are classified as requiring substantial support in social communication have marked deficits in both verbal and nonverbal social communication abilities (American Psychiatric Association, 2022). Even with support, they will experience social impairment. Individuals requiring substantial support rarely initiate social interactions and exhibit reduced, atypical responses to social overtures from others. Individuals who are classified as requiring substantial support in restricted, repetitive behaviors have difficulty coping with change and exhibit inflexible behaviors, even with support. Also, other restricted, repetitive behaviors may appear frequently enough to be obvious to a casual observer and interfere with functioning. These individuals have marked stress and/or difficulty with executive functioning as well, including difficulty with self-monitoring, behavior regulation, emotional regulation, organization, planning, and working memory (American Psychiatric Association, 2022).

Individuals who are classified as requiring very substantial support in social communication have severe deficits in verbal and nonverbal social communication skills, which causes severe impairment in functioning (American Psychiatric Association, 2022). For example, they very rarely initiate social interactions and minimally respond to social overtures from others. Individuals who require very substantial support may have very few words of intelligible

speech and may respond only to very direct social approaches. Individuals who are classified as requiring very substantial support in restricted, repetitive behaviors exhibit extreme difficulty coping with change, inflexible behaviors, and other restricted, repetitive behaviors that markedly interfere with daily functioning. Additionally, individuals exhibit significant difficulty with executive functioning (American Psychiatric Association, 2022).

Of note, the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* also included the diagnosis Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS, American Psychiatric Association, 1994). The criteria for PDD-NOS included "severe and pervasive impairment in the development of reciprocal social interaction or verbal and nonverbal communication skills, or when stereotyped behavior, interests, and activities are present but are not met for a specific pervasive developmental disorder." Of note, this diagnosis was often provided when individuals exhibited some but not all ASD symptoms or when there was late onset of symptoms, as they did not meet prior criteria for ASD based on age restrictions (American Psychiatric Association, 1994). Currently, the symptoms of PDD-NOS are captured within the diagnosis of ASD (American Psychiatric Association, 2022).

Autism spectrum disorder (ASD) has emerged as a significant public health concern, and it has received increased attention by researchers, media, clinicians, and the general public in recent years. Currently in the United States, for every eight-year-old child, one in 36 has a diagnosis of autism spectrum disorder (Maenner et al. 2023). Additionally, Dietz and colleagues (2020) estimated that 2.21% (95% CI 1.95%, 2.45%) of adults are diagnosed with ASD in the United States. Autistic individuals encounter challenges due to symptom presentation, such as unemployment, few peer relationships, and lack of independent living (Fernell et al., 2013). Given the large number of individuals diagnosed with this disorder and negative impacts, further

research is necessary to determine which interventions will be most effective in improving daily functioning, social abilities, and long-term outcomes.

Recently, the National Autism Center sought to systematically review the literature to create evidence-based practice guidelines for practitioners to treat autistic individuals (National Autism Center, 2015). Based on the findings of their research, interventions were considered established, emerging, or unestablished. Established interventions demonstrated sufficient evidence to conclude that they have favorable outcomes for autistic individuals, and they were considered to be effective in treating ASD. The following interventions were considered to have an "established" level of evidence: behavioral interventions, cognitive behavioral intervention packages, comprehensive behavioral treatment for young children, language production training, modeling, natural teaching, parent training, peer training, pivotal response training, schedules, scripting, self-management, social skills package, and story-based interventions. Of note, these interventions were only considered effective for individuals under age 22. Also, several of the interventions listed would typically be included in a treatment. For instance, a social skills training intervention would include modeling, scripting, social stories, and natural teaching strategies. Also of note, the cognitive behavioral interventions targeted the following outcomes: cognitive functions, responsibility, problem behaviors, and sensory/emotional regulation. They did not specifically address symptoms of depression (National Autism Center, 2015).

Depressive disorders

Depressive disorders are characterized by sad moods and/or diminished interest in activities. For instance, the diagnostic criteria for major depressive disorder are listed below in Figure 2.

Figure 2.
Diagnostic Criteria for Major Depressive Disorder (MDD)

A. Five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure. **Note:** Do not include symptoms that are clearly attributable to another medical condition.
    1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful). (**Note:** In children and adolescents, can be irritable mood.)
    2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation).
    3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month) or decrease or increase in appetite nearly every day. (**Note:** In children, consider failure to make expected weight gain.)
    4. Insomnia or hypersomnia nearly every day.
    5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
    6. Fatigue or loss of energy nearly every day.
    7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
    8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
    9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, a specific suicide plan, or a suicide attempt.
B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
C. The episode is not attributable to the physiological effects of a substance or another medical condition.
D. At least one major depressive episode is not better explained by schizoaffective disorder and is not superimposed on schizophrenia, schizophreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders.
E. There has never been a manic episode or a hypomanic episode.

MDD is a highly prevalent mental health condition world-wide. The Substance Abuse and Mental Health Service Administration (SAMHSA) estimated that 21.0 million adults in the United States had at least one major depressive episode in 2020, representative of 8.4% of the adult population within the United States of America. Of note, young adults and adolescents had the greatest prevalence of a major depressive episode, as 17% of this population experienced a major depressive episode in 2020 (SAMHSA 2020).

Compared to MDD, persistent depressive disorder (PDD) is another depressive disorder that requires less symptoms for diagnosis, and the symptoms are generally less severe. However, individuals diagnosed with persistent depressive disorder must exhibit symptoms for at least two years. Of note, individuals with persistent depressive disorder can also experience major depressive episodes. Diagnostic criteria from the DSM-5-TR for persistent depressive disorder are listed in Figure 3. Epidemiological studies of persistent depressive disorder (PDD) estimate the lifetime prevalence of PDD to be 1-to-6% (Schramm et al. 2020).

Figure 3.
Diagnostic Criteria for Persistent Depressive Disorder (PDD)

A. Depressed mood for most of the day, for more days than not, as indicated by either subjective account or observation by others, for at least 2 years. **Note:** In children and adolescents, mood can be irritable, and duration must be at least 1 year.
B. Presence, while depressed, of two (or more) of the following:
    1. Poor appetite or overeating.
    2. Insomnia or hypersomnia.
    3. Low energy or fatigue.
    4. Low self-esteem.
    5. Poor concentration or difficulty making decisions.
    6. Feelings of hopelessness.
C. During the 2-year period (1 year for children or adolescents) of the disturbance, the individual has never been without the symptoms in Criteria A and B for more than 2 months at a time.
D. Criteria for a major depressive disorder may be continuously present for 2 years.
E. There has never been a manic episode or a hypomanic episode.
F. The disturbance is not better explained by a persistent schizoaffective disorder, schizophrenia, delusional disorder, or other specified or unspecified schizophrenia spectrum and other psychotic disorder.
G. The symptoms are not attributable to the physiological effects of a substance (e.g., a drug of abuse, a medication) or another medical condition (e.g., hypothyroidism).
H. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

Functional consequences of depressive disorders vary from mild-to-severe. In mild cases, individuals with a depressive disorder may interact with others in a manner in which others are unaware of their symptoms. Conversely, severe presentations of depression can result in

complete incapacity to complete basic self-care needs. Furthermore, individuals with depressive disorders may exhibit suicidality, which can result in death (American Psychiatric Association, 2022).

Depression can be treated using a variety of different methods. For example, psychopharmacological interventions, or medications, are often used for depressive disorders. A recent meta-analysis examined the effectiveness of the most commonly prescribed antidepressants in children and adolescents with major depressive disorder, and only one drug, fluoxetine, was found to have greater efficacy than placebos (Cipriani et al. 2018). Additionally, in children and adolescents, 9-10% of children who take fluoxetine have also exhibited suicidal ideation or behaviors (Cipriani et al. 2018). In addition, anti-depressant medications also include a variety of side-effects. Thus, therapy is often used in lieu of anti-depressant medication or in addition to anti-depressant medications.

Co-occurring autism spectrum disorder and major depressive disorder

A recent meta-analysis of 66 articles by Hudson and colleagues (2019) estimated a lifetime prevalence rate of co-occurring depression at 14.4% (95% CI 10.3-19.8%) and a current prevalence rate of 12.3% (95% CI 9.7-15.5%) for autistic individuals, including children, adolescents, and adults. Specifically for autistic adults, the current prevalence of co-occurring depression was estimated to be 19.4% (95% CI 9.2-36.5%), and the lifetime prevalence was estimated to be 40.2% (95% CI 22.8-60.6%). In autistic children and adolescents, the current prevalence estimates of co-occurring depression were estimated to be at 10.6% (95% CI 7.0-15.7%), and the lifetime prevalence was estimated to be 7.7% (95% CI 4.7-12.4%) (Hudson et al. 2019).

Additionally, a study by O'Hollaran and colleagues (2022) indicated that 25.2% (95% CI 18.2-33.8%) of autistic children and adolescents experience suicidal ideation. Additionally, they found that 8.3% (95% CI 3.6-18.2%) of autistic children and adolescents attempt suicide, and 0.2% (95% CI 0.05-0.52%) of autistic children and adolescents died by suicide (O'Halloran et al., 2022). Furthermore, a study comparing the risk of suicidality in autistic individuals, as compared to typically developing individuals, found that individuals with autism are more than three times as likely to experience suicidality (Odds Ratio 3.32, 95% CI 2.60, 4.24), with children being more than two times more likely to experience suicidality (Odds Rati 2.53, 95% CI 1.70, 3.76) and adults being more than three times more likely to experience suicidality (Odds Ratio 3.38, 95% CI 2.78, 5.30, Blanchard et al., 2021).

Given the high prevalence of depression in autistic children, adolescents, and adults, it is necessary to establish the evidence base for depression interventions within this population. For instance, cognitive behavioral therapy (CBT) is an example of a well-researched depression intervention. More details regarding the background around CBT, the evidence supporting CBT's utility in treating symptoms of depression, and the research regarding CBT's utility in treating symptoms of depression in autistic individuals are provided below.

Identifying Depression Symptoms within the Autistic Population

Despite the high prevalence of co-occurring depression and ASD, depression is often under- or mis-diagnosed in autistic individuals (Magnuson & Constantino et al., 2011). First, some symptoms of depression overlap with features of ASD, such as social withdrawal, limited emotional expression, and sleep disturbances (APA 2022). Thus, depression symptoms can be mistaken for typical symptoms of ASD, and thus depression is not treated. Second, individuals with ASD may demonstrate atypical depressive symptoms or express typical depression

symptoms differently, as compared with neurotypical individuals (Magnuson & Constantino 2011). For example, autistic individuals' depression symptoms may include developmental/behavioral regression, increased stereotyped behavior, hyperactivity or catatonia, and other behavioral changes. Also, individuals with co-occurring intellectual disability may be more likely to demonstrate atypical symptoms. Thus, since the behaviors are not associated with depression, no diagnosis and/or treatment is provided. Third, autistic individuals often experience alexithymia, which includes the following characteristics: difficulty identifying emotions, difficulty differentiating emotions from bodily sensations, difficulty describing emotions to other people, and difficulty with imaginative thinking (Poquérusse et al., 2018). Accordingly, depressed mood, which is a core symptom of depression, often was not endorsed by the autistic individual, but it may be inferred by others, as evidenced by observed "sad" affect or tearfulness (Stewart et al., 2006). As the diagnosis of depression often relies heavily on self-report standardized measures (ex. *Beck Depression Inventory),* the lack of endorsed depressed mood can result in decreased likelihood of depression diagnosis and treatment. Accordingly, self-report measures are often missing when evaluating individuals with autism due to concerns related to emotional labeling. However, this also causes issues with validity, as observers cannot always accurately evaluate a person's mood. Thus, both observer-report and self-report measures include validity concerns.

Cognitive Behavioral Therapy.

Background History and Theory.

Cognitive behavioral therapy combines the principles of cognitive theory and behavioral theory. First, behavioral theory was prevalent in the 1940s and the 1950s. Behavioral theory is based on the principles of classical conditioning and operant conditioning. Classical conditioning

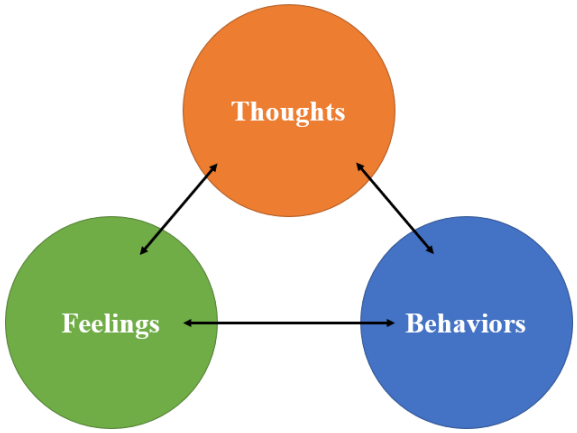
established that stimuli could result in an involuntary response (Pavlov, 1927). Conversely, operant conditioning established that adding a stimulus or removing a stimulus can result in either increased or decreased behaviors (Skinner, 1938). Behavioral theory can be applied to mental health through behavioral activation, or purposefully engaging in activities that results in positive moods and thoughts. A limitation to behavioral theory is that it did not incorporate cognitions or emotions into the core components of the theory.

Cognitive behavioral therapy (CBT), or "cognitive therapy" at the time, was initially introduced in the early 1960s and 1970s by Dr. Aaron T Beck (Beck, J.S. & Beck A.T., 2011; Beck, A.T., 2019). The cognitive model is based on the idea that dysfunctional thinking is common in all psychological disorders, and dysfunctional thinking affects an individual's moods and behaviors as well. The cognitive model proposes that all individuals have core beliefs about themselves and the world, which impact their automatic thought responses and behavioral responses to external stimuli. The theory of change in cognitive behavioral theory is that by modifying people's dysfunctional beliefs about themselves, their world, and other people, they see improvements in moods and behaviors. Within cognitive theory, the therapist trains the client to focus on their automatic thoughts and evaluate their cognitive distortions, or their thought misinterpretations or thought exaggeration of situations. This process is called cognitive restructuring (Beck, J.S. & Beck, A.T., 2011; Beck, A.T., 2019).

Cognitive behavioral therapy is the combination of behavioral principles and cognitive theory. The main idea behind cognitive behavioral therapy is cognitive triad, or the idea that thoughts, feelings, and emotions all impact one another (Figure 4.) Beck's cognitive theory posits that people can affect their feelings and behaviors by changing their maladaptive thought patterns via cognitive restructuring. Also, behavioral theory posits that we can change our

emotions and thoughts by engaging in more positive activities and less maladaptive activities. More details about specific therapy components included in CBT are described below.

Figure 4.
Cognitive Behavioral Theory Triad



Components of Cognitive Behavioral Therapy.

Since cognitive behavioral therapy's introduction in the 1960s, a plethora of research has been conducted exploring its utility, as described below. Often in the research, CBT is delivered in a manualized format, and many different manualized CBT programs have been tested throughout the years. However, specific elements of CBT are not always evaluated in research papers. Rather, most often the program as a whole is evaluated, or specific aspects are implemented alone, rather than within CBT as a whole.

To address this limitation, Cuijpers and colleagues (2020) explored the overall efficacy of cognitive behavioral therapy, as well as the individual CBT components of behavioral activation therapy and problem-solving therapy to reduce symptoms of depression in adults using a meta-analysis. CBT was found to improve symptoms of depression post-treatment, as compared to pre-treatment depression levels (and treatment controls when available) (n=52 studies, g=0.73,

95% CI 0.65, 0.80). Also, the individual CBT component of behavioral activation therapy alone was found to be effective in reducing symptoms of depression (n=9 studies, g=1.05, 95% CI 0.80, 1.30). Additionally, problem-solving therapy was found to be effective in reducing symptoms of depression (n=11 studies, g=0.75, 95% CI 0.53, 0.97, Cuijpers et al., 2020).

Given the differential data regarding CBT efficacy, depending on the number of treatment components included, it appears necessary for all studies utilizing cognitive behavioral therapies to define the included components of the CBT program, to confirm that the implemented program is utilizing all necessary core elements of the intervention. A recent meta-analysis exploring the effectiveness of CBT defined the following elements as core CBT components: psychoeducation, cognitive restructuring, behavioural activation, skills training (i.e., self-monitoring, relaxation; Oud et al., 2019). Given that exposure is most often used to treat anxiety, rather than depression (Sharma et al. 2021), it was not included as a core element to treat depression.

Cognitive Behavioral Therapy for Depression.

Cognitive behavior therapy (CBT) has been one of the most common treatments for depression for over 40 years. A recent meta-analysis explored the treatment utility of CBT to decrease symptoms of depression for children and adolescents (Oud et al. 2019). The meta-analysis evaluated 31 studies with 4,335 total participants. The meta-analysis indicated that the use of CBT resulted in decreased depression symptoms in children and adolescents immediately post-treatment (SMD=-0.41, 95% CI -0.56, -0.27) and at follow-up (SMD=-0.20, 95% CI -0.33, -0.07), as compared to treatment control groups and pre-treatment data. However, there was significant heterogeneity at post-treatment (I^2 = 81%, 95% CI 74, 86%) and at follow-up (I^2 = 68%, 95% CI: 45, 79%). Also, moderator analyses were conducted for the following variables:

presence/absence of CBT components (psychoeducation, cognitive restructuring, behavioral activation, relaxation, social skills training), direct parental involvement, group vs individual format, presence/absence of face-to-face sessions, presence/absence of online sessions, treatment setting (inpatient care setting, outpatient clinic, non-psychiatric settings like schools or homes), intervention dosage, the type of control condition, and the risk of bias. The moderator analysis indicated that direct inclusion of caregivers and the presence of behavioral activation and cognitive restructuring were associated with better outcomes. Other moderator analyses were non-significant (Oud et al. 2019).

Also, a different meta-analysis explored the effectiveness of CBT with adolescents with depression (Keles & Idsoe 2018). The meta-analysis explored 23 randomized controlled studies and found that group CBT resulted in decreased depression symptoms, as compared to control conditions, both at post-intervention (SMD = −0.28, 95% CI -0.36, −0.19) and at follow-up (SMD = −0.21, 95% CI -0.30, −0.11). There was significant heterogeneity at the post- (I^2 = 28.24%) and follow-up time points (I^2 = 51.7%). They completed moderator analyses for the following variables: age, gender, type of control group, intervention duration, professional facilitator, publication year, and follow-up duration. Only the type of control group was associated with differences in effect sizes across studies (Keles & Idsoe 2018).

For adults, another recent meta-analysis explored the utility of CBT for symptoms of depression with adult populations (López-López et al. 2019). The meta-analysis included 91 studies with 6,973 participants. The results of the meta-analysis indicated that the use of CBT resulted in decreased symptoms of depression with large effect sizes immediately after treatment (SMD=-1.11, 95% CI -1.62, -0.60). Of note, many studies did not include follow-up analyses to determine long-term effects of CBT treatment, and minimal information was provided regarding

the heterogeneity of the samples. The following moderator variables were explored: delivery format (group v. individual), treatment dosage, presence/absence of patient-initiated interactions with therapist, tailored versus untailored CBT programs, and format of multimedia CBT interventions (face-to-face, hybrid, self-guided). None of the moderating variables resulted in significantly different effect sizes across studies (López-López et al., 2019).

Additionally, another meta-analysis was conducted to assess the effectiveness of CBT in treating depression symptoms for adults within a primary care setting (Santoft et al., 2019). They completed a meta-analysis using 34 randomized controlled trials of CBT to treat depression. The results indicated that CBT resulted in depression symptom remission over time, as compared to control conditions (g = 0.22, 95% CI 0.15, 0.30). Treatment was also found to be effective long-term, based on follow-up data, as compared to controls (g = 0.17, 95% CI 0.10, 0.24). However, heterogeneity was high (I^2 = 40%). Thus, moderator analyses were conducted for the following variables: main inclusion criteria (depression diagnosis, cut-off score on depression scale, or presence/absence of depression symptoms), baseline depression severity, outcome measurement (self-rated versus clinician-rated/both), type of control group, study location, individual versus group format, delivery setting (primary care versus specialist), treatment fidelity, training level of therapists, and behavioral activation versus CBT. Only the type of control group and the CBT delivery setting were associated with significantly different effect sizes across studies (Santoft et al., 2019).

The results of the literature review indicate that CBT is an effective treatment for typically developing children, adolescents, and adults with depression. CBT has been shown to be an effective treatment to reduce symptoms of depression and/or lead to better outcomes across studies. Of note, most studies had high heterogeneity. All studies attempted to explain

heterogeneity with different moderating variables. The following variables were found to be significant moderators in one or more studies: type of control group, direct involvement of parents in therapy for minors under 18 years old, inclusion of behavioral activation within the CBT program, inclusion of cognitive restructuring within the CBT program, and CBT delivery setting (Keles & Idsoe 2018; Lopez-Lopez et al., 2019; Oud et al., 2019; Santoft et al., 2019).

Acceptance and Commitment Therapy (ACT).

Acceptance and commitment therapy (ACT) is a new generation cognitive behavioral therapy intervention (Hayes et al., 2012). While CBT aims to change negative psychological experiences through cognitive restructuring, ACT aims to change the client's approach to those negative psychological experiences through practicing of mindfulness, accepting the experience, increasing values-oriented behaviors, and practicing cognitive defusion, or the practice of observing thoughts rather than automatically believing them to be true. ACT programs also incorporate other core elements of traditional CBT, such as psychoeducation, relaxation, problem-solving, and behavioral activation. However, the lens with which these core elements are applied is slightly different, as the goal is to accept negative thoughts as separate from oneself, rather than change negative thoughts (Hayes et al., 2012).

A recent meta-analysis was conducted to determine ACT's effect on depression (Bai et al., 2020). The analysis included 18 studies with 1,088 participants. The overall effectiveness of ACT was significant (SMD=0.59, 95% CI 0.38, 0.90). However, heterogeneity between the studies was high (I^2=58%). Sub-group analyses were conducted for different follow-up times points, ages, and pre-treatment depression levels. The studies appeared to complete subgroup meta-analyses rather than meta-regressions, but they did not report which statistical tests they used. None of the moderating factors explained significant heterogeneity, as measured by I^2.

However, there were different levels of significance for difference variables. The depression reduction remained significant at 3-month follow-up but not at 6-month follow-up. Depression reductions were significant for adults but not for children. Mild pre-treatment depression symptoms demonstrated significant reductions in depression, whereas moderate and severe pre-treatment depression levels did not result in statistically significant symptom reduction (Bai et al., 2020).

Also, Gloster and colleagues (2020) conducted a separate meta-analysis exploring the empirical status of ACT in general. Specifically for depression, nine studies were included. The overall effect size of ACT for symptoms of depression was significant (g=0.33, no confidence interval or standard error reported), and heterogeneity (as measured by I^2) ranged from 39.7 to 79.7% (Gloster et al., 2020).

Another recent meta-analysis examined the efficacy of ACT with children (Fang & Ding 2020). They analyzed 14 randomized controlled trials with 1,189 children. This meta-analysis indicated that ACT resulted in significantly decreased symptoms of depression (SMD=-0.86, 95% CI -1.13, -0.59, p-value<0.001). However, heterogeneity within the studies was high (I^2 = 59.9%). A meta-regression indicated that the different control conditions explained significant heterogeneity. Also, a meta-regression indicated that there was not a significant difference between the effects of CBT and ACT. (Fang & Ding, 2020).

Dialectical Behavior Therapy (DBT).

Dialectical behavior therapy (DBT) is another new generation cognitive behavioral therapy intervention (Linehan, 2020). DBT originated due to challenges encountered when therapists attempted to use CBT with chronically suicidal clients. DBT was created by modifying several aspects of CBT. First, rather than focusing on cognitive restructuring, therapists

employed radical acceptance of the client's current capabilities and behavioral functioning. Thus, the term dialectical was added to address the opposing therapeutic ideas of change and acceptance. Second, the structure of DBT was created, which includes group/individual skills training, individual psychotherapy, and telephone contacts with the therapist to monitor coping skills utilization. Third, DBT includes a therapist consultation team. DBT still includes other traditional CBT components, such as psychoeducation, relaxation, problem-solving, and behavioral activation (Linehan, 2020).

A recent meta-analysis was conducted exploring DBT's effectiveness to reduce symptoms of depression. The meta-analysis included 12 studies with a total of 305 participants. DBT has been shown to be effective (g=0.36, 95% CI 0.30, 0.42) in reducing symptoms of depression (Cook & Gorraiz 2016). Of note this study used a fixed effect model, and the heterogeneity of the study was high ($Q(11)=34.04$, p-value<0.001). Thus, further research is necessary to determine if DBT is effective in reducing symptoms of depression. Additionally, further research is needed to identify how alternative factors, such as co-occurring diagnosis alter the efficacy of DBT.

Modifications to Cognitive Behavioral Therapies for Autistic Individuals.

While CBT has been shown to be effective in reducing symptoms of depression in typically developing individuals, autistic individuals have symptoms which can impact their ability to engage in CBT. First, approximately 50% of autistic individuals exhibit alexithymia, or challenges expressing or identifying emotions (Kinnaird et al., 2019), which would cause challenges with identifying the connection between thoughts, emotions, and behaviors, a core theme of CBT. Second, autistic individuals often have under-developed theory of mind, or perspective taking abilities (Yirmiya et al., 1998), which may impact their ability to understand

the consequences of their behavior and/or engage in role playing activities/hypotheticals. Additionally, autistic individuals exhibit difficulties with cognitive flexibility (Leung et al., 2014), or the ability to switch between different tasks. The combined difficulty of theory of mind and cognitive flexibility may result in challenges generating multiple approaches to dealing with negative thought patterns. Third, autistic individuals exhibit weak central coherence, or a preference for local rather than global processing (Happe & Frith 2006). This preference for local processing may result in challenges generalizing behaviors from CBT therapy sessions to daily living.

Given these challenges, practitioners and program developers often modify CBT programs to accommodate for these difficulties. However, there is no current standardized procedure for modifications for CBT for depression. Most often, individual studies describe their modifications and program development process. However, several studies have reviewed the available evidence for CBT utilization in autistic individuals and provided recommendations for modifications based on their review of the literature.

First, Moree and Davis (2010) reviewed the available literature on the use of CBT programs with autistic children. Of note, all studies reviewed examined the CBT programs administered specifically for anxiety. After reviewing the literature, the authors identified four main modifications of CBT. First, they noticed that CBT programs often targeted symptoms of ASD, as well as mental health. For example, studies introduced social skills training into the CBT programs. Second, they observed that research papers tended to modify materials to include more concrete examples and visual stimuli. For example, several studies included visual pictures, drawings, visual worksheets, narratives, and social stories, and role-playing activities. Third, the authors stated that many studies incorporated the autistic child's special interest into CBT. For

example, if a child exhibits a restricted interest in a specific movie, the therapist could incorporate role-playing scenarios from the movie to discuss emotions (Moree & Davis 2010).

Additionally, Rotheram-Fuller and MacMullen (2011) also conducted a literature review and suggested different changes to CBT for autistic children. Of note, this review also explored studies utilizing CBT to treat anxiety in autistic children. The authors of this study also recommended making materials more concrete by using visual aids, hands-on activities, written worksheets, and drawing activities. Additionally, they recommended that therapists focus on participants' strengths during therapy and using Socratic questioning techniques with hints to the answer and/or intended construct. Next, the authors recommended increased exposure and practice of new skills, as compared to traditional CBT. For instance, they recommended that therapists provide multiple opportunities for practice with feedback, incorporate social reinforcement, video model activities, utilize in-vivo rehearsal, and engage in group therapy to allow practice opportunities with peers. Finally, the authors recommended increased attention toward generalizing skills via parent participation, engaging in in-vivo rehearsal to address challenges in relevant settings, and coaching in typical environments.

Also, Spain and colleagues (2015) reviewed the available literature on studies utilizing CBT to treat a variety of mental health symptoms in autistic adults. Based on the available evidence, the authors recommended several modifications for CBT programs for autistic individuals. First, they recommended using both written and pictorial methods. Next, they recommended having participants engage in emotional literacy activities prior to active CBT treatment, to better assess and describe their symptoms, as a way to address alexithymia. Also, they suggested using idiosyncratic language to describe emotions, so as to better help the participants understand the emotion. Additionally, they suggested using individualized outcome

measures. Next, they suggested that therapy have an emphasis on behavioral change and skills development. Finally, they recommended a less Socratic (question-answer) therapeutic style (Spain et al.., 2015). Of note, this is contrary to the recommendations described in Rotheram-Fuller and MacMullen (2011).

Walters and colleagues (2016) also reviewed modifications to CBT for autistic young people. This study used the framework of The National Institute of Health Care Excellence (NICE) guidelines for treating anxiety in autistic youth. The NICE guidelines recommend the following CBT modifications: emotion recognition training, greater use of written and visual information and structured worksheets, a more concrete and structured approach, simplified cognitive activities, caregiver involvement, maintaining attention by offering regular breaks, and, incorporating the child or young person's special interests (Baird et al., 2013). Walters and colleagues (2016) reviewed the modifications studies utilizing cognitive behavioral therapy for anxiety (n=12), OCD (n=1, Russell et al., 2013), and depression (n=1, McGillivray & Evert 2014). In addition to the NICE recommendations, the following treatment modifications were listed within studies: longer treatment dosages, post-session summation of information, role plays, token reinforcement, social skills training, and integrated school components.

Overall, the recommendations for modifying CBT programs to best suit the needs of autistic clients vary between studies and between reviews. Further research is necessary to determine which modifications are most helpful to improve the CBT treatment utility for autistic children, adolescents, and adults. Of note, further research is also necessary to determine if different modifications may be necessary to treat different co-occurring mental health diagnoses, as the majority of the published literature focuses on using CBT with modifications to treat

anxiety, rather than depression. The next section details the available evidence for CBT's utility in treating depression-specific symptoms in autistic individuals.

Cognitive Behavioral Therapy Targeting Depression for Autistic Individuals

While cognitive behavior therapy (CBT) has been utilized for depression for many years, there have been few studies completed investigating the efficacy of CBT interventions for individuals who have co-occurring ASD and depression. While research has been extensive studying the effects of CBT for anxiety in autistic individuals (Sharma et al., 2019), research exploring the treatment of depression in autistic clients with CBT is relatively new, as the first available research paper with depression outcome measures found was published in 2008 (Russell et al., 2008). Only 28 studies were able to be gleaned from the literature review that included autistic participants, CBT programming, and depression outcome measures. Also, the study designs and interventions varied across the studies described, including treatment control groups, age of participants, treatment fidelity, dosage of treatment, treatment setting, sample size, and other factors. Moreover, the method and level of detail regarding reporting adaptations to CBT programs for autistic individuals varied significantly. Furthermore, the data regarding treatment utility of CBT is mixed within studies found as well, as several of the included studies did not report significant treatment outcomes.

Upon reviewing individual studies, researchers are not currently able to determine if CBT is effective in treating depression for autistic individuals based on the variability in methods and the variability of statistical conclusions within individual primary studies. Given the variation in treatment effects observed, further statistical analysis is necessary to determine whether there is an overall treatment effect of CBT on symptoms of depression using combined data from the available studies. Accordingly, practitioners can make evidence-based decisions on which mental

health interventions to include for clients with co-occurring ASD and depression after reviewing the meta-analytic results.

Research Questions and Hypotheses

The purpose of the current study was to review the available published and unpublished literature using CBT to address symptoms of depression in autistic individuals. To the author's knowledge, there has never been a meta-analysis addressing the question as to whether cognitive-behavioral-based interventions are effective in treating symptoms of depression in autistic individuals. The following research questions and related hypotheses were included in the study.

Research Question #1: Overall, does CBT result in decreased depression symptoms immediately after treatment, as compared to pre-treatment depression levels (and pre- and post-depression levels within comparator groups when available), in autistic individuals?

Hypothesis #1: The author hypothesized that CBT would result in decreased depression symptoms immediately post-treatment, as compared to pre-treatment depression levels (and pre- and post-treatment depression levels in the treatment control group when available), in autistic individuals, as measured by a negative effect size. This finding would be consistent with effect sizes for CBT's effect on depression symptoms within typically developing populations (Oud et al., 2019; Lopez-Lopez et al., 2019; Santoft et al., 2019; Keles & Isoe 2018).

Research Question #2: Overall, does CBT result in decreased depression symptoms long-term, months after treatment, as compared to pre-treatment depression levels (and pre and follow-up-depression levels within comparator groups when available), in autistic individuals?

Hypothesis #2: The author hypothesized that CBT would result in overall decreased depression

symptoms long-term, months post-treatment, as compared to pre-treatment depression levels (and pre- and follow-up-depression levels in the treatment control group when available), in autistic individuals, as measured by a negative effect size. This finding would be consistent with effect sizes for CBT's effect on depression symptoms within typically developing populations (Oud et al., 2019; Lopez-Lopez et al., 2019; Santoft et al., 2019; Keles & Idsoe 2018).

Given the limited studies gleaned, the author took an inclusive approach to study inclusion. Thus, there were a variety of different research designs, CBT programs, co-occurring disorders of interest, and participant characteristics. The following research questions assessed whether these differing factors moderated the overall effect size estimate.

Research Question #3: To what extent do the effect sizes vary, depending on the level of pre-treatment depression symptoms of participants within the treatment group?

Hypothesis #3: The author hypothesized that the effect size estimates would be greater in magnitude for studies in which the participants had greater levels of pre-treatment depression symptoms. As seen below in the equations for effect sizes, greater pre-treatment depression scores have greater potential for decrease, as compared to pre-treatment levels with lower pre-treatment depression scores.

Research Question #4: To what extent do the effect sizes vary, depending on whether or not the study included a treatment control group that did not receive a mental health intervention?

Hypothesis #4: Given that depression symptoms are often episodic (APA 2022), it is hypothesized that both treatment and control groups may show a decrease in depression symptoms over time but that the treatment group will see greater decreases. As seen in the

equations for effect sizes within the methods section, treatment-controlled studies subtract the average change of the control group from the average change of the treatment group. Assuming both treatment and control groups would see decreased depression symptoms, the lack of the subtraction factor in studies without a control group would result in effect size estimates greater in magnitude, as compared to studies with a treatment control group.

Research Question #5: To what extent do the effect sizes vary within treatment-controlled studies, depending on whether or not researchers established group equivalence for presenting pre-treatment depression symptoms between the treatment group and the control group?

Hypothesis #5: The author hypothesized that the effect size estimates would be different between studies in which the researchers established equivalence for the pre-treatment depression symptoms between the treatment group and the control group, as compared to studies that did not establish equivalence between the depression levels of the treatment group and the control group. The author hypothesized that the directional difference would be different depending on whether the treatment group or the control group had significantly larger average pre-treatment depression levels. As seen in the equations for effect sizes within the methods section, the average change in both the treatment group and the treatment control group is calculated by subtracting the pre-treatment depression score from the post-treatment depression score. Significant differences in pre-treatment depression scores between the treatment group and the control group would result in less accurate effect size estimates.

Research Question #6: To what extent do the effect sizes vary, depending on the number of core elements included in the CBT intervention?

Hypothesis #6: The author hypothesized that studies that included greater CBT treatment fidelity by including all four core elements of CBT would have greater effectiveness, as compared to

studies that did not adhere to standard CBT treatment by utilizing all four CBT core elements within the intervention. This hypothesis is consistent with meta-analysis and meta-regression results from Oud and colleagues (2019), which found that the presence behavioral activation and cognitive restructuring within CBT programs moderated the effect sizes across studies exploring depression effectiveness for typically developing children and adolescents.

Research Question #7: To what extent do the effect sizes vary, depending on whether or not the CBT intervention included elements intended to treat other, non-depressive disorders (i.e., exposure for anxiety or exposure response prevention for obsessive-compulsive disorder)?

Hypothesis #7: Given that several studies included participants with a primary diagnosis of anxiety and/or obsessive-compulsive disorder, the CBT programs included exposure or exposure response prevention elements within the CBT program, which is evidence based for these diagnoses (Reid et al., 2021; Parker et al., 2018). The author hypothesized that the effect size estimates would be greater in magnitude for studies in which the CBT intervention did not include elements intended to treat other, non-depressive disorders, as compared to studies with CBT interventions that did include elements intended to treat non-depression-related symptoms. This hypothesis was based on the assumption that CBT treatments with non-depression related elements would include greater treatment time dedicated to treating other non-depressive symptoms, rather than depressive symptoms.

Research Question #8: To what extent do the effect sizes vary, depending on the treatment dosage?

Hypothesis #8: The author initially hypothesized that the effect size estimates would be greater in magnitude in studies with greater treatment dosages, based on the assumption that increased therapist contact would lead to better outcomes. However, upon an examination of the literature,

other reviews and meta-analysis exploring depression in typically developing populations did not find treatment dosage as a significant moderating factor (Oud et al., 2019; Yang et al., 2017; Cuijpers et al., 2013). Thus, the author amended her hypothesis such that differences in treatment dosages were not expected to result in changes in effect size estimates.

Research Question #9: To what extent do the effect sizes vary, depending on whether or not the CBT intervention was adapted to meet the needs of autistic individuals?

Hypothesis #9: The author hypothesized that the effect size estimates would be greater in magnitude for studies in which the CBT treatment was adapted to meet the needs of autistic individuals, as modifications would aid in difficulties associated with alexithymia, perspective-taking, abstract speech, and cognitive rigidity in individuals with autism, as described above.

Research Question #10: To what extent do the effect sizes vary, depending on the participant characteristics (intellectual ability, age, gender, race, socioeconomic status)?

Hypothesis #10: The author hypothesized that the effect size estimates would not vary when studies had participants with different characteristics, including intellectual ability, age, gender, race, and social-economic status, as CBT has been shown emerging evidence in reducing depression symptoms in adults with intellectual disability (Vereenooghe & Langdon, 2013) and in children, adolescents, and adults in typically developing populations (Oud et al., 2019; Lopez-Lopez et al., 2019).

Additionally, the author set out to explore differing qualitative differences between papers. The following research questions explore the descriptions of CBT programs, autism symptom severity, and adverse events. No specific hypotheses were included for these research questions, as they were meant to be descriptive in nature.

Research Question #11: What are the qualitative differences in how CBT programs were modified in order to meet the needs of autistic individuals?

Research Question #12: What are the qualitative differences in how autism spectrum disorder symptom presentation is described?

The author also included two exploratory research questions and hypotheses. These research questions were included as exploratory, as the author was unsure at the proposal stage if the included studies would have sufficient data to answer the questions.

Exploratory Research Question #1: To what extent do the effect sizes vary, depending on the participants' pre-treatment level of autism spectrum disorder symptoms?

Hypothesis for Exploratory Research Question #1: The author hypothesized that the effect size estimates would be greater in magnitude for studies in which participants had less severe autism spectrum disorder symptoms, as they would have less difficulties associated with alexithymia, perspective-taking, abstract speech, and cognitive rigidity in individuals with autism, as described above.

Exploratory Research Question #2: What are the qualitative differences in how included studies report adverse effects?

Hypothesis for Exploratory Research Question #2: No specific hypothesis was established for this research question, as the question was descriptive in nature.

These research questions were answered by conducting a systematic review/screening of the literature, providing a qualitative synthesis of the included studies, completing meta-analyses to determine the overall effect size of CBT on symptoms of depression after treatment in autistic

individuals, completing meta-regressions to assess for moderating variables, and conducting content analyses to describe the different CBT modifications, severity of autism spectrum disorder symptoms, and to summarize the descriptions of adverse events within studies. Further details on the methods used are included in the following section.

CHAPTER 2: METHODS

Literature search procedures

Studies were identified for this meta-analysis through computerized searches on online research databases. Computerized searches were conducted utilizing the following research databases: Academic Search Premier, ERIC, PsychINFO, PubMed, Web of Science, and ProQuest Dissertations and Theses. The author also searched grey, unpublished literature from the following sources: American Psychological Association (APA) conference proceedings, Cochrane library, Campbell Collaboration Library, clinicaltrails.gov, and the WHO International Clinical Trials Registry.

For grey literature sources, if a study title and/or abstract included a reference to autism and cognitive behavioral therapy, then the study title was searched to determine if any published data was available. If no published studies were found, then study authors were contacted to request unpublished data for inclusion within the meta-analysis.

Furthermore, ancestral data was collected by screening all articles within the included studies reference sections. Also, within the screening articles, any meta-analysis and/or review related to CBT within autistic individuals was excluded, as it did not have primary effect size data for inclusion in this meta-analysis. However, the primary studies within the reference sections were screened for inclusion in this meta-analysis. Additionally, the author used google search engine using the same Boolean phrases as the computer search to find other ancestral and/or unpublished data.

Boolean phrases for the searches included: ("cognitive behavior therapy" OR “cognitive behavior theory” OR “cognitive behavior intervention” OR "cognitive-behavior therapy" OR “cognitive-behavior theory” OR “cognitive-behavior intervention” OR "CBT" OR “cognitive

behavioral theory” OR “cognitive behavioral intervention” OR "cognitive-behavioral therapy" OR “cognitive-behavioral theory” OR “cognitive-behavioral intervention” OR "cognitive behaviour therapy" OR “cognitive behaviour theory” OR “cognitive behaviour intervention” OR "cognitive-behaviour therapy" OR “cognitive-behaviour theory” OR “cognitive-behaviour intervention” OR "cognitive behavioural therapy" OR “cognitive behavioural theory” OR “cognitive behavioural intervention” OR "cognitive-behavioural therapy" OR “cognitive-behavioural theory” OR “cognitive-behavioural intervention” OR CBT OR “Coping Cat” OR “Strong Teens” OR “Strong Kids” OR PEERS OR “cognitive therapy” OR "dialectical behavior therapy" OR “dialectical behavior theory” OR “dialectical behavior intervention” OR "dialectical-behavior therapy" OR “dialectical -behavior theory” OR “dialectical-behavior intervention” OR “dialectical behavioral therapy" OR “dialectical behavioral theory” OR “dialectical behavioral intervention” OR "dialectical-behavioral therapy" OR “dialectical-behavioral theory” OR “dialectical-behavioral intervention” OR "dialectical behaviour therapy" OR “dialectical behaviour theory” OR “dialectical behaviour intervention” OR "dialectical-behaviour therapy" OR “dialectical-behaviour theory” OR “dialectical-behaviour intervention” OR "dialectical behavioural therapy" OR “dialectical behavioural theory” OR “dialectical behavioural intervention” OR "dialectical-behavioural therapy" OR “dialectical-behavioural theory” OR “dialectical-behavioural intervention” OR DBT OR “acceptance and commitment therapy”) AND (depression OR depressive OR dysthymia) AND (Autism OR autistic OR Asperger’s OR Asperger).

After studies were identified, they were screened to determine if they met inclusion criteria and if any exclusionary criteria required their removal. Details on the inclusion and exclusion criteria for the study are provided below.

Study inclusion criteria

For studies to be included in the full-article screening phase of the current study, the articles needed to include the following characteristics.

1. Studies must be published in English.
2. All study participants must have a diagnosis of autism spectrum disorder, as defined by the DSM-V-TR, DSM-V, or the DSM-IV, or a diagnosis or either Asperger's syndrome or Persistent Developmental Disorder, Not Otherwise Specified (PDD-NOS), as defined by the DSM-IV.
3. Studies must implement a cognitive-behavioral theory-based intervention.
4. Studies must include an outcome measure related to depression (ex., *Beck Depression Inventory, Second Edition*).
5. The study's depression outcome measure must be completed in relation to the autistic individual's level of depression, not the parent's or the teacher's level of depression.
6. Studies must provide sufficient quantitative data to calculate effect sizes (e.g., visual graphs, means, standard deviations, etc.). If the necessary data were not included, authors were contacted to see if the necessary data were available.

Details for Depression Outcome Measures

Of note, a variety of different depression outcome measures were used within the included studies. Thus, a summary of each outcome measure is provided, including data that was used to code the qualitative pre-treatment depression level. First, the *Beck Depression Inventory, Second Edition (BDI-II,* Beck et al., 1996) is a self-report, includes 21 Likert-scale questions that measure the presence and severity of a MDD symptoms based on the DSM-IV diagnostic criteria for depression. Total scores less than 13 are considered no or minimal depression, while scores ranging between 14 and 19 are considered mild depression. Moderate depression scores range

between 20 and 28, while severe depression is indicated by scores greater than 29. The BDI-II possesses excellent internal consistency, and the BDI has convergent validity with observer-rated measures diagnosing depression (Beck et al., 1996; Marton et al., 1991; Startup & Barkham 1992). Internal consistency was .89 and test–retest reliability .75 (Erford et al., 2016). Evidence of convergent validity was offered primarily by a correlation of r = .71 with the Revised Hamilton Psychiatric Rating Scale for Depression (n = 87; Beck et al., 1996). A factor analysis revealed a two-factor structure with somatic-affective questions and cognitive questions (Beck et al., 1996). Of note, the BDI-II was validated for use with autistic adults (Williams et al., 2021). It was found to have strong reliability and validity within autistic adults, and it demonstrated moderate ability to discriminate between depressive and non-depressive states (Williams et al., 2021). Within the study by Williams and colleagues, they describe an autism-specific *T*-score where ≤ 49.1 is considered average, a *T*-score between 49.1 and 50.4 as mild symptoms, a *T*-score 50.5- 59.9 as moderate, and with a *T*-score > 60 as severe symptoms (Wiliams et al., 2021). This autism-specific *T*-score was used in one study (Bemmouna et al., 2021).

The *Depression Anxiety Stress Scale* (DASS; (Lovibond et al., 1995) was used in three studies (McGillivray & Evert 2017; Santomauro et al., 2016; Bemmer et al., 2021) The DASS is self-report measure with 21 questions that measure of depression, anxiety, and stress (Lovibond et al., 1995). The depression subscale is categorized as mild for scores from 10–13, moderate for scores from 14–20, and severe for scores over 21. The DASS Depression scale correlated 0.74 with the BDI (Lovibond, 1995). The reliability of the DASS depression scale was 0.96 (Brown et al., 1997). Of note, the DASS was recently validated for use in ASD populations (Park et al., 2020).

The *Hamilton Depression Rating Scale* (HAM-D; Hamilton, 1960) is a structured clinician interview after which the clinician rates 21 items on a Likert-scale based on the participant's interview answers. HAM-D scores from 0-10 are considered average, 14-17 are considered mild, 18-24 are considered moderate, 25 or greater are considered severe. In a recent review of the HAM-D, the internal reliability ranged from 0.46 to 0.97, and test-retest reliability ranged from 0.81-0.98 (Carrozzino et al., 2020). Convergent validity with the BDI-II ranged in studies from 0.48 to 0.89. Of note, this measure is limited due to the subjectivity and issues with reliability related to a third party rating the participants' qualitative answers using a quantitative scale.

The *Hospital Anxiety and Depression Scale* (HADS; Zigmond and Snaith, 1983) is a self-report questionnaire consisting of 14 Likert-style questions, 7 relating to depressive symptoms (Zigmond and Snaith, 1983). Scores on the HADS are considered mild at 8-10, moderate at 11-14, and severe at 15 or greater. The HADS showed that the test-retest reliability and the internal consistency were "good" (Spinhoven et al., 1997). To the author's knowledge there is no validation data specifically for adults with ASD.

The *Children's Depression Inventory, Second Edition* (CDI-II; Kovacs 2011) has two forms, a self-report form and a parent form with questions related to childhood depression (Kovacs 2011). The child form has 28 items with three separate sentences to choose from to indicate severity (ex. "I am sad once in a while," I am sad many times," "I am sad all the time."). The 28-item self-report scale is considered average below 16, mild from 16-19, moderate from 20-23, and severe at 24 or greater. Additionally, the CDI-II includes a self-report short form contains 12 similarly worded items. The self-report short form CDI-II scores are considered average below 5, mild at 6-7, moderate at 8, and severe above 9. The parent form has 17 items

Likert-style questions that score up to 4 points each (from “not at all” to “much/most of the time”), and the CDI-II scores are considered average below 14, mild from 15-20, moderate from 20-25, and severe over 25 (Kovacs 2011). The CDI-II has previously been proven sufficiently reliable, with Cronbach’s α ranging from 0.80 to 0.94 (Saylor et al., 1984). In (Balci et al., 2020), CDI-II reports showed high internal consistency, ranging from Cronbach’s α=0.79–0.86. To the author’s knowledge, no study has validated the CDI-II for use within autistic populations. Rather, a study by Mazefsky and colleagues (2011) compared self-report CDI-II scores to longer DSM parent interviews and found that the CDI-II scores had a high rate of false negative scores for children.

The *Anxiety Depression and Mood Scale* (ADAMS; Esbensen et al., 2003) is a 28-item informant-report, Likert-scale questionnaire that was developed to screen for mental health disorders in people with below average intellectual abilities. The ADAMS yields a total score and five subscale scores for different disorders, including Manic/Hyperactive Behavior, Depressed Mood, Social Avoidance, General Anxiety, and Obsessive/Compulsive Behavior. The ADAMS has acceptable internal consistency across subscales (Chronbach’s alphas range: .75–.83) and total scores, in addition to excellent test–retest reliability for individuals with intellectual disability (Esbensen et al., 2003). *T*-scores were considered average below 60, mild from 60-65, moderate from 65-75, and severe above 75.

The *Adult Self Report* (ASR, Achenbach & Rescorla, 2003) is a self-report 123-item scale with Likert-style questions. Raw subscale scores are transformed to *T*-scores to allow for comparison. *T*-scores were considered average below 60, mild from 60-65, moderate from 65-75, and severe above 75. Reliability, validity, and stability are “well-documented” for the ASR (Achenbach & Rescorla, 2003). Within the study by Capriola-Hall and colleagues (2021), the

ASR was administered at pre-, post-, and follow-up time points. Internal consistencies were acceptable across time points for the depression subscale (α = .84 at pretreatment; .88 at post-treatment). To the author's knowledge no study has validated the ASR within autistic populations.

The *Automatic Thoughts Questionnaire* (ATQ; Hollon and Kendall 1980) is a self-report assessment that measures the frequency of 30 negative self-talk statements often associated with depression (ex. "I am a failure"). Participants rated each item on a 5-point scale indicating how frequently they have had these thoughts in the past week (1 = not at all, 5 = all the time). Scores are considered average from 0-55, mild from 55-80, moderate from 80-100, and severe above 85 (Hollon & Kendall 1980). Cronbach's alpha coefficient for the included study was 0.95 (McGillivray & Evert 2017). To the author's knowledge no study has validated the ATQ within autistic populations.

The *Behavior Assessment System for Children, Second Edition* (BASC-2; Reynolds and Kamphaus 2006) parent form includes 134 items. All items are scored on a 4-point Likert scale from ''Never'' to ''Almost Always.'' Psychometric properties for composite scores are strong for internal consistency (0.90's), test–retest reliability (0.80's), inter-rater reliability (0.57–0.74), and convergent validity (~0.70, ~ 0.80). Each BASC-2 subscale creates a *T*-score. Scores from 0-59 are considered average, scores from 60-65 are considered mild, scores from 65-75 are considered moderate, and scores above 75 are considered severe (Reynolds and Kamphaus 2006). To the author's knowledge no study has validated the BASC within autistic populations. One study provided descriptive data but did not validate the measure within the autistic sample populations (Waggoner 2005). Also, one study validated the teacher version of the BASC, but not the parent version (Hass et al., 2012).

The *Beck Hopelessness Scale* (BHS, Beck et al., 1974) is a 20-item true/false self-report measure that assesses negative feelings about the future, loss of motivation, and lack of hope. The BHS interpretation guidelines indicate scores from 0 to 3 are within the average range, 4 to 8 is mild, 9 to 14 is moderate, and greater than 14 is severe. In both clinical and non-clinical samples, the BHS has been found to have good psychometric properties (e.g., Beck et al., 1974; Bouvard et al., 1992; Steed, 2001; Kliem et al., 2018). To the author's knowledge no study has validated the BHS within autistic populations. The BHS has only been used to assess hopelessness in autistic individuals two times to the author's knowledge (Cashin et al., 2013; Koegel et al., 2016).

The *Beck Youth Inventories* (BYIs) are a set of child self-report questionnaires (Beck 2001). There are five subscales, one of which is depression. Each scale consists of 20 items scored never, sometimes, often, or always. For the depression subscale, scores from 0-15 are considered average, 15-20 are considered mild, 20-25 are considered moderate, and 25 and greater are considered severe. The original reported internal consistency ranged between 0.89 and 0.94 (Beck 2001). To the author's knowledge no study has validated the BYIs within autistic populations.

The *Center for Epidemiological Studies, Depression* (Radloff et al., 1977) is a self-report assessment designed to measure depressive symptoms. The CES-D was found to have "very high" internal consistency and "adequate" test-re-test repeatability. CES-D scores from 0-15 are considered average, from 16-18 are considered mild, from 18-25 are considered moderate, and over 26 are considered severe (Radloff 1977). Validity was established by patterns of correlations with other self-report measures. Of note, this scale was created for epidemiologic

studies of depression, not as a diagnostic tool. To the author's knowledge, this measure has not been validated in autistic samples.

The *Emotion Dysregulation Inventory –Short Form* (EDI-13; Mazefsky et al., 2018) is a caregiver-report measure with Likert-style questions designed to capture emotional distress and problems with emotion regulation (Mazefsky et al., 2018). The EDI-13 includes a total of 13 items with two subscales, reactivity (7 items) and dysphoria (6 items). The dysphoria scale includes questions related to decreased positive affect, increased negative affect, and nervousness. Cronbach's alpha internal consistency 0.90 for dysphoria (Mazefsky et al., 2018). In the dissertation by Lee (2021), the overall internal consistency was 0.93 for dysphoria. Of note, this measure was specifically created for and validated for use within autistic populations.

The *Montgomery Asberg Depression Rating Scale, Self-Report (MADRS-S)* depression subscale is a 9-item self-report scale assessing depression symptoms with Likert-style questions (Svanborg and Åsberg, 1994). Given the average MADRS-S score for patients diagnosed with major depression was 14.5 (4.7), the MADRS-S scores were listed as average below 8, mild from 8.1-10, moderate from 10.1-16.5, and severe above 16.5. The MADRS-S has a high correlation with the Beck Depression Inventory (r=0.87; Svanborg & Åsberg, 2001). also has high internal consistency (α=0.82–0.90; Carlbring et al., 2007).

The *Patient Health Questionnaire, Nineth Edition* (PHQ-9; Kroenke & Spitzer 2002) is a nine-item self-report measure of depression that is commonly used in primary care settings. The PHQ-9 scores were considered average from 0-4, mild from 5-10, moderate from 10-16, and severe above 17. The PHQ-9 has been found to be reliable (Cronbach's α = 0.84–0.93), valid and sensitive to change in the general population (Kronenke & Spitzer 2002). To the authors' knowledge, the PHQ-9 has not been validated for use in autistic populations.

The *Patient-Reported Outcomes Measurement Information Systems, Depression Scale* (PROMIS – Dep) is a 14-item scale that was developed via the National Institute of Health initiative as a brief, change-sensitive depression outcome measure (Irwin et al., 2010). The reliability of the PROMIS-depression scales was estimated to be 0.85 (Irwin et al., 2010). The interpretation of the PROMIS-depression scores is based on guidelines from the emerging measures within the DSM-IV (APA 2013). Raw scores less than 32 are considered average, 33-38 are considered mild, 39-52 are considered moderate, and greater than 53 are considered severe (APA 2013). To the author's knowledge, this measure has not been validated for use with autistic populations.

The *Revised Children's Anxiety and Depression Scale, Depression* (RCADS; Chorpita et al., 2015) consists of 10 items. Raw scores are converted to *T*-scores. *T*-scores between 0-59 were considered average; scores from 60-65 were considered mild; scores from 66-75 were considered moderate; and scores 75 or greater were considered severe. Both the parent and the child completed the RCADS depression subscale in the study by Schwartzman and colleagues (2023). This measure has been validated for use within autistic populations (Sterling et al., 2015). Within autistic populations, this measure showed convergent validity with the Child Behavior Checklist (Achenbach 2001).

The *Short Form of the Mood and Feelings Questionnaire* (SMFQ; Messer et al. 1995) is a 13-item self-report measure with Likert-style questions related to low mood, low self-esteem, low self-worth, and depression symptoms. A score of 11 or greater has previously been shown to have a high sensitivity and specificity for depression symptoms (Thapar & McGuffin, 1998). Thus, scores were coded as follows: 8 or low as average, 8-9 as mild, 9-11 as moderate, 12 or

more as severe (Thapar & McGuffin, 1998). To the author's knowledge, this measure has not been validated for use within autistic populations.

Study exclusion criteria

Studies with the following criteria were not included in the current study. The author chose to limit the exclusion criteria due to the minimal number of studies exploring the concepts of interest.

1. Case study designs without ABAB designs were excluded due to no available effect sizes.
2. Qualitative review, quantitative review, correlational, and meta-analysis studies were not included due to no available effect size.

Screening

All retrieved studies were screened using the above-described inclusion and exclusion criteria. First, the author screened the title and abstract. If the study met inclusion criteria and did not include any exclusionary criteria, it was coded as "Yes," and the study was included in the full text review. If it was unclear if the study met in the inclusion criteria or had any exclusionary factors, then it was coded as "Maybe," and the study was included in the full text review. If there was evidence that the study did not meet the inclusion criteria or had an exclusionary criterion, then it was coded as "No," and the study was not included in the full-text review stage.

During the full-text review, the author reviewed the full article to determine if it included all inclusion factors and if it included any exclusion factors. Whenever an article was deemed ineligible for inclusion, the article was coded for which inclusion criteria was not met. If an

article was deemed eligible for inclusion after the full-text screening, then it was fully coded using the criteria described below.

Coding

After the full-text screening was completed, studies that met inclusion criteria were coded using the coding manual described in Appendix B with variables of interest defined. The following variables were categorized: report characteristics, intervention characteristics, setting characteristics, participant characteristics, research design characteristics, and depression data. Table 1 summarizes the coding variables within the manual in Appendix B.

Table 1.
Coding Manual Summary

Variable	Description
Report Characteristics	
Report ID number	The individual two-digit identification number assigned to each study.
Last name	The last name of the first author.
Publication year	The year the study was published.
Type of publication	Peer-reviewed journal article, doctoral dissertation, technical report, or unpublished study
CBT Program Characteristics	
Program Name	Name of the CBT program.
Core Elements	List of CBT core elements included in CBT program (i.e., psychoeducation, behavioral activation, cognitive restructuring, skills training)
Group size	One-on-one or group CBT.
Type of interventionist	Researcher, clinician, other.
Dosage	Total number of minutes that the CBT program was delivered to participants
ASD Modified	Presence or absence of adaptations to CBT program to meet the needs of autistic individuals.
Non-Depression Elements	Presence/absence of CBT elements not associated with depression treatment (ex. exposure, exposure response prevention)
Treatment Integrity	Record the percentage of planned manualized treatment components that were administered over the course of treatment.
Setting Characteristics	
Country	USA or outside of the US (specify if other)
Setting	Clinic, school, online, or other.

Participant Characteristics (Treatment and Control Groups)	
Intellectual Ability	Average FSIQ
Age	Average age of participants.
Gender	%Male participants
Social Economic Status	%Participants with high social-economic status, as identified by income over $100,000/year, graduate education, or parental graduate education.
Race/Ethnicity	%Caucasian
Research Design Characteristics	
Comparison condition	Presence or absence intervention/waitlist control group.
Control group detail	Type of control, comparison group included (i.e., waitlist control, treatment as usual, alternative intervention, no comparison group)
Group randomization	Whether participants were randomized or non-randomized to the intervention or comparison group.
Group equivalence	If comparison group is present, presence or absence of group equivalence evaluation prior to treatment.
Treatment fidelity	Percentage of implementation fidelity reported (i.e., Not measured, measured but not reported, percentage of adherence if measured).
ADOS-2 Diagnosis	Whether or not participants completed the ADOS-2 to confirm their ASD diagnosis.
Depression Inclusion	Whether or not depression symptoms and/or diagnosis was an inclusion factor for the study.
Low FSIQ Exclusions	Whether or not below average intelligence, as measured by a full-scale intelligence quotient (FSIQ), was an exclusion factor for the study.
Depression Data	
Depression Outcome Measure	Norm-referenced, standardized measure used to measure depression.
Qualitative pre-treatment depression level	The qualitative average pre-treatment depression level was coded for both the treatment group and the control group (ex. average, mild, moderate, severe).
Quantitative pre/post/ follow-up depression level	The quantitative standardized depression score mean, standard deviation, and sample number for both the treatment and control groups at pre-treatment time points, post-treatment time points, and/or follow-up time points.
Coder and Coding Process	
Date Coded	Date coded by coder 1
Coder 1	Initials of coder 1
Date Double Coded	Date coded by coder 2
Coder 2	Initials of coder 2

Agreement

During the abstract screening phase, another graduate student (SI) was trained in screening abstracts for inclusion and exclusion criteria. The reliability coder and the author met to review inclusion and exclusion criteria. After successfully screening 15 abstracts with 100% agreement, the reliability coder was deemed trained and co-screened all articles from the literature search.

During the full-text screening, the reliability coder (SI) screened three studies for training purposes. After reaching 85% agreement or greater on three articles, then they were deemed reliable and allowed to independently screen the full-text articles, while still allowing for questions on an as-needed basis. The reliability coder independently screened 30% of the articles to estimate the full-text screening reliability.

During the full-text coding phase, the reliability coder was trained in the coding manual, including the coding variable definitions, and they reviewed the coding manual together. The reliability coder coded two example articles during the training session. Once the reliability coder reached 85% agreement with the author on articles, they were considered trained and deemed reliable. The reliability coder independently coded 30% of the articles to estimate reliability of the full-text coding.

Computing Effect Sizes and Variances for Each Included Study

The author extracted the following data for participants in the treatment (and control group when applicable) at the pre-treatment, post-treatment, and follow-up time points (when applicable): number of participants; average level of depression, as measured by a standardized outcome measure; and the standard deviation of the average level of depression. This information was used to calculate effect size(s) for each study to estimate the effect the CBT-

based program had on depression levels over time. The standardized mean difference (SMD) was used. First, for studies with single group pre/post designs without a treatment control, the SMD was calculated using the following formula (Cooper et al., 2019) described in Figure 5.

Figure 5.
Effect Size Equation - Without Control Group

$$SMD = \frac{M_{post,T} - M_{pre,T}}{SD_{pre,T}}$$

Mpost,T=average value of depression outcome measure score post-treatment, Mpre,T=average value of depression outcome measure score pre-treatment, SDpre,T=standard deviation of the pre-treatment depression outcome measure score

The variance of the effect size for uncontrolled pre/post treatment studies was calculated using the formula described in Figure 6.

Figure 6.
Effect Size Variance - Without Treatment Control Group

$$V_d = \left(\frac{1}{n} + \frac{d^2}{2n}\right)2(1-r)$$

n=sample size, d=SMD, r =correlation between the pre-treatment and post-treatment depression outcome measure scores

For controlled, two group pre/post study designs, the SMD was calculated to measure the difference in the change in depression between the control group and the treatment group using the formula described in Figure 7 (Becker, 1988; Morris 2008).

Figure 7.
Effect Size Equation - With Treatment Control Group

$$SMD = c_T\left(\frac{M_{post,T} - M_{pre,T}}{SD_{pre,T}}\right) - c_C\left(\frac{M_{post,C} - M_{pre,C}}{SD_{pre,C}}\right)$$

Mpost=average value of depression outcome measure score post-treatment, Mpre=average value of depression outcome measure score pre-treatment, SDpre=standard deviation of the pre-treatment depression outcome measure score, ,T=value for the treatment group, ,C=value for the control group, C_x=small sample adjustment for groups

The variance of the effect size for controlled, pre/post studies was calculated using the formula described in Figure 8 (Becker, 1988; Morris 2008).

Figure 8.
Effect Size Variance - With Treatment Control Group

$$V_{SMD} = c_T^2\left(\frac{2(1-\rho)}{n_T}\right)\left(\frac{n_T-1}{n_T-3}\right)\left(1+\frac{n_T\delta_T^2}{2(1-\rho)}\right)-\delta_T^2 + c_C^2\left(\frac{2(1-\rho)}{n_C}\right)\left(\frac{n_C-1}{n_C-3}\right)\left(1+\frac{n_C\delta_C^2}{2(1-\rho)}\right)-\delta_C^2$$

CT/Cc=small sample correction for treatment/control group, ρ=correlation between the pre-test and post-test depression scores, n=sample size, T=treatment group, C=control group, δ=SMD

A small sample adjustment was included for both the treatment controlled and uncontrolled studies, as shown in Figure 9 (Morris et al., 2008).

Figure 9.
Small Sample Adjustment Equation

$$c_j = 1 - \frac{3}{4(n_j-1)-1}$$

n=sample size

Of note, the variance equations for both treatment-controlled studies and the uncontrolled studies all require an r value, which is the correlation between the pre-treatment depression level and post-treatment depression levels. These correlations were calculated for each individual study using a combination of summary statistics and statistical test summaries pre-treatment, post-treatment, and follow-up (ex. means, standard deviations, n, t-statistics for repeated measures t-tests, f-statistics from repeated measures two-way ANVOAs, standardized mean differences with standardized deviations, and/or standardized mean differences between pre- and post-depression levels with confidence intervals. Correlations were able to be calculated for 22 of 28 studies. After each individual pre/post or pre/follow-up correlation was calculated for studies that included the necessary data, a meta-analysis was conducted to determine the overall

weighted correlation for the pre-treatment to post-treatment depression values and the overall correlation for the pre-treatment to follow-up depression values. These overall values were used in the variance equations for each individual study.

Meta-Analysis Procedures

To answer **Research Question #1 and Research Question #2**, a random-effects model was used to calculate summary effects of depression. Specifically, the correlated-and-hierarchical effects (CHE) model was used (Pustejovsky & Tipton, 2022). This model was chosen, as it uses robust variance estimation to control for multiple, dependent, correlated effect sizes within one study. For instance, researchers collected data related to depression symptoms at different time points, used multiple measures to measure depression symptoms, and used multiple CBT-based intervention programs, which resulted in multiple non-independent effect sizes within one study.

The CHE model combines the hierarchical effects model and the correlated effects models. The hierarchical effects model treats each effect size as an independent sample, as it assumes that the dependency of the effect sizes is only related to the common features of the study, not estimation error. Conversely, the correlated effects model treats multiple effect sizes within one study as dependent and correlated. The correlated effects model includes the following assumptions: there is no within-study variation in the effect size estimates, except for the variation explained by the covariates; the sampling variances are approximately the same; and the correlation between effect sizes is the same, both within-studies and between-studies. The CHE model allows for both within-study and between-study heterogeneity, as well as correlated effect sizes, which results in a more well-controlled meta-analysis and more accuracy in the weighting of the different effect sizes into the overall effect size. The CHE model assumes

there is one single correlation between pairs of effect sizes from the same study, or a constant sampling correlation. The equation for the CHE model is shown in Figure 10 (Pustejovsky & Tipton 2022).

Figure 10.
Correlated and Hierarchical Effects Model

$$T_{ij} = \mathbf{x}_{ij}\beta + u_j + v_{ij} + e_{ij}$$

Tij=effect size estimate number i from study j, xij= covariates, β=regression coefficients, uj=between study heterogeneity, vij=within study heterogeneity, eij=sampling error

The {metafor} and {clubSandwich} packages within R were used to complete the analysis (R Core Team, 2023; Viechtbauer, 2010; Pustejovsky 2022). First, a meta-analysis was conducted to determine the CBT-program's effect on depression for time points immediately after treatment, yielding an overall effect size, standard error of the effect size, and a confidence interval. Also, for studies that include follow-up data, another meta-analysis was conducted for CBT-based programs' effectiveness in decreasing depression long-term to determine the long-term effect size, the standard error of the effect size, and a confidence interval. Heterogeneity, or the to the extent to which effect sizes from individual studies vary, was assessed using the standard deviations of each meta-analysis and meta-regression.

To answer **Research Question #3, Research Question #4, Research Question #6, Research Question #7, Research Question #8, Research Question #9, and Research Question #10,** meta-regression analyses were also completed to determine the extent to which effect sizes vary depending on different factors. Separate meta-regression were calculated for the following variables: (RQ3) the pre-treatment depression level of participants in the treatment group (average, mild, moderate, or severe), (RQ4) the presence/absence of a treatment control group, (RQ6) the number of included CBT core elements, (RQ7) the presence/absence of CBT

elements designed to treat non-depressive disorders (exposure for anxiety or exposure/response prevention for obsessive-compulsive disorders), (RQ8) the treatment dosage, or the total intervention minutes, (RQ9) the presence/absence of modifications to CBT interventions to address the needs of autistic participants, and (RQ10) the participant characteristics, including participant full scale intelligence quotient estimate average, average age, percentage of male participants, and the percentage of participants with high social-economic status. The author had planned to complete meta-regression analyses to answer **Research Question #5** and **Exploratory Research Question #1,** but there was insufficient data to run the analyses.

Assessment of Bias

Risk of Bias (RoB) was evaluated for each included study using the Cochrane RoB in randomized trails tool to assess for biased research designs (RoB2, Cochrane Methods 2021), and the RoB data was visualized using Cochrane charting and graph tools (Cochrane Methods 2021). Additionally, the author visually inspected a funnel plot to evaluate for asymmetry to assess for publication bias.

Qualitative Research Questions

The author answered the qualitative research questions using a content analysis approach (Stemler, 2001). The author used emergent coding procedures. After reviewing all data, a comprehensive set of features was established, and the author coded the presence or absence of each feature within each study (Stemler, 2001).

Research Question 11: Descriptions of Modifications to CBT Programs for ASD

To answer **Research Question #11**, the author conducted a content analysis to determine different methods used to modify the CBT interventions to be more appropriate for autistic individuals. The author reviewed information provided in the primary study, which often

included narrative descriptions and summary tables of intervention session themes. The author also reviewed referenced literature within the primary study including pilot studies, study protocols, and published manuals, when available without a fee and published in English. The author emailed authors to request full text of manuals when they created the manuals themselves. After the studies, referenced literature, and/or manuals were reviewed, a comprehensive checklist of modifications to the CBT programs was compiled. The presence or absence of each modification was coded within all studies, and the frequency of each modification was calculated.

Research Question 12: Description of ASD Symptom Presentation

To answer **Research Question #12,** the author conducted a content analysis of the intervention descriptions to determine different methods used to quantify the level of autism spectrum disorder (ASD) symptom severity within the participants of each study. After all studies were reviewed, a comprehensive checklist of methods was compiled. The author coded the presence or absence of each method within the checklist for each of the included studies. Also, many studies used quantitative measures as their method to measure ASD symptom severity, and many studies listed summary statistics for these quantitative measures. The presence or absence of each method was coded within all studies, and the frequency of each method was calculated. Also, the average symptom severity level, as measured by the standardized outcome measures, was reported for any measure included in three or more studies.

Exploratory Research Question 1: Presenting Autism Symptom Severity

There was insufficient data to run a meta-regression for the variable of presenting autism symptom severity. However, data for the effect size estimate, variance, and average pre-treatment ADOS-2 scores are summarized in a table.

Exploratory Research Question 2: Adverse Events

To answer **Exploratory Research Question #2**, the author conducted a content analysis of the explicit descriptions of adverse events and attrition descriptions. After all studies were reviewed, the author planned to complete a comprehensive checklist detailing different descriptions of adverse events. Given the minimal data provided in studies, the author simply summarized the text included within articles that addressed adverse events.

CHAPTER 3: RESULTS

Literature Search Results

The Boolean search terms listed in the methods section was run to locate articles, and the search yielded the following number of studies for each database: Academic Search Premier produced 194 studies; Education Research Complete produced 82 studies, ERIC produced 56 studies, PyscINFO produced 479 studies; PubMed produced 179 studies; Web of Science produced 435 studies, and ProQuest Dissertations and Thesis produced 245 studies. The grey, unpublished literature searches yielded the following number of studies: APA conference proceedings produced 0 studies, Cochrane Library produced 65 studies, Campbell Collaboration Library produced 0 studies, clinicaltrials.gov produced 37 studies, and the World Health Organization (WHO) International Clinical Trials Registry produced 9 studies. Additionally, reference searches yielded 1,901 studies from included articles and 1,072 studies from reviews and meta-analyses related to this dissertation. A total of 4,754 studies were identified. After de-duplicating studies, 4,291 studies were screened using the initial screening criteria described in the methods section (Table 2.)

Table 2.
Literature Search Results

Database	Number of Results
Published Literature	
Academic Search Premier	194
Education Research Complete	82
ERIC	56
PsycINFO	479
Web of Science	435
PubMed	179
ProQuest Dissertations and Thesis	245
Grey Literature	
APA Conference Proceedings	0
Cochrane Library	65
Campbell Collaboration Library	0

Clinicaltrials.gov	37
WHO International Clinical Trails Registry	9
Ancestral Search	
References in Included Articles	1,901
References in Related Reviews/Meta-Analysis	1,072
Total	4,754
Total without Duplicates	4,291

Reliability

The author and the reliability coder established 93% agreement during this initial title/abstract screening phase. After consultation, the final title/abstract screening percentage was 100%. The full-text screening agreement percentage was 95%. After consultation, the final full-text screening percentage was 100%. The full-text coding agreement percentage was 92%. After consultation, the final full-text coding agreement percentage was 100%.

Qualitative Synthesis

Qualitative data is summarized for all studies that met inclusion criteria below. First, Table 3 details the types of publications included in the meta-analysis. After full-text screening, 28 articles met criteria for inclusion. Of the 28 studies, 25 were published in peer-reviewed journal articles, one was a published letter to the editor within a peer-reviewed journal, one was an approved dissertation published on ProQuest Dissertations and Thesis, and one was unpublished data provided by Dr. Jessica Schwartzman, the author of a study protocol listed on clinicaltrials.gov. Report characteristics for individual studies are summarized in Appendix C.

Table 3.
Summary of Report Characteristics

Type of Publication	**# of Studies**
Article in Peer Reviewed-Journal	25
Approved Dissertation	1
Unpublished Data	1
Letter to the Editor	1

Table 4 details the qualitative data collected related to the Cognitive Behavioral Therapy (CBT) interventions. A variety of CBT interventions were used. Of note, Wickberg and colleagues (2022) used two CBT interventions within their study. Thus, a total of 29 interventions are described in Table 4. Of the 29 included CBT interventions, 10 were a generalized CBT program without a specific name or published manual. Three studies utilized second wave CBT programs, Acceptance and Commitment Therapy (ACT; Pahnke et al., 2014; Pahnke et al., 2019) and Dialectical Behavioral Therapy (DBT; Bemmouna et al., 2022). The Resourceful Adolescent Program (Shochet & Wurfl, 2015a, 2015b) was used in two studies (Mackay et al., 2017; Shochet et al., 2022). The remaining 15 studies utilized existing CBT programs with published manuals or created their own manuals for CBT programs.

Across all studies reviewed, the CBT interventions were completed in a group (n=11 studies) or in individual formats (n=16 studies), and two studies did not report the group size. Most CBT programs were reported to be facilitated by a clinician (n=26 studies), as evidenced by a stating the individual had a master's degree or mental health licensure. Two CBT interventions were reported to be facilitated by non-licensed providers with only study-specific training. The dosage, or the number of hours of therapy, varied between studies. The smallest dosage was 5.25 hours, while the longest dosage was 108 hours. Of the 29 CBT programs, four included 0-to-10 hours of content, 13 included 10.1-to-20 hours of content, 4 included 20.1-30 hours of content, two included more than 30 hours of treatment, and 6 studies did not list the treatment dosage.

Within all included CBT programs, almost all programs included all CBT core elements (psychoeducation, behavioral activation, cognitive restructuring, and skills training; see pages 10-15). Four included studies' CBT interventions did not include cognitive restructuring

(Habayeb et al., 2017; Nakagawa et al., 2019; Russell et al., 2020; Bemmer et al., 2021). Also, two included studies did not include skills training (Nakagawa et al., 2019; Russell et al., 2020). Lastly, most included studies referenced modifications to CBT programs to meet the needs of autistic individuals (n=26 studies), either directly within the paper or within referenced documentation. Only three referenced CBT programs did not report any modifications for autistic individuals within the descriptions of programs in the primary research study and/or in referenced documentation for the CBT program (Balci et al., 2022; Gaigg et al., 2020; Russell et al., 2008). Treatment characteristics within each included study are summarized in Appendix C.

Table 4.
Summary of Treatment Characteristics

CBT Program Details	**Number of Studies**
Program Name	
Acceptance and Commitment Therapy (ACT)	1
Cat-Kit and CBT	1
Competitive Memory Training (COMET)	1
Dialectical Behavioral Therapy (DBT)	1
Emotional Awareness and Skills Enhancement (EASE)	1
Engage Program	1
Exploring Depression	1
Facing Your Fears	1
Guided Self-Help, Low Intensity CBT	1
iCBT	1
NeuroACT	1
Resilience Builder Program (RBP)	1
Resourceful Adolescent Program, RAP-A (RAP – Autism)	2
Serenity Online Program	1
Skills Improvement for Emotion Regulation for Adults (SIERA)	1
Stepped Transition in Education Program for Students with ASD (STEPS)	1
Think Well, Feel Well, Be Well	1
Treatment of Anxiety in Late Adolescents with ASD (TALAA)	1
Unspecified CBT Program	10
CBT Core Elements Included	
Psychoeducation	29
Behavioral Activation	29
Cognitive Restructuring	25
Skills Training	27

CBT Non-Depression Elements	
Typical CBT	11
CBT + Exposure/ERP	18
Group size	
One-on-one	11
Group	16
Not Reported	2
Type of interventionist	
Clinician	26
Other	2
Not Listed	1
Dosage	
0-to-10 hours	4
10.1-to- 20 hours	13
20.1-to-30 hours	4
Greater than 35 hours	2
Not Listed	6
ASD Modified	
CBT program adapted for ASD	26
CBT program not adapted for ASD	3
Treatment Integrity	
Treatment Integrity <80%	0
Treatment Integrity >80%	6
Not listed	23

*****One study included two CBT interventions. Thus, data was collected for 29 CBT interventions.

Table 5 describes details about the setting of the interventions. The 28 included studies were conducted in a variety of different countries, including the United States of America (n=7 studies), the United Kingdom (n=6 studies), Australia (n=5 studies), Sweeden (n=5 studies), Japan (n=2 studies), the Netherlands (n=2 studies), and France (n=1 study). The locations of the program intervention also varied. Of note, one study utilized two CBT programs that were implemented in two different settings. Thus, the total number of settings was 29. Of the 29 intervention settings, 12 were conducted in a clinical setting, three were conducted in a school

setting, and three were conducted online with interventionist support, and 11 did not identify the intervention setting. Setting characteristics for included studies are summarized in Appendix C.

Table 5.
Summary of Setting Characteristics within Included Studies

Setting Details	Number of Studies
Country	
USA	7
United Kingdon	6
Australia	5
Sweeden	5
Japan	2
Netherlands	2
France	1
Setting	
Clinic	12
School	3
Online	3
Not Reported	11

*One study included two interventions which were conducted in two settings. Thus, there were 29 different recorded settings.

Table 6 describes the average participant characteristics within the treatment groups and the control groups of included studies. One study included two interventions which were conducted with two separate groups of treatment participants. Thus, data regarding treatment group participant characteristics were recorded for 29 interventions within 28 studies. Only 12 studies included a treatment control group. Thus, data regarding control group participant characteristics were recorded for 12 studies. For studies that completed intelligence testing, the average full-scale intelligence quotient standard score (FSIQ) was recorded. Most studies did not complete intelligence testing and/or report an average score (17 of 29 treatment groups, 7 of 12 control groups). Only one study (Blakely-Smith et al., 2021) included participants with FSIQ scores below one standard deviation of the mean (FSIQ average=100, standard deviation=15, Wechsler et al., 2008, Wechsler et al., 2005), and only one study's participants had FSIQ scores greater than one standard deviation above the mean (Gaigg et al., 2020). Originally the intent of

this research was to report the percentages of all genders. However, many studies only reported the total number and/or percentage of male participants, rather than including the numbers and/or percentages of male, female, non-binary, and transgendered participants as well. Thus, the numbers of female, non-binary, and transgendered participants was unable to be collected for these studies. Accordingly, only the percentage of male participants was recorded for each study, as to include as many studies as possible within analyses. Gender was stratified by groups with participants below and above 75% because the most recent prevalence data estimates that the male: female prevalence ratio is 3:1 (Loomes et al., 2017). Similarly, the author originally intended to report percentages of all races, but primary studies often only provided the number/percentage of Caucasian participants within the sample. Accordingly, only the percentage of Caucasian participants was recorded for each study, as to include as many studies as possible within analyses. The percentage of Caucasian participance was stratified by groups with participants below and above 60% because current demographics within the United States of America estimate that Caucasian population to be 60%. Participant characteristics for each included study are summarized in Appendix C.

Table 6.
Summary of Participant Characteristics within Included Studies

Participant Details	**# Studies (Control)**	**# Studies (Treatment)**
Intellectual Ability		
FSIQ Avg < 70	0	1
FSIQ Avg 71-85	0	0
FSIQ Avg 86-100	2	3
FSIQ Avg 100-115	2	7
FSIQ Avg > 115	1	1
Not reported	7	17
Gender		
%Male<75%	3	18
%Male>75%	7	6
Not reported	2	5

Social Economic Status (SES)		
%High SES<30%	1	5
%High SES>30%	2	6
Not reported	9	18
Race/Ethnicity		
%Caucasian<60%	0	1
%Caucasian>60%	3	10
Not reported	9	18
Total Number	12	29

Table 7 summarizes the variety of different standardized depression outcome measures used within the included studies. Further detail on each of the included depression outcome measures can be found in the introduction section (pages 32-40). Of note, several studies utilized more than one depression outcome measure. Thus, the total number of included depression outcome measures is 36. The most used depression outcome measure was the *Beck Depression Inventory, Second Edition (BDI-II),* which was used in seven studies. Also, the *Depression and Anxiety Scale (DAAS), Hamilton Depression Rating Scale (HAM-D), Hospital Anxiety and Depression Scale, Depression Sub-scale (HADS-D),* and the *Children's Depression Inventory, Second Edition (CDI-II)* were used within three studies each as well. All other measures were only used within one study. A summary of depression outcome measures used within each included study is provided in Appendix C.

Table 7.
Summary of Depression Outcome Measures used within Included Studies

Standardized, Norm-Referenced Depression Measure	**# of Studies Utilizing Measure**
Beck Depression Inventory, Second Edition (BDI)	7
BDI-II Autism, Specific *T*-score (BDI-ASD)	1
Depression and Anxiety Scale, Depression Subscale (DAAS)	3
Hamilton Depression Rating Scale (HAM-D)	3
Hospital Anxiety and Depression Scale, Depression Subscale (HADS-D)	3
Children's Depression Inventory (CDI)	3
The Anxiety Depression and Mood Scale, Depression Subscale (ADAMS)	1

Adult Self Report, Depressive Problems Subscale (ASR - D)	1
Automatic Thoughts Questionnaire (ATQ)	1
Behavior Assessment System for Children, Depression Subscale (BASC)	1
Beck Hopelessness Scale (BHS)	1
Beck Youth Inventories, Depression (BYI-D)	1
Center for Epidemiological Studies Depression Scale (CES-D)	1
Emotion Dysregulation Inventory – Reactivity Short Form Dysphoria (EDI-Dys)	1
Montgomery Asberg Depression Rating Scale, Self-Report (MADRS-S)	1
Patient Health Questionnaire, Nineth Edition (PHQ-9)	1
Patient-Reported Outcomes Measurement Information Systems Depression Scale (PROMIS – Dep)	1
Revised Children's Anxiety and Depression Scale, Depression (RCADS)	1
Short-Form of the Mood and Feelings Questionnaire (SMFQ)	1
Total Number of Measures Used	36

Table 8 summarizes the different research designs used within the primary studies. Only 12 included studies included a treatment control group. Within the studies with control groups, six used a waitlist control group (WLC), five used treatment as usual (TAU), and one study (Hesselmark et al., 2014) used a non-CBT related intervention (a recreational activity in which participants visited community locations together). All studies with control groups established group equivalence in the pre-treatment depression levels, but two studies (Russell et al., 2008; McGillivray & Evert et al., 2017) did not randomize participant assignment to the treatment and control groups. Fourteen studies collected data at pre-treatment, at post-treatment, and at follow-up, while 13 studies only collected data at pre-treatment and post-treatment. One study was a follow-up study from 2011 (Nakagawa et al., 2019). Thus, data was only reported for the pre-treatment and follow-up time points. Only three of 28 studies listed depression symptoms and/or a depression diagnosis within their inclusion criteria. The majority of studies excluded participants with intellectual impairments, as measured by a full-scale intelligence quotient standard score (FSIQ) below 80. Of note, even within the studies that did not explicitly exclude

participants with low FSIQ, only one study included low FSIQ in the inclusion criteria, and this was the only study where the average FSIQ of the participants was less than 85 (one standard deviation below the mean Wechsler et al., 2012, Wechsler et al., 2004). Additionally, only eight studies confirmed the participants' diagnosis of autism using the ADOS-2, while 20 studies relied on other reporting measures. A summary of research design methods used in each included study is provided in Appendix C.

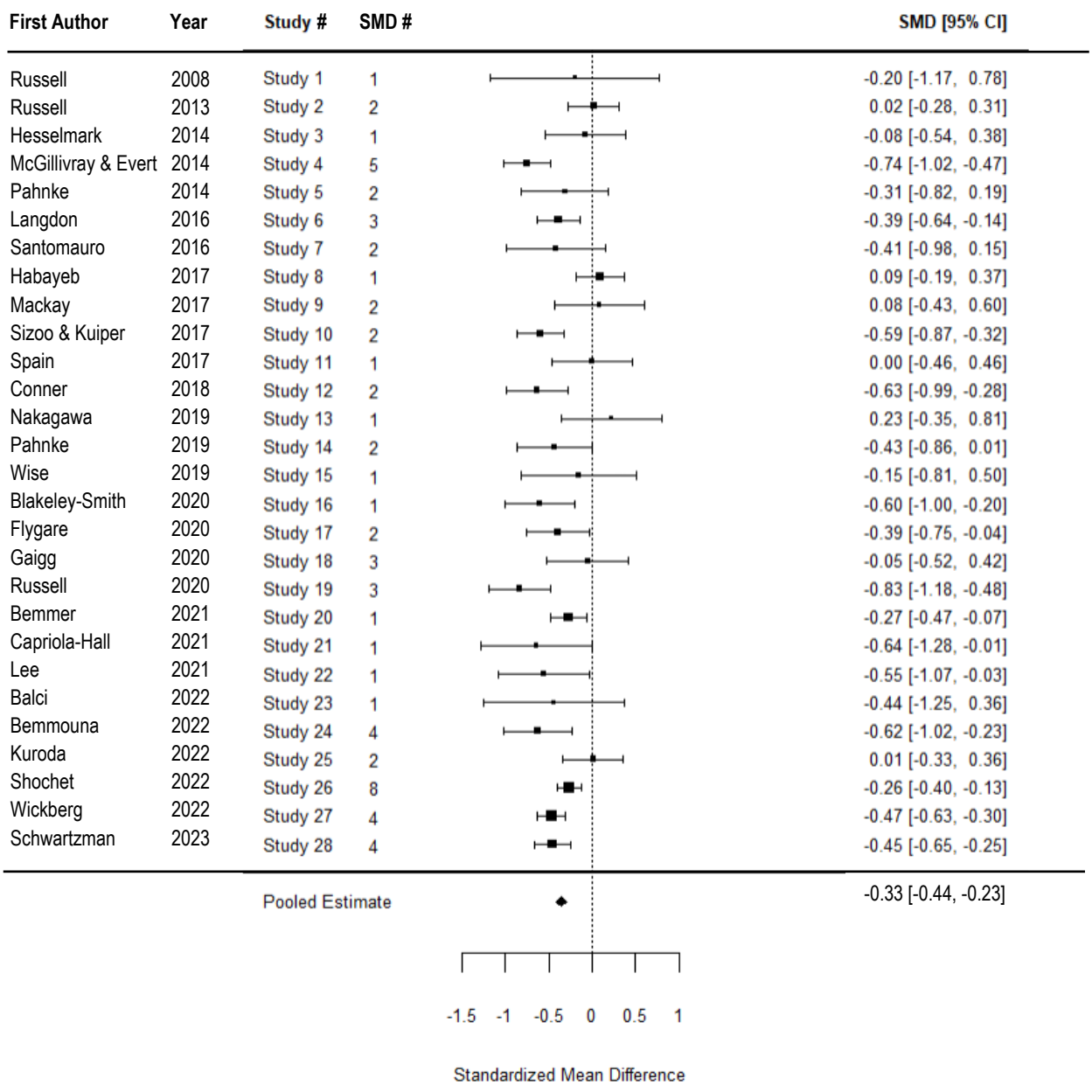
Table 8.
Summary of Research Design Methods used within Included Studies

Variable	Number of Studies
Treatment Control Group	
Present	12
Not Present	16
Control group detail	
Waitlist control/No treatment provided	6
Treatment As Usual	5
Alternative Non-Mental Health Intervention	1
No control group	16
Group equivalence	
Group Equivalence Established	12
Group Equivalence Not Established	0
No control group	16
Group randomization	
Participant group placement randomized	10
Participant group placement not randomized	2
No control group	16
Data Collection Time Points	
Pre/Post Only	13
Post/Post and Follow-Up	14
Pre/Follow-Up	1
Depression Symptoms as Inclusion Criteria	
Depression Symptoms Required for Inclusion	3
Depression symptoms Not Required for Inclusion	25
Intellectual Impairment as Exclusion Factors	
Intellectual Impairment as Exclusion Factor	21
Intellectual Impairment not an Exclusion Factor	7
ADOS-2 Used to Confirm ASD Diagnosis	
Yes	8
No	20

Effect Sizes of Individual Studies

Effect size estimates were calculated for each study, as described in the methods section. The final sample included 28 studies. After coding, there were 63 effect sizes pulled from the studies. Given that studies had up to eight effect size estimates, the data were aggregated for this forest plot summary. Figure 11 illustrates a forest plot of the aggregated standardized mean difference (SMD) effect size estimate for each study. Table C7 in Appendix C summarizes depression data and effect size estimates within each study.

Figure 11.
Forest Plot of Aggregated Effect Size Estimates for Each Included Study



Research Question 0: Meta Analysis CBT's Effect on Depression Overall

Although this procedure was not included in the proposed research questions, an overall effect size estimate was calculated to determine the pooled efficacy of cognitive behavioral therapy to reduce self-reported symptoms of depression at any time point. Table 9 illustrates the results. The overall effect size estimate of the intervention was estimated to be -0.33 with a

standard error of 0.05 from 28 studies and 63 individual effect size estimates. Thus, CBT resulted in significantly decreased symptoms of depression, as compared to the pre-treatment depression levels (and as compared to pre-and post-treatment depression levels in control groups) in autistic individuals within included studies. The 95% confidence interval for the effect size spans from -0.44 to -0.23. The between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.20. Given the standard deviation value, as compared to the effect size estimate across studies, the prediction interval was also reported. The prediction interval was -0.74 to 0.07.

Table 9.
Overall Effect Size

#Studies	#ES	ES (SE)	95% CI	95% PI	p-value	Between Study SD	Within Study SD
28	63	-0.33 (0.05)	(-0.44, -0.23)	(-74, 0.07)	<0.0001***	0.00	0.20

#=number; ES=effect size estimate; SE=standard error; CI=confidence interval; PI=prediction interval,***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 1: Meta Analysis CBT's Effect on Depression Post-treatment

An overall effect size estimate was calculated to determine the pooled efficacy of cognitive behavioral therapy to reduce self-reported symptoms of depression immediately after treatment for autistic individuals. Table 10 illustrates the results. The overall effect size estimate of the intervention immediately after treatment was estimated to be -0.36 with a standard error of 0.05 from 27 studies and 38 individual effect size estimates. Thus, CBT results in significantly decreased symptoms of depression immediately after treatment, as compared to the pre-treatment depression levels (and as compared to pre-and post-treatment depression levels in control groups) in autistic individuals, which is consistent with the hypothesis. The 95% confidence interval spans from -0.46 to -0.26. This result is statistically significant at a p-value of less than

0.0001. The between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.23. Given the standard deviation value, as compared to the effect size estimate across studies, the prediction interval was also reported. The prediction interval was -0.82 to 0.10.

Table 10.
Overall Effect Size Immediately Post-Treatment

#Studies	#ES	ES (SE)	95% CI	95% PI	p-value	Between Study SD	Within Study SD
27	38	-0.36 (0.05)	(-0.46, -0.26)	(-0.82, 0.10)	<0.0001***	0.00	0.23

#=number; ES=effect size estimate; SE=standard error; CI=confidence interval; PI=prediction interval,***p<0.0001, Between Study SD=between study standard deviation of the effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 2: Meta Analysis CBT's Effect on Depression at Follow-Up

An overall effect size estimate was calculated to determine the pooled efficacy of cognitive behavioral therapy to reduce self-reported symptoms of depression several months after treatment for autistic individuals. Table 11 illustrates the results. The overall effect size estimate of the intervention months after treatment was estimated to be -0.32 with a standard error of 0.09 from 15 studies and 25 individual effect size estimates. Thus, CBT results in significantly decreased symptoms of depression months after treatment, as compared to the pre-treatment depression levels (and as compared to pre-and post-treatment depression levels in control groups) in autistic individuals, which is consistent with the hypothesis. The 95% confidence interval spans from -0.52 to -0.13. This result is statistically significant at a p-value of 0.0004. The between study standard deviation of the effect size estimates was 0.18, and the within study standard deviation of the effect size estimates was 0.17. Given the standard deviation value, as compared to the effect size estimate across studies, the prediction interval was also reported. The prediction interval was -0.84 to 0.19.

Table 11.
Overall Effect Size at Follow-Up

#Studies	#ES	ES (SE)	95% CI	95% PI	p-value	Between Study SD	Within Study SD
15	25	-0.32 (0.09)	(-0.52, -0.13)	(-0.84, 0.19)	0.0004***	0.18	0.17

#=number; ES=effect size estimate; SE=standard error; CI=confidence interval; PI=prediction interval,***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Meta-Regression Results

Meta-regression analyses were completed to determine the extent to which effect sizes varied depending on different moderating factors for autistic individuals. Meta-regressions analyses were completed for the following variables: the pre-treatment depression level of participants in the treatment group (average, mild, moderate, or severe), the presence/absence of a treatment control group, the number of CBT core elements included in the intervention, the presence/absence of included CBT elements designed to treat non-depressive disorders (exposure for anxiety or exposure/response prevention for obsessive-compulsive disorders), the treatment dosage, the presence/absence of CBT modifications for individuals with autism spectrum disorder, and the participant characteristics (average full scale intelligence quotient estimate, average age, percentage of male participants, percentage of Caucasian participants, and the percentage of participants with high social-economic status).

Although it was planned to complete several other meta-regressions, these were unable to be conducted due to insufficient data provided in the primary studies. The moderator analyses meta-regression for **Research Question #5** was unable to be answered because all studies with treatment control groups established group equivalence for the pre-treatment depression levels of participants. Thus, there was no variation in the data to complete a moderator analysis.

Additionally, **Exploratory Research Question #2** for the moderator of the level of pre-treatment autism symptoms was also unable to be answered due to insufficient data.

Research Question 3: Moderating Factor of Pre-Treatment Depression

A meta-regression was conducted to determine the moderating effect of pre-treatment depression levels on CBT's effect on depression symptoms for autistic individuals. Details regarding qualitative labels for average, mild, moderate, and severe depression levels for each of the included depression outcomes measures is detailed within the literature review (pages 32-40). The Wald test indicated that the overall effect sizes were not significantly different when the pre-treatment depression levels were different ($F(3, 5)=3.24$, p-value=0.12). The results of the meta-regression are summarized in Table 12. When the average participant pre-treatment depression level was average, the effect size estimate was -0.43 with a standard error of 0.13 ($p=0.06$). When the average participant pre-treatment depression level was mild, the effect size was -0.18 with 0.06 standard error ($p = 0.02$). When the average participant pre-treatment depression level was moderate, the effect size was -0.39 with a standard error of 0.10 ($p =0.007$). When the average participant pre-treatment depression level was severe, the effect size was -0.59 with a standard error of 0.14 ($p = 0.01$). Overall, differing levels of pre-treatment depression within autistic participants were not associated with different effect sizes across studies, which was inconsistent with the hypothesis. Rather, at all levels of pre-treatment depression, there was a significant decrease in depression symptoms after CBT treatment, as compared to pre-treatment depression symptoms and depression symptoms within the treatment control group. Also, the heterogeneity between studies was considerable. The between study standard deviation of the effect size estimates was 0.08, and the within study standard deviation of the effect size estimates was 0.13.

Table 12.
Meta-Regression - Pre-Treatment Depression Level

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Pre-Treatment Depression				0.08	0.13
Average	-0.43 (0.13)	(-0.88, 0.02)	0.06		
Mild	-0.18 (0.06)	(-0.33, -0.04)	0.02*		
Moderate	-0.39 (0.10)	(-0.62, -0.15)	0.007**		
Severe	-0.59 (0.14)	(-0.96, -0.22)	0.01*		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 4: Moderating Factor of Treatment Control Group

A meta-regression was conducted to determine the moderating effect of treatment-controlled vs non-controlled studies on CBT's effect on depression symptoms for autistic individuals. The Wald test indicated that the overall effect sizes were not significantly different between studies that had a treatment control group and studies that did not have a treatment control group ($F(1, 10.8)=1.78$, p-value=0.21). The results of the meta-regression are summarized in Table 13. When there was a treatment control group, the effect size was not significantly different than 0 ($p = 0.21$). When there was an absence of a treatment control group, the effect size estimate was -0.38 with a standard error of 0.07 ($p < 0.0001$), indicating an effect size significantly different from 0. While the results of the Wald test and the significance levels for controlled versus uncontrolled studies appear contradictory, the overall result of the analysis indicates that the presence/absence of a treatment control group did not result in significantly different average effect sizes, which is contrary to the hypothesis. Of note, differing levels of sample size, statistical power, and variance within studies with and without a treatment control group likely resulted in this phenomenon. After accounting for the pre-treatment depression

level, the between study standard deviation of the effect size estimates was 0.05, and the within study standard deviation of the effect size estimates was 0.19.

Table 13.
Meta-Regression - Treatment Control Group

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Treatment Control				0.05	0.19
No Control	-0.38 (0.07)	(-0.54, -0.23)	<0.0001***		
Control Group	-0.17 (0.12)	(-0.45, 0.11)	0.21		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Given the many studies with and without treatment control groups, an overall effect size estimate was calculated to determine the mean change in depression symptoms for treatment control participants who did not receive the CBT intervention (n=12 studies). Table 14 illustrates the results. The overall standardized mean change in depression symptoms was -0.12 with a standard error of 0.06 from 12 studies and 21 individual effect size estimates. Thus, depression symptoms decreased over time, even in the absence of treatment. The 95% confidence interval spans from -0.24 to -0.005. This result is statistically significant at a p-value of 0.04. After accounting for the presence/absence of a treatment control group, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.00.

Table 14.
Effect Size of the Treatment Control Group

#Studies	#ES	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
12	21	-0.12 (0.06)	(-0.24, -0.006)	0.04*	0.00	0.00

#=number; ES=effect size estimate; SE=standard error; CI=confidence interval; PI=prediction interval,***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 5: Moderating Factor of Pre-Treatment Depression Group Equivalence

All 12 included studies with treatment control groups established group equivalence in the pre-treatment depression levels between the treatment control groups and the treatment groups. Thus, there was no variation in the data collection, and no moderator analysis was conducted.

Research Question 6: Moderating Factor of Number of Included CBT Core Elements

A meta-regression was conducted to determine the moderating effect of the number of CBT elements on CBT's effect on depression symptoms for autistic individuals. The Wald test indicated that the overall effect sizes were not significantly different between studies with differing numbers of included CBT core elements ($F(2,0.75)=0.040$, p-value=0.76). The results of the meta-regression are summarized in Table 15. When there were only two or three CBT core elements included, the effect sizes were not significantly different from 0. When all four core CBT elements were included in in the intervention, the effect size estimate was -0.35 with a standard error of 0.05 ($p < 0.0001$). While the results of the Wald test and the significance levels for studies with interventions with differing numbers of included CBT core elements appear contradictory, the overall result of the analysis indicates that studies with differing numbers of included CBT core elements within the intervention did not have significantly different overall effect size estimates, which is contrary to the hypothesis. Of note, only four studies included less than four CBT core elements within the intervention. Thus, the sample size and power of these combined studies is low. After accounting for the differing number of core elements between studies, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.20.

Table 15.
Meta-Regression - Number CBT Core Elements

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
# CBT Core Elements				0.00	0.20
2 Core Elements	-0.41 (0.52)	(-6.96, 6.14)	0.58		
3 Core Elements	-0.10 (0.18)	(-2.37, 2.16)	0.67		
4 Core Elements	-0.35 (0.05)	(-0.46, -0.25)	<0.0001***		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 7: Moderating Factor of Non-Depression CBT Elements

A meta-regression was conducted to determine the moderating effect of the presence/absence of additional non-depression related CBT elements on CBT's effect on depression symptoms for autistic individuals. The Wald test indicated that the overall effect sizes were not significantly different between studies with non-depression CBT elements and studies without non-depression CBT elements (F(1, 14.7)=0.65, p-value=0.43). The results of the meta-regression are summarized in Table 16. When there were no non-depression-related CBT elements included in the intervention, the effect size estimate was -0.37 with a standard error of 0.07. (p=0.0001). When non-depression-related CBT elements were present in the intervention, the effect size estimate was -0.28 with a standard error of 0.08 (p =0.01). Overall, the presence or absence of non-depression-related CBT elements was not associated with different overall effect sizes across studies. This result was contrary to the hypothesis. After accounting for the presence or absence of non-depression-related CBT content, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.21.

Table 16.
Meta-Regression - Non-Depression CBT Elements

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Non-Depression CBT				0.00	0.21
CBT	-0.37 (0.07)	(-0.51, -0.22)	0.0001***		
CBT+	-0.28 (0.08)	(-0.47, -0.09)	0.01*		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 8: Moderating Factor of Treatment Dosage

A meta-regression was conducted to determine the moderating effect of the treatment dosage, or number of CBT intervention minutes, on CBT's effect on depression symptoms for autistic individuals. The Wald test indicated that the overall effect sizes were not significantly different between studies with different treatment dosages (F(1, 1.41)=0.91, p-value=0.48). The results are summarized in Table 17. At the average treatment dosage, the overall effect size is -0.35 with a standard error of 0.06 (p<0.0001), but studies with different dosages did not have significantly different effect size estimates (p=0.48). Thus, differing levels of treatment dosages within included studies were not associated with differing levels of effect sizes across studies. This result was consistent with the hypothesis. After accounting for the differing treatment dosages across studies, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.22.

Table 17.
Meta-Regression - Treatment Dosage

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Tx Dosage				0.00	0.22
Intercept	-0.35 (0.06)	(-0.46, -0.23)	<0.0001***		
Dosage	0.00 (0.00)	(-0.0002, 0.0003)	0.48		

ES=effect size estimate; SE=standard error; CI=confidence interval; ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 9: Moderating Factor of CBT Modifications for ASD

A meta-regression was conducted to determine the moderating effect of the presence/absence of CBT modifications to meet the needs of autistic individuals on CBT's effect on depression symptoms for autistic individuals. The Wald test indicated that the overall effect sizes were not significantly different between studies with non-depression CBT elements and studies without non-depression CBT elements (F(1, 1.99)=0.89, p-value=0.45). The results of the meta-regression are summarized in Table 18. When there were no CBT modifications (n=3 studies), the effect size was non-significant (p=0.27). When CBT modifications were present, the effect size was -0.34 with a standard error of 0.05 (p <0.0001). While the results of the Wald test and the significance levels for studies with interventions with and without modifications for autism appear contradictory, the overall result of the analysis indicates that the presence or absence of modifications for autism did not significantly affect the overall effect size. Of note, only three studies did not include modifications for autism within their CBT program, which likely affected this analysis. This result was inconsistent with the hypothesis. After accounting for the presence or absence of CBT modifications for autism, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.20.

Table 18.
Meta-Regression - CBT Modifications for ASD

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
CBT Modifications				0.00	0.20
Not Modified	-0.21 (0.13)	(-0.83, 0.42)	0.27		
Modified	-0.34 (0.05)	(-0.45, -0.23)	<0.0001***		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Research Question 10: Moderating Factor of Participant Characteristics

Research Question #10 was intended to assess whether participant characteristics significantly affected the overall effect size estimate. The original plan was to assess more participant characteristics, including other genders (i.e., female, non-binary, transgender male, transgender female), race/ethnicity (i.e., Black/African American, Latino, Asian American/Pacific Islander, Native American/Indigiounos, Multi-Racial), and social-economic status (i.e., middle income, low-income). However, due to the methods of reporting within primary studies, only the following participant characteristics were able to be assessed: average participant intelligence, as measured by full scale intelligence quotient standard score (FSIQ); average participant age, percentage of Caucasian participants, and percentage of participants with high social-economic status, as measured by income over $100,000, graduate level education, and/or parental graduate education across studies that reported this information.

First, a meta-regression was conducted to determine the moderating effect of participant FSIQ on CBT's effect on depression symptoms for autistic individuals. Of the 28 included studies, 12 reported average FSIQ scores for the participants in the treatment group. The average treatment group FSIQ score was 100.67 with a standard deviation of 14.51. The Wald test indicated that the overall effect sizes were not significantly different between studies with

different average FSIQ scores of participants (F(1, 1.37) =24.5, p-value =0.08). The results are summarized in Table 19. At the average FSIQ, the overall effect size is -0.23 with a standard error of 0.07 (p=0.013), but studies with different average participant FSIQ scores did not have significantly different effect size estimates (p=0.08). Although FSIQ averages differed across studies, differing FSIQ scores were not associated with differing effect sizes of the CBT intervention, which is consistent with the hypothesis. After accounting for differing average FSIQ scores across studies, the between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.12.

Table 19.
Meta-Regression - Participant FSIQ

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Intercept	-0.23 (0.07)	(-0.40, -0.07)	0.013*	0.00	0.12
FSIQ	0.008 (0.002)	(-0.003, 0.02)	0.08		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Second, a meta-regression was conducted to determine the moderating effect of participant age on CBT's effect on depression symptoms for autistic individuals. All included studies reported the average age of the treatment group participants. The average age of participants across studies was 23.35 with a standard deviation of 10.02. The Wald test indicated that the overall effect sizes were not significantly different between studies with different average participant ages (F(1, 10.5)=0.0007, p-value=0.98). The results of the meta-regression are summarized in Table 20. At the average age, the overall effect size is -0.31 with a standard error of 0.05 (p<0.0001), but studies with different average participant ages did have significantly different effect size estimates (p=0.98). Although average ages of participants differed across studies, differing ages were not associated with differing effect sizes of the CBT

intervention, which is consistent with the hypothesis. After accounting for the differing average age of participants across studies, the between study standard deviation of the effect size estimates was 0.07, and the within study standard deviation of the effect size estimates was 0.15.

Table 20.
Meta-Regression - Participant Age

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Intercept	-0.31 (0.05)	(-0.41, -0.20)	<0.0001***	0.07	0.15
Age	0.0001 (0.01)	(-0.01, 0.01)	0.98		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD= between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Third, a meta-regression was conducted to determine the moderating effect of participant gender on CBT's effect on depression symptoms for autistic individuals. Given the limitations of the reported data in the primary literature, this was coded as the percentage of male participants in the sample. Of the 28 included studies, only five did not report the percentage of male participants. The average percentage of male participants across studies was 66.40 with a standard deviation of 15.49. The Wald test indicated that the overall effect sizes were not significantly different between studies with different percentages of male participants ($F(1, 10.1)=1.02$, p-value=0.34). The results of the meta-regression are summarized in Table 21. At the average percentage of male participants, the overall effect size was -0.30 with a standard error of 0.05 ($p<0.0001$), but studies with different average of percentages of male participants did not have significantly different effect size estimates ($p=0.34$). Although there were different percentages of male participants across studies, differing percentages of male participants was not associated with differing effect sizes of the CBT intervention, which is consistent with the hypothesis. After accounting for the different percentages of male participants across studies, the

between study standard deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.15.

Table 21.
Meta-Regression - Participant Gender

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Intercept	-0.30 (0.05)	(-0.41, -0.19)	<0.0001***	0.00	0.15
Male	0.003 (0.003)	(-0.004, 0.01)	0.34		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Fourth, a meta-regression was conducted to determine the moderating effect of participant race on CBT's effect on depression symptoms for autistic individuals. Given the limitations of the reported data in the primary literature, this was coded as the percentage of Caucasian/white participants in the sample. Of the 28 included studies, 11 reported the percentage of Caucasian participants. The average percentage of Caucasian participants was 83.83 with a standard deviation of 13.09. The Wald test indicated that the overall effect sizes were not significantly different between studies with different percentages of Caucasian/white participants (F(1, 2.76)=0.39, p-value=0.58). The results of the meta-regression are summarized in Table 22. At the average percentage of Caucasian/white participants, the overall effect size was -0.46 with a standard error of 0.08 (p=0.001), but studies with different in the average percentages of Caucasian/white participants did not have significantly different effect size estimates (p=0.58). Although there were different percentages of Caucasian participants across studies, differing percentages of Caucasian participants were not associated with differing effect size estimates across studies, which is consistent with the hypothesis. After accounting for the differing percentages of Caucasian participants across studies, the between study standard

deviation of the effect size estimates was 0.00, and the within study standard deviation of the effect size estimates was 0.25.

Table 22.
Meta-Regression - Participant Race

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Intercept	-0.46 (0.08)	(-0.65, -0.26)	0.001***	0.00	0.25
Caucasian	-0.01 (0.01)	(-0.04, 0.03)	0.58		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

Fifth, a meta-regression was conducted to determine the moderating effect of participant social economic status (SES) on CBT's effect on depression symptoms for autistic individuals. Given the limitations it the data reported in the primary literature, this was coded as the percentage of participants with high SES, as measured by income greater than $100,000 per year, graduate education, parental graduate education, and/or participants labeled as "high SES." Of the 28 included studies, 10 reported the percentage of participants with high social-economic status. The average percentage of participants with high SES was 27.49 with a standard deviation of 25.90. The Wald test indicated that the overall effect sizes were not significantly different between studies with different percentages of participants with high SES (F(1, 3.29)=1.70, p-value=0.28). The results of the meta-regression are summarized in Table 23. At the average percentage of participants with high SES, the overall effect size was -0.33 with a standard error of 0.07 (p=0.01), but studies with different percentages of participants with high SES did not have significantly different effect size estimates (p=0.28). Although there were different percentages of participants with high SES across studies, differing percentages of participants with high SES was not associated with differing effect sizes of the CBT intervention, which is consistent with the hypothesis. After accounting for the differing percentages of participants with

high SES across studies, the between study standard deviation of the effect size estimates was 0.02, and the within study standard deviation of the effect size estimates was 0.14.

Table 23.
Meta-Regression - Participant Social-Economic Status

Moderator	ES (SE)	95% CI	p-value	Between Study SD	Within Study SD
Intercept	-0.33 (0.07)	(-0.53, -0.13)	0.01*	0.02	0.14
High SES	0.004 (0.003)	(-0.005, 0.01)	0.28		

ES=effect size estimate; SE=standard error; CI=confidence interval; *p<0.05; **p<0.01, ***p<0.0001, Between Study SD=between study standard deviation in effect size estimates, Within Study SD=within study standard deviation in effect size estimates

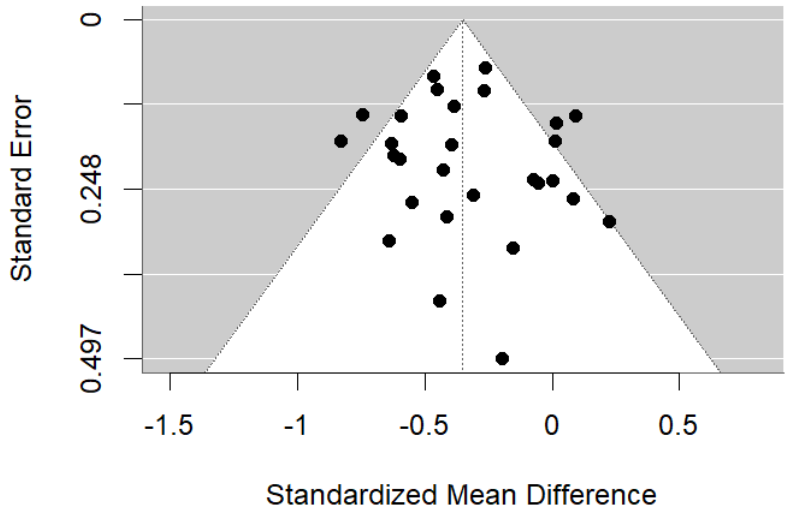
To answer **Research Question #10**, five different meta-regressions exploring different characteristics of participants were completed. Differences within all of the explored characteristics (FSIQ, age, race, gender, SES) did not result in significantly different effect sizes across studies, which was consistent with the hypothesis that different participant characteristics would not be associated with different effect size estimates.

Qualitative Data

Risk of Bias

In order to assess for publication bias, or assessing if studies with non-significant findings may have been missing from the research synthesis due to being unpublished, a visual funnel plot analysis was conducted. Figure 12 illustrates the funnel plot for all aggregated effect size estimates for each individual included studies. The aggregated effect size estimates for each study appear symmetrical around the overall effect size estimate. Thus, there does not appear to be bias for significant results within the included studies based on the visual analysis of the funnel plot.

Figure 12.
Funnel Plot



Second, the author coded each article using the Risk of Bias (RoB)2 Tool to assess for study quality and potential methods biases toward generating positive results within each study (Cochrane, 2021). The risk of bias arising from the randomization process (Domain 1) was the most variable between studies. Many studies did not include a treatment control group. Thus, there was no randomization, and it was coded as a high risk of bias. These studies accounted for 57.1% (16 of 28) of included studies. Within the studies that included a treatment control group (12 studies total), 10 studies randomized participant allocation to the treatment or control group. Two studies did not randomize participants to conditions. Of note, given the word limit in most journal articles, the author judged papers to randomly allocate participants if they described the study as a randomized controlled trial and referenced any randomization process within the methods. Also, of note, several studies included comparator control groups that were not of interest for this study. For example, one study treated groups of participants with and without autism spectrum disorder diagnoses (Nakagawa et al., 2019). Also, Sizoo and Kuiper (2017) compared CBT and mindfulness-based stress reduction (MBSR) techniques, and there was no

control group that did not receive a mental health intervention that could impact depression symptoms. Thus, only the group with the diagnosis was analyzed in this study, and for the purposes of bias assessment, it was deemed as not having a treatment control, and the D1 section was coded as a high risk of bias.

The risk of bias due to deviations from the intended interventions (Domain 2) was high for the majority of studies (78.6%, 22 of 28 studies). Of note, many studies did not include treatment integrity data to report their adherence to the study protocol. Only six studies referenced treatment integrity. All studies that referenced treatment integrity adhered to the protocol with greater than 85% accuracy. The average reported treatment integrity percentage was 92.3%. Any study that did not list treatment integrity was coded as a high risk of bias within this domain.

The risk of bias due to missing outcome data (Domain 3) was low for most studies (89.3%, 25 of 28 studies). Per the guidance within the RoB2 tool, studies were considered to be a low risk of bias if data for 95% of participants was collected at both pre-and post-treatment. Several studies (3 of 28, 10.7%) noted they were unable to collect post-intervention data for 5% or more of the participants.

There were some concerns for risk of bias in measurement of the outcome (Domain 4) for most studies (96.4%, 27 of 28 studies). In psychotherapy research, the masking of both the participants and interventionists/researchers is often not a feasible goal (Munder & Barth 2018). Thus, the majority of studies were rated as a high risk of bias due to the outcome assessors not being blinded to the participants' treatment condition.

There were some concerns for risk of bias in the selection of the reported result (Domain 5) for most studies (89.3%, 25 of 28 studies), as most studies did not publish a treatment protocol prior to completing the study. Thus, the adherence to the intended statistical analyses was unable to be evaluated.

Overall, the majority of studies were coded as high risk of bias (92.9%). Any study with a high risk of bias in any one domain was coded as a high risk of bias. Any study that did not have a treatment control group was coded as a high risk of bias due to the lack of a comparator group, despite Domain 1 being coded as “No information.” Given the high rate of studies without treatment control groups and the lack of data provided regarding treatment integrity, the vast majority of studies were coded as a high risk of bias. Figures 13 and 14 detail the data collected for risk of bias for individual studies and summary data for risk of bias across studies.

Figure 13.
Risk of Bias of Individual Studies

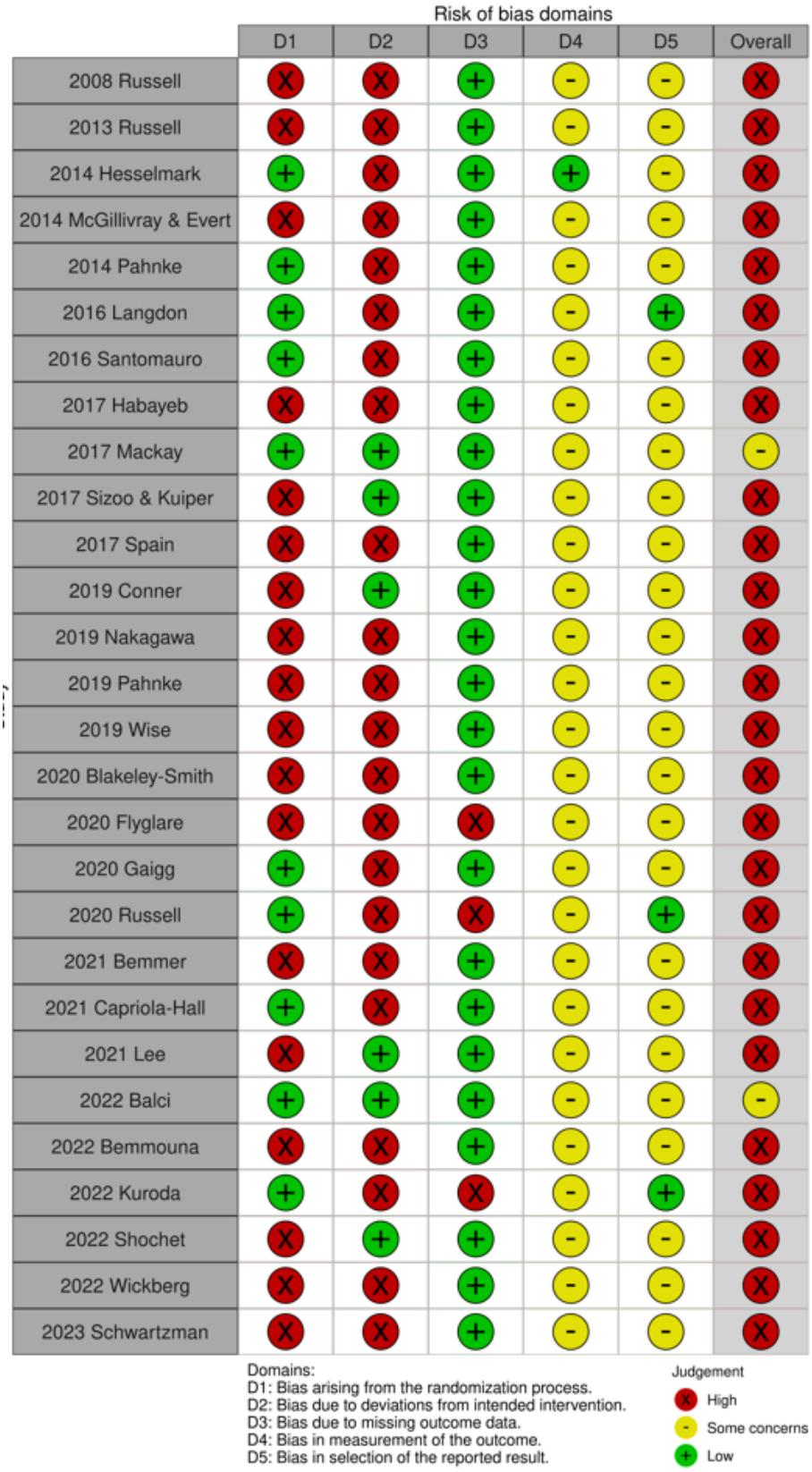
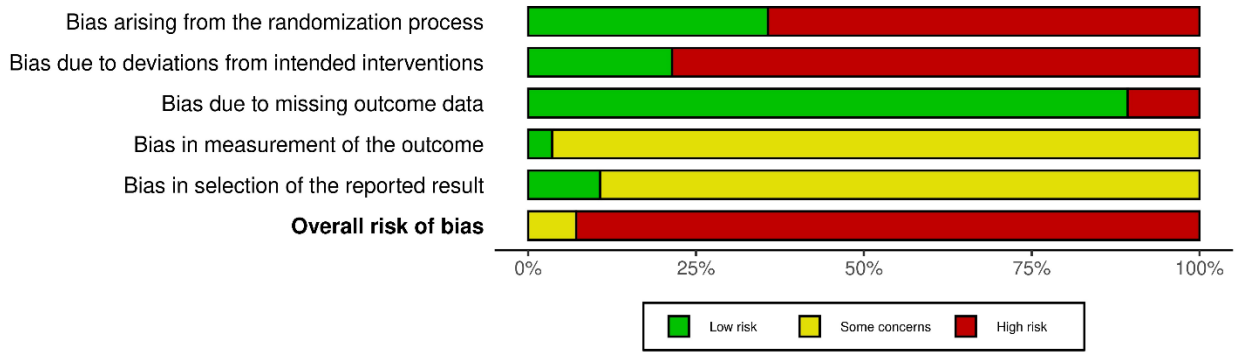


Figure 14.
Summary Risk of Bias



Research Question 11: Descriptions of Modifications to CBT Programs for ASD

The author conducted a content analysis to describe the different methods used to modify the CBT interventions to be more appropriate for autistic individuals. The following modifications were gleaned from studies: visual aids (ASD, n=17 studies), emotional labeling (n=13 studies), social skills training (n=13 studies), consistent structure (n=13 studies), concrete/simplified language (n=12 studies), in-vivo practice of skills (n=12 studies), psychoeducation specific to ASD (n=10 studies), incorporation of special interests (n=9 studies), parental involvement (n=7 studies), stakeholder involvement (n=6 studies), online/computer component (n=6 studies), self-advocacy (n=5 studies), vocational support (n=4 studies), social stories (n=3 studies), reward systems (n=3 studies), and sensory accommodations (n=2 studies). Table 24 summarizes the frequency of each program modification. Of note, none of the included studies incorporated all of the recommended NICE modifications (Baird et al., 2013).

Table 24.
Modifications for Autism Spectrum Disorder

Program Modification	# of Studies
Visual Aids	17
Emotional Labeling	13
Social Skills Training	13
Structure/Similarity in Session	13
Concrete/Simplified Language	12
Community Practice/Role Play	12
Psychoeducation ASD	10
Incorporation of Special Interests	9
Parent Involvement	7
Stakeholder Involvement	6
Online/Computer Component	6
Advocacy	5
Vocational Support	4
Social Stories	3
Reward System	3
Sensory Accommodations	2

Research Question 12: Description of ASD Symptom Presentation

The author conducted a content analysis to determine different methods used to quantify autism spectrum disorder (ASD) symptoms within study participants. The following methods were used: descriptions of participants as being diagnosed with "high functioning" autism spectrum disorder, *Autism Diagnostic Observation Schedule, Second Edition* (ADOS-2; Lord et al., 2012), *Autism Diagnostic Interview, Revised* (ADI-R; Rutter et al., 2003a), *Social Responsiveness Scale (SRS;* Constantino et al., 2012*), Social Communication Questionnaire* (SCQ; Rutter et al., 2003b), *Australian Scale for Autism Spectrum Disorder Conditions* (ASASC; Garnett et al., 2013), *Autism Quotient* (AQ; Baron-Cohen et al., 2001), *Sheehan Disability Scale* (SDS; Sheehan et al., 1996), *and Adaptive Behavior Assessment System* (ABAS; Harrison & Oakland 2015). Table 25 summarizes the frequencies of the different methods across papers. The average ADOS-2 total score was 10.5 with a standard deviation of 0.98 (Lord et al., 2012). Second, the average SRS *T*-score was 78.1 with a standard deviation of 12.11 (Constantino et al., 2012).

Table 25.
Methods Used to Describe Autism Symptom Severity

Method	# of Studies
"High Functioning"	7
Autism Diagnostic Observation Schedule, Second Edition	7
Autism Diagnostic Interview, Revised, Communication	2
Autism Diagnostic Interview, Revised, Reciprocal Social Interaction	2
Autism Diagnostic Interview, Revised, Restricted, Repetitive Behaviors	2
Social Responsiveness Scale, Second Edition	5
Autism Quotient	2
Social Communication Questionnaire	1
Australian Scale for Autism Spectrum Disorder Conditions	1
Sheehan Disability Scale	1
Adaptive Behavior Assessment System	1

Exploratory Research Question #1

The author planned to complete a meta-regression to determine if differences in ADOS-2 total scores were associated with significantly different effect size estimates across studies. However, there were not sufficient data points to run a meta-regression (Borenstein et al., 2011). Rather, Table 26 details the effect size estimates, variances, and ADOS-2 total scores for individual studies.

Table 26.
ADOS-2 Scores and Effect Size Estimates

Study ID	ES ID	First Author	Year	ES	Var	ADOS-2 Score
2	2	Russell	2013	-0.03	0.04	10.70
2	3	Russell	2013	0.09	0.06	10.70
3	4	Hesselmark	2014	-0.08	0.06	11.40
11	22	Spain	2017	0.00	0.06	10.70
15	28	Wise	2019	-0.15	0.11	11.86
18	32	Gaigg	2020	-0.05	0.14	8.80
18	33	Gaigg	2020	0.01	0.19	8.80
18	34	Gaigg	2020	-0.13	0.19	8.80
20	38	Bemmer	2021	-0.27	0.01	10.16
25	46	Kuroda	2022	-0.15	0.06	10.20
25	47	Kuroda	2022	0.23	0.07	10.20

ES=effect size estimate, Var=variation

Exploratory Research Question 2: Adverse Events

Of the 28 included studies, 21 studies did not address whether any adverse events occurred. Two studies reported that no adverse events occurred (Pahnke et al., 2014, Langdon et al., 2016). Bemmouna and colleagues (2021) reported specific outcomes related to the study outcome measures, which included self-harm and suicidal attempts. Of the four participants presenting with self-injurious behaviors, three indicated a cessation in self-harming behaviors over the course of treatment. After follow-up, only two of four indicated self-harming behaviors, and they reported their self-harming behaviors were infrequent. Of the five participants with

presenting suicidal ideation, three reported decreased suicidal ideations. Researchers reported that there were zero suicide attempts and zero hospitalizations during the treatment and follow-up period as well (Bemmouna et al., 2022). Santomauro and colleagues (2016) reported that one participant had a suicidal attempt in which they drank bleach mid-way through treatment, which resulted in hospitalization. Conner and colleagues (2019) reported that three participants discontinued treatment, one due to a hospitalization without a reported reason for hospitalization. Flygare and colleagues (2020) reported that three participants discontinued treatment, one due to a hospitalization without a reported reason for hospitalization as well. Lastly, Russell and colleagues (2020) reported four adverse events for participants over the course of treatment: one related to a traffic accident, one "medical investigation," one instance of homelessness, and one instance of "deterioration in housing." Overall, most studies did not report on adverse events, which is necessary for intervention studies.

CHAPTER 4: DISCUSSION

The purpose of this dissertation was to conduct a systematic review of the available published and unpublished data to evaluate the efficacy of cognitive behavioral therapy (CBT)-based interventions to decrease depression symptoms for autistic individuals. While several meta-analyses and reviews have explored CBT's effect on anxiety symptoms within autistic populations (Sharma et al., 2021), to the author's knowledge, this is the first review and meta-analysis exploring CBT's effectiveness to reduce depression symptoms for autistic individuals. After conducting a thorough search of the literature, 4,291 studies were identified and screened, resulting in 28 primary studies with 631 total treatment participants for inclusion in this meta-analysis. To answer the research questions, a descriptive analysis was first completed regarding the different study components for each included study. Second, a meta-analysis was conducted to determine the overall effect size estimate of CBT's impact on depression symptoms in autistic individuals. Third, meta-analyses were conducted to determine the overall effect size estimates of CBT's impact on depression symptoms in autistic individuals immediately post-treatment and at follow-up, months after the treatment cessation. Fourth, meta-regressions were conducted to determine if different study factors explained the overall heterogeneity between studies. Lastly, qualitative data was collected using content analyses regarding descriptions of the following factors: (1) the autism symptom presentation and severity in study participants, (2) modification to the CBT programs to address needs of autistic individuals, and (3) the study descriptions of adverse events.

Descriptive Analysis Interpretation

Of the 28 included studies, 25 were published in peer reviewed journals, one was an approved dissertation, one was a letter to the editor, and one was unpublished data provided by

Dr. Jessica Schwartzman, the primary investigator of a published study protocol on clinicaltrials.gov. The included studies were conducted in a variety of countries and were conducted in a variety of settings, including mental health clinics, schools, and online. Many different CBT programs were used in included studies. CBT was administered individually and in groups. Only six studies reported treatment integrity data to provide evidence that the CBT programs were implemented as intended. The included studies used a variety of different research designs and methods. Within studies that included a treatment control group, most studies randomly assigned participants to the treatment or control group (10 of 12 studies). Also, all included studies with treatment control groups established equivalence in the pre-treatment depression level between the treatment group and the control group. Additionally, a wide range of outcome measures were used to measure depression symptoms both before and after treatment. In order to prevent type I errors, the author conducted meta-regression analyses on the following planned variables: qualitative pre-treatment depression level, presence/absence of a treatment control group, the number of included CBT core elements within the intervention, the presence/absence of non-depression-related CBT elements within the intervention, the treatment dosage, the presence/absence of modifications to the CBT interventions to meet the needs of autistic individuals, and participant characteristics. However, there was still a wide range of differences within the included CBT programs, treatment settings, treatment formats, and outcome measures, which may have contributed to the unexplained heterogeneity of the meta-analysis.

All studies included at least some concerns for risk of bias, based on the qualitative coding of the Cochrane Risk of Bias Tool, Second Edition (Cochrane 2021). Studies were coded as having bias due to the lack of a treatment control group, lack of treatment integrity data,

missing outcome data, participants not being blinded to treatment condition, outcome assessors not being blind to treatment condition, and lack of previously reported data analysis plans. Thus, given the lack of rigorous design standards within all included studies, there was potential for the results of studies to have been conflated. Accordingly, the meta-analysis findings should be interpreted with caution due to the validity concerns related to the lack of rigorous design standards.

Quantitative Research Questions

Meta-Analyses Questions.

The analysis for **Research Question # 0** indicated that the overall effect size estimate for CBT's effect on depression symptoms for autistic individuals at any time point was -0.33 (0.05) and significant (p-value<0.0001). This indicates that the CBT program resulted in significantly reduced symptoms of depression in autistic participants across studies, as compared to pre-treatment depression levels (and pre- and post-/follow-up depression levels within treatment control groups when available). This result is similar to effect size estimates from previous studies (Keles & Idsoe 2018; Lopez-Lopez et al., 2019; Oud et al., 2019; Santoft et al., 2019). However, the heterogeneity between the included studies was considerable. Also, none of the meta-regressions explained significant amounts of the heterogeneity. In such cases, the prediction interval is often interpreted (Valentine et al., 2019). Even with the heterogeneity, the prediction interval of the overall effect size ranged from –0.74 to 0.08. Given the minimal overlap in positive values within the prediction interval, the author can be fairly confident that future CBT programs would result in decreased depression symptoms within autistic populations. However, given the high level of heterogeneity and the overlap of the prediction interval into positive values, there is a small possibility that future use of CBT could result in

minor increases in depression symptoms. Additionally, within the included studies, many did not include treatment control groups or treatment integrity data, which introduces validity concerns regarding included data. Thus, the efficacy of CBT to reduce symptoms of depression within autistic populations should be interpreted with caution.

The analysis for **Research Question #1** indicated that the overall short-term effect size estimate for CBT's effect on depression symptoms for autistic individuals immediately post-treatment was -0.36 (0.05) and significant (p-value<0.0001). This indicates that the CBT program significantly reduced symptoms of depression in autistic participants across studies immediately after treatment, as compared to pre-treatment depression levels (and pre- and post-treatment depression levels within the treatment control groups when available). This result is consistent with *Hypothesis #1*. This decrease in depression symptoms following CBT treatment is consistent with other studies within typically developing populations (Keles & Idsoe 2018 (SMD= -0.28, 95% CI -0.36, -0.19); Lopez-Lopez et al., 2019 (SMD= -1.11, 95% CI -1.62, -0.60); Oud et al., 2019 (SMD= -0.41, 95% CI -0.56, -0.27)). Also, Santoft and colleagues (2019) found symptom remission following CBT in typically developing adults (SMD= 0.22, 95% CI 0.15, 0.30). Of note, this study's heterogeneity between the studies was considerably high. Accordingly, again, the prediction interval was interpreted. The immediate post-treatment prediction interval ranged from -0.82 to 0.10. Given the minimal overlap in positive values within the prediction interval, the author can be fairly confident that future CBT programs would result in decreased depression symptoms within autistic populations immediately after treatment. However, given the high level of heterogeneity, the overlap of the prediction interval into positive values, and the lack of rigorous research designs, the effect size estimate of CBT to

reduce symptoms of depression within autistic populations immediately after treatment should be interpreted with caution.

The analyses for **Research Question #2** indicated that the overall long-term effect size estimate for CBT's effect on depression symptoms of autistic individuals months after treatment conclusion was -0.32 (0.09) and significant (p-value=0.0004). This indicates that the CBT program significantly reduced symptoms of depression in autistic participants months after treatment across studies, as compared to pre-treatment depression levels (and pre- and follow-up depression levels within in the treatment control group when available). This was consistent with *Hypothesis #2.* Also, this positive finding at long-term follow-up is consistent with other studies. For example, Oud and colleagues (2019) and Keles and Idsoe (2018) estimated the long-term effect size of CBT on depression symptoms for typically developing children and adolescents to be -0.20 (95% CI -0.33, -0.07) and -0.21 (95% CI -0.30, -0.11), respectively. Also, for typically developing adults, CBT resulted in symptom remission at long-term follow-up as well (g=0.17 (95% CI 0.10, 0.24; Santoft et al., 2019). However, this study's heterogeneity between the studies was considerable. Accordingly, again, the prediction interval was interpreted. The long-term follow-up treatment prediction interval ranged from -0.84 to 0.19. Given the wide range of the prediction interval, there is less evidence that CBT is effective long term. Also, given the high level of heterogeneity, the overlap of the prediction interval into positive values, and the lack of rigorous research designs, the effect size estimate of CBT to reduce symptoms of depression within autistic populations months after treatment should be interpreted with extreme caution.

Overall, the meta-analyses indicated that CBT is a promising treatment for depression. However, given the heterogeneity, large prediction intervals, and lack of rigorous research

designs, future studies are necessary to make firm conclusions about the treatment utility of CBT in treating depression in autistic clients. Given the considerable heterogeneity, several meta-regressions were conducted to determine if different variables moderated the effect size and explained the heterogeneity, as explained below.

Meta-Regression Questions.

Given the limited studies gleaned, the author took an inclusive approach to study inclusion. Thus, there were a variety of different research designs with varying rigor, CBT programs, co-occurring disorders of interest, and participant characteristics within the included studies. Thus, meta-regressions were conducted to determine if heterogeneity within the included studies could be explained by a variety of different moderating variables.

Research Question #3 sought to determine whether differences in the qualitative level of pretreatment depression symptoms (i.e., average, mild, moderate, or severe, as defined on pages 32-40) resulted in significantly different effect sizes across studies. This research question was included to determine whether the inclusive nature of the author's inclusion/exclusion criteria for inclusion within the meta-analysis affected the results. The author hypothesized that included studies in which participants had a greater level of pre-treatment depression levels would have effect sizes greater in magnitude than included studies in which participants had lower levels of depression based on the greater potential for symptom decrease and the effect size calculation formula. The results of the meta-regression indicated that different pre-treatment depression levels did not result in significantly different effect sizes. This was contrary to *Hypothesis #3.* Upon an examination of the literature, Santoft and colleagues (2019) included pre-treatment depression severity as a moderator variable within their meta-analysis exploring CBT's effectiveness in treating depression within typically developing adults, and they did not find the

factor to moderate the effect size estimate, similar to this study. They hypothesized that the insignificant finding may be due to low statistical power (Santoft et al. 2019). This analysis was also lower powered with only 28 included studies, which may have impacted findings. Thus, conservative interpretations of this meta-regression indicate that future research exploring CBT's effectiveness within autistic populations may consider including participants with a variety of differing presenting depression levels. However, studies should include sub-group analyses within primary studies, and future research syntheses should include moderator analyses exploring the effect of pre-treatment depression severity levels.

Research Question #4 sought to determine whether the presence/absence of a treatment control group resulted in significantly different effect sizes across studies. The author hypothesized that the effect size estimates would be greater in magnitude for studies in which there was no treatment control group based on the equations for effect size estimates (referenced in the methods section), which biases for significant results in the absence of a treatment control group. The results of the meta-regression indicated that the presence/absence of a treatment control group did not result in significantly different effect sizes. This was contrary to *Hypothesis #4*. This finding is likely due to the low power and heterogeneity of results. Despite these findings, treatment control groups should still be included in future studies for more rigorous, less biased research methods.

Research Question #5 was not able to be answered because all included studies with treatment groups established group equivalence in pre-treatment depression levels between the treatment group and the control group. Thus, there was no variation within this parameter available to moderate the overall effect size.

Research Question #6 sought to determine whether the differing numbers of included CBT core elements within the interventions resulted in significantly different effect sizes across studies. The author hypothesized that studies that included greater CBT treatment fidelity by including all four core elements of CBT would have greater effectiveness, as compared to studies that did not adhere to standard CBT treatment by utilizing all four CBT core elements within the intervention. This hypothesis was consistent with meta-analysis and meta-regression results from Oud and colleagues (2019), which found that the presence of behavioral activation and cognitive restructuring elements within CBT programs moderated the effect sizes across studies exploring depression effectiveness for typically developing children and adolescents. All but three studies included all four previously described core elements of CBT (psychoeducation, skills training, behavioral activation, and cognitive restructuring). Four included studies did not include cognitive restructuring within their CBT program (Capriola-Hall et al., 2021; Habayeb et al., 2017; Nakagawa et al., 2019; Russell et al., 2020). Also, two studies did not include skills training in their CBT intervention (Nakagawa et al., 2019; Russell et al., 2020). For instance, Russell (2020) and colleagues described the results of a "low intensity cognitive behavioral therapy" intervention, which was called "guided self-help," in which intervention goals were to increase awareness about the connections between thoughts, feelings, and behaviors and to schedule positive activities, after providing psychoeducation (Russell et al., 2020). The results of the meta-regression indicated that different numbers of included CBT core elements did not result in significantly different effect sizes. This finding was contrary to *Hypothesis #6* and prior research by Oud and colleagues (2019). This result was likely impacted by the low power and minimal variability within included studies. For instance, the effect size estimates for studies with only two and three included core elements only included two and four studies, respectively.

Thus, the effect sizes for studies with less than four included core elements were not very precise. Conversely, Cuijpers and colleagues (2019) established that problem solving therapy, related to the core element of skills training, and behavioral activation resulted in significant improvement of symptoms in and of themselves. Thus, future studies may consider incorporating modular CBT programs that address specific needs of clients and completing factor analyses to determine which aspects of CBT are most effective.

Research Question #7 sought to determine whether the presence/absence of non-depression-related CBT elements included within the intervention resulted in significantly different effect sizes across studies. For instance, several CBT interventions included CBT elements that were intended to treat other mental health disorders. For example, several studies also included exposure for anxiety or exposure response prevention for obsessive-compulsive disorder (OCD) (n=11 studies). These studies also often listed anxiety or OCD as the primary outcome variable. Additionally, only three included studies explicitly listed depression symptoms/diagnosis under their inclusion criteria. However, due to concerns for reverse study designs based on study findings, as well as limited studies found explicitly exploring depression, these studies were included. Thus, the author hypothesized that the effect size estimates would be greater in magnitude for studies in which the CBT intervention did not include elements intended to treat other, non-depressive disorders, as compared to studies with CBT interventions that did include elements intended to treat non-depression-related symptoms, based on the assumption that CBT treatments with non-depression related elements would include greater treatment time dedicated to treating other non-depressive symptoms, rather than depressive symptoms. The results of the meta-regression indicated the presence/absence of non-depression-related CBT elements did not result in significantly different effect sizes. This was contrary to *Hypothesis #7*.

Despite these studies not explicitly targeting depression in their reported study designs, the author conceptualized this result as being due to the fact that CBT programs designed for anxiety and/or OCD may also result in improved depression outcomes due to overlapping CBT program elements. For example, learning to target maladaptive cognitive schemas with evidence can be helpful in addressing both anxiety and depression. Thus, the results of this meta-regression indicate that CBT programs intended for other mental health disorders may also be effective in reducing depression.

Research Question #8 sought to determine whether differing treatment dosages, or the total number of treatment minutes, resulted in significantly different effect sizes across studies. The dosage of the CBT interventions ranged from 5.25 hours to 108 hours with an average dosage of 20.13 hours. The author hypothesized that differences in treatment dosages would not result in differences in effect size estimates. The results of the meta-regression indicated different treatment dosages did not result in significantly different effect sizes. This was consistent with *Hypothesis #8* and consistent with meta-regressions in other research syntheses (Oud et al., 2019; Yang et al., 2017; Cuijpers et al., 2013). This finding is promising, given the many mental health treatment barriers within the autistic population (Adams et al., 2020). For instance, if practitioners choose to use a shorter CBT program with established effectiveness, rather than a longer CBT program, then they can treat more clients over time, which could possibly reduce the overall current depression rates within autistic populations, and thus long waitlists for treatment from a qualified CBT therapist with experience in autism. While the field needs to continue to train practitioners competent in both CBT and in working with autistic populations to meet the needs of autistic individuals with co-occurring depression, this finding may make treatment protocols more feasible for both practitioners and clients.

Research Question #9 sought to determine whether the presence/absence of CBT modifications for autism within interventions resulted in significantly different effect sizes across studies. All but three included studies modified the intervention to be more appropriate for individuals with autism spectrum disorder. The three studies that did not adapt their programs used programs that were previously validated in non-autistic samples of participants. For instance, Russell and colleagues (2008) provided CBT for obsessive-compulsive disorder (OCD), which included exposure-response prevention elements without adapting the program in anyway. Also, Gaigg and colleagues (2020) used the "Serentiy" online CBT program, which had previously been shown effective in reducing anxiety in non-autistic individuals, with no adaptations noted (Slegg et al., 2009). Additionally, Balci and colleagues utilized the *Competitive Memory Training (COMET)* program, which was previously shown to be effective in treating depression symptoms and low self-esteem in non-autistic clients with depression (Ekkers et al., 2011; Korrelboom et al.., 2012) with no noted adaptations. The author hypothesized that the effect size estimates would be greater in magnitude for studies in which the CBT treatment was adapted to meet the needs of autistic individuals, as modifications would aid in difficulties associated with alexithymia, perspective-taking, abstract speech, and cognitive rigidity in individuals with autism, as described in the literature review. The results of the meta-regression indicated that the presence/absence CBT modifications did not result in significantly different effect sizes. This was contrary to *Hypothesis #9*. This finding suggests that while researchers should endeavor to ensure that interventions are most appropriate for study participants, they may consider using a CBT manual/program previously shown to be effective in reducing depression symptoms within typically developing populations and making more informal accommodations to support individuals with autism. However, monitoring and ideally

sharing of these findings with the field would be helpful to document outcomes as well as both short and long-term impacts for individuals with autism. More details on the specific modification used within the CBT programs are provided in the discussion for **Research Question #11.**

Research Question #10 sought to determine whether differences in the participant characteristics (FSIQ, age, gender, race, and social economic status) resulted in significantly different effect sizes across studies. The author hypothesized that the effect size estimates would not vary by participant characteristics, including intellectual ability, age, gender, race, and SES. This hypothesis was based on research showing that CBT has shown emerging evidence in reducing depression symptoms in adults with intellectual disability (Vereenooghe & Langdon, 2013) and in both children, adolescents, and adults in typically developing populations (Oud et al., 2019; Lopez-Lopez et al., 2019). The results of the five meta-regressions indicated the differences in participant characteristics did not result in significantly different effect sizes. Thus, the results indicate that CBT is effective for persons with a variety of different intellectual abilities, ages, genders, races, and SES levels. This result was consistent with *Hypothesis #10* and prior research. Thus, future studies should not exclude participants in CBT research studies/treatments based on FSIQ scores, ages, genders, races, and SES-levels. However, modifications may be helpful to make sure that CBT program materials are at the developmental level for participants with atypical FSIQ scores and younger ages. For example, more concrete language may be helpful for both persons with lower FSIQ sores and younger children. Also, different modifications, especially in older CBT programs, are likely necessary to be more gender-inclusive and racially inclusive, as experiences of discrimination may exacerbate depression symptoms, and it may be helpful to reference these experiences in the skill building

and behavioral activation sections of CBT programs. For example, it may be helpful to include self-advocacy in the skills building section and seeking out inclusive spaces/individuals as a part of the behavioral activation sections. Also, periodic discrimination may contribute to cognitive distortions related to self-worth and self-reliance. Additionally, while practitioners should not exclude diverse client populations, they should ensure that they have competence in working with diverse client populations. For example, conceptualizing blatant discrimination as a cognitive distortion would likely be damaging to the client's mental health and decrease rapport/engagement. Furthermore, it could result in decreased interest in present/future mental health treatment due to distrust.

Qualitative Research Questions

Research Question #11

To answer **Research Question # 11,** the author conducted a content analysis to describe the different methods used to modify the CBT interventions to be more appropriate for autistic individuals. There was no specific hypothesis for this research question, as it was exploratory in nature. As reported in the results section, the following modifications were gleaned from studies: visual aids (n=17), emotional labeling (n=13), social skills training (n=13), consistent structure in session format (n=13), concrete/simplified language (n=12), in-vivo practice of skills (n=12), psychoeducation specific to ASD (n=10), incorporation of clients' special interests into session (n=9), parental involvement for clients under 18 (n=7), stakeholder involvement in CBT program creation (n=6), online/computer component (n=6), CBT element related to self-advocacy (n=5), vocational support (n=4), social stories (n=3), reward systems (n=3), and sensory accommodations (n=2). Of note, while all CBT programs generally include psychoeducation and emotional labeling aspects, studies coded with these modifications included additional content on

psychoeducation related to autism-specific symptoms, and the studies included increased focus and time spent on emotional labeling, as to address issues with alexithymia often seen in autistic individuals. None of the included studies reported using all the recommended modifications, based on the NICE guidelines for treating anxiety using CBT in autistic children and adolescents. (Baird et al., 2013).

The results for **Research Question #11** should be interpreted with caution, as there were often limited descriptions of the modifications included within primary studies. The author researched referenced studies, attempted to access published manuals, and contacted primary authors for access to full CBT program manuals. However, the author did not receive access to the complete treatment manuals for any CBT programs. Thus, future studies should detail all included modifications to the CBT within primary studies to decrease access issues.

To the author's knowledge, this is the first qualitative synthesis of modifications for CBT programs in treating depression in autistic individuals. Given the wide variety of modifications used within CBT programs in this research synthesis and the variety of modifications previously reviewed in the anxiety literature (described in the introduction), it appears that guidelines for modifying CBT programs used to treat depression for autistic individuals are unestablished, and the literature regarding effective modifications is still emerging. It is recommended that future studies include a variety of modifications, list the modifications used, and conduct factor analyses to determine how different modifications moderate the effectiveness of CBT for treating depression.

Research Question #12

To answer **Research Question # 12,** the author conducted a content analysis to describe the different methods used to quantify autism spectrum disorder (ASD) symptoms within study participants. No specific hypothesis was created for this research question, as it was exploratory in nature. As reported in the results section, the following methods were used to describe autism symptom severity: descriptions of participants as being diagnosed with "high functioning" autism spectrum disorder (n=7 studies); *Autism Diagnostic Observation Schedule, Second Edition (ADOS-2)* total score (n=7 studies); *Autism Diagnostic Interview-Revised (ADI-R)* scores for reciprocal social interaction, communication, and restricted, repetitive behaviors (n=2 studies), *Social Responsiveness Scale, Second Edition (SRS-2)* total *T*-score (n=5), *Social Communication Questionnaire* (SCQ, n=1 study), *Australian Scale for Autism Spectrum Disorder Conditions* (ASASC; n=1 study), *Autism Quotient* (AQ; n=2 studies), *Sheehan Disability Scale* (SDS; n=1 study), *and Adaptive Behavior Assessment System* (ABAS; n=1 study).

The average SRS T-score was 78.1 with a standard deviation of 12.11 (Constantino et al., 2012). The SRS-2 is a 55-item assessment with Likert-style questions related to common symptoms of autism, including social awareness, social cognition, social communication, social motivation, and restricted repetitive behaviors. There is a self-report form for individuals 18 years or older and a school aged form for children between age 4 and 18. Both forms calculate a raw score that is transformed into a *T*-score. The severity levels are mild for *T*-scores between 60-65, moderate for *T*-scores between 66-75, and severe for *T*-scores greater than 76 (Constantino et al., 2012). Therefore, on average, study participants demonstrated severe symptoms, based on SRS-2 data. However, the SRS-2 has been shown to have poor discriminant

validity between autism and anxiety, as individuals with anxiety (but not ASD) have been shown to report high scores on SRS-2 (South et al., 2017). Thus, the SRS-2 average findings should be interpreted with caution.

The average ADOS-2 total score was 10.5 with a standard deviation of 0.98. The ADOS-2 is a quantitative behavioral observation where trained researchers code the severity of observed ASD symptoms (Lord et al., 2012). All included studies included participants with ages within the expected Module 4 range. The Module 4 cutoff score for autism spectrum symptoms is 7, and the cutoff for symptoms in the autism range is 10. Thus, the average participant level of autism was likely between the Level 1/Requiring Support and the Level2/Requiring Substantial support, which is consistent with typical reported requirements for cognitive behavioral interventions (Lord et al., 2012).

The ADOS-2 is generally considered the gold-standard for assessing symptoms of ASD. Thus, the general lack of reported scores limits the generalizability of results for individuals with differing levels of severity of ASD symptoms. Additionally, the minimal use of the ADOS-2 to confirm ASD diagnoses introduces a validity concern, as the studies may not have been studying CBT in their target population. Also, participant symptom severity may affect the necessary CBT modifications. For example, alexithymia is coded within the ADOS-2 under “communication of own affect” and “comments on others’ emotions/empathy.” These codes would give the researchers insight into different necessary modifications for alexithymia. Thus, future researchers should complete and document average total ADOS-2 scores, as well as average ratings at the symptom-level, to increase generalizability of results, confirm that they are using interventions within their intended populations, and to inform their CBT modifications.

Exploratory Research Question #2

To answer **Exploratory Research Question #2,** the author conducted a content analysis of the descriptions of adverse events within included studies**.** There was no specific hypothesis for this research question, as it was exploratory in nature. As reported in the results section, of the 28 included studies, 21 studies did not address whether any adverse events occurred. When reported, minimal details were provided regarding adverse events, even when reporting hospitalizations. This dearth of data regarding adverse events is consistent with other published data. For instance, a review by Amick and colleagues (2015) investigated the benefits and risks of cognitive behavioral therapy for depression in typically developing populations, and only included two of eleven trials reported adverse event data. Additionally, Bottema-Beutel and colleagues reviewed 150 group intervention studies with autistic children and found that only 11 (7.3%) reported on adverse events (Bottema-Beutel et al., 2021.)

As described in the literature review, 25.2% (95% CI 18.2-33.8%) of autistic children and adolescents experience suicidal ideation (O'Hallaran et al., 2022). Additionally, 8.3% (95% CI 3.6-18.2%) of autistic children and adolescents attempt suicide, and 0.2% (95% CI 0.05-0.52%) of autistic children and adolescents died by suicide (O'Halloran et al., 2022). Also, autistic children are more than two times more likely to experience suicidality (Odds Rati 2.53, 95% CI 1.70, 3.76), as compared to typically developing children, and autistic adults are more than three times more likely to experience suicidality (Odds Ratio 3.38, (95% CI 2.78, 5.30)), as compared to typically developing adults (Blanchard et al., 2021). Thus, the risk for suicidal adverse events is high, especially when further targeting the population of depressed, autistic individuals. Given the inherent risks of suicidality when working with clients with depression, researchers must plan for and report any adverse events. Future studies should assess suicidality during recruitment and

monitor suicidality throughout treatment using evidence-based risk assessments, such as the *Columbia Suicidal Severity Rating Scale* (CSSRS; Posner et al., 2008). They should also implement safety plans, in conjunction with parents/caregivers, when appropriate. Participants with a history of suicidal attempts (SA) and/or non-suicidal self-injury (NSSI) should especially be monitored, as their risk for future suicidal attempts is greater than individuals without history of SA and NSSI (Asarnow et al., 2011). Furthermore, researchers should document different participant characteristics, which may moderate their suicidal risk (ex. history of trauma, history of bullying, history of SA, history of NSSI, marginalized identities, etc.) as to help future researchers and practitioners monitor, treat, and prevent suicidality within the depressed, autistic population.

Limitations

First, this review and meta-analysis was limited by the heterogeneity of the studies, which resulted in decreased generalizability of the findings. There was a wide range in effect sizes within included studies (-1.36 to 0.23). The overall effect size estimate was -0.33 (0.05), which indicates that CBT results in a decrease in depression symptoms for autistic adults. However, six of the 28 included studies included at least one effect size that resulted in an increase in depression symptoms for autistic individuals over time (Russell et al., 2013; Habayeb et al., 2017; Mackay et al., 2017; Nakagawa et al., 2019; Gaigg et al., 2020; Kuroda et al., 2022). Also, none of the included analyses of moderating variables (pre-treatment depression level, presence/absence of a treatment control group, presence/absence of non-depression-related CBT elements, treatment dosage, participant characteristics) resulted in non-significant heterogeneity.

Additionally, generalizability of the results was also limited by the group format of many studies. Of the 28 included studies, 16 studies included CBT programs that were delivered in a

group format. Thus, individuals with severe social anxiety and/or social withdrawal symptoms may not have been able to access the intervention.

Also, this meta-analysis's generalizability is limited by the lack of included participants with below average intellectual functioning. While seven included studies did not explicitly exclude participants with below average intellectual functioning, only one study reported an average participant full-scale intelligence quotient standard score below 85, or below one standard deviation from the mean (Blakely-Smith et al., 2022). Additionally, the results of this study showed statistically significant reduced depression symptoms for autistic individuals with intellectual developmental disorder (Blakely Smith et al., 2022). Furthermore, a recent meta-analysis compiled evidence from 6 treatment-controlled studies utilizing CBT to treat depression in adults with intellectual disability and found that the overall effect size estimate was -0.65, but heterogeneity was high (I^2=505; Graser et al., 2022). Thus, the lack of included participants with low FSIQ within included studies from this meta-analysis is concerning, as individuals with intellectual disabilities are likely able to participate in CBT programs. Additionally, a recent archival study explored the intelligence of 7,344 children diagnosed with autism, and they found that 24.1% of autistic children have FSIQ scores below 70 (Billeiter and Froiland 2023). Thus, 27 of 28 included studies did not adequately sample the autistic population, which limits generalizability of the results across the autistic population. Of, the average percentage of Caucasian participants was 83.82%. Thus, minimal findings can be summarized for CBT's effectiveness for persons of color and/or persons with below average FSIQ.

Second, this review and meta-analysis was limited due to the limited number of studies explicitly exploring depression. Only 28 studies were able to be gleaned from the literature review that included autistic participants, CBT-based programming, and depression outcome

measures. Upon examination of the inclusion criteria and/or reported primary outcomes within the 28 studies, only 11 studies explicitly sought out to explore CBT's effect on depression symptoms within autistic populations. Of note, other studies included depression within their outcome measures, but they were addressing either general mental health outcomes (ex. quality of life, emotional regulation) or other mental health disorders (ex. anxiety, OCD). For the purposes of this review and meta-analysis, any study with a depression outcome measure was included to provide the most thorough review of the available published/unpublished literature and to control for backwards research designs. To control for the other intended outcomes within the studies, the author completed meta-regressions assessing for potential moderators, including pre-treatment depression levels (Research Question #3) and the presence/absence of non-depression-related CBT elements (Research Question #7). Both meta-regressions indicated that differences in these factors across studies were not associated with different effect size estimates. Thus, while 17 studies included within the analysis were not explicitly intending on treating depression, the quantitative data indicates that depression symptoms reduced after treatment and sustained long-term, months after treatment cessation. Of note, the lack of research explicitly exploring depression may be explained by challenges with recruitment. For example, Santomauro and colleagues (2016) reported significant challenges recruiting eligible participants, as 19% of participants screened for eligibility were excluded due to "high suicidal ideation," which required more intensive treatment. Also, they hypothesized challenges recruiting may be due to lack of motivation, a core symptom of depression, which may lead to decreased treatment engagement (Santomauro et al., 2016).

Third, this review and meta-analysis was limited by the methods with which the outcome variable, depression, was measured. The majority of studies measured depression symptoms

using self-report measures both before and after treatment to measure treatment efficacy. Mazefsky and colleagues (2011) detailed how individuals with ASD tend to under-report depression symptoms on self-report measures, as compared to data gleaned from a longer clinical interview. Additionally, autistic individuals often demonstrate alexithymia, which is defined as difficulty identifying emotions, difficulty differentiating emotions from bodily sensations, difficulty describing emotions to other people, and difficulty with imaginative thinking (Kinnaird et al., 2019; Poquérusse et al., 2018). While many studies included additional practice in labeling emotions to address alexithymia within autistic participants, which would be helpful long term for mental health, this may have resulted in differential ability to label emotions at pre-treatment and post-treatment, which could have affected the validity of the pre- and post-treatment depression measurements, and thus, the effect sizes of the studies. Lastly, as described in the introduction section, a variety of different depression outcome measures were utilized, and many measures have not been validated for use within autistic populations. Thus, studies may not have been using valid measures for depression within the autistic populations, and the depression score may not reflect the actual level of depression symptoms within the individual.

Of note, the included studies were published in a variety of different countries, including the United States of America, the United Kingdom, Australia, Sweden, Japan, the Netherlands, and France. While the range of countries improves international generalizability of the results, the range of cultural norms and differing societal rules may have impacted the different definitions of ASD. Thus, the definition of the target population may have differed between studies. Additionally, as discussed earlier in this discussion, the lack of confirmation of ASD diagnoses using the ADOS-2 also introduces validity concerns regarding the target population.

Overall, the quantitative results of this meta-analysis should be interpreted with caution due to concerns with the generalizability, the lack of depression-specific studies, the validity of the depression outcome measures, and the potential for different definitions of autism spectrum disorder. Additionally, the qualitative results of this study are limited by the descriptions of the CBT program modifications for autism spectrum disorder, the descriptions of the severity of autism symptoms within program participants, and the descriptions of adverse events. This author hypothesizes that the primary studies were limited in word count, and there is likely missing data related to these qualitative research questions.

Practice Implications & Future Directions

This meta-analysis yielded promising results for CBT's effectiveness in treating depression in autistic individuals, both immediately and months after treatment. However, there was a significant heterogeneity, and there were validity concerns related to rigor of design standards within included studies. Thus, these results should be interpreted with caution, and additional studies with methods in accordance with Cochrane guidelines need to be completed to determine whether CBT should be used in the best practice of treating depression within autistic populations.

To address the limitations within the included studies, additional studies need to be conducted. First, more studies need to be conducted exploring CBT's effect of depression symptoms with inclusion criteria specifically related to depression. Given the limitations described in Santomauro and colleagues (2016), it may be helpful to conduct studies within school settings, intensive outpatient, and/or in-patient facilities to address challenges with attendance/motivation and co-occurring suicidality, which requires more intensive care. Additionally, more studies need to be conducted using more in-depth clinical assessment of

depression symptoms, rather than just self-report. For instance, researchers can conduct in-depth clinical interviews to assess symptoms of depression, collect caregiver-report measures, and/or use qualitative symptom severity measures. Also, behavioral observations by qualified practitioners may be helpful. Additionally, for studies using self-report measures, researchers should use depression outcome measures that have been validated for use with autistic participants.

Second, while there was no significant difference in effect sizes with different FSIQ scores, the range of FSIQ scores was narrow, and all but one study (Blakely-Smith et al., 2020) had participants with average FSIQ scores above 85. Thus, further studies are needed that are more inclusive of autistic individuals with a range of FSIQ scores to ensure that CBT is effective across different intellectual ability levels. Also, additional studies need to be completed with individual format to include autistic individuals who may have anxiety and/or social withdrawal that would preclude their participation in a group format. Furthermore, future studies should complete the ADOS-2 for participants to confirm their ASD diagnosis and to better be able to differentiate treatment responsiveness in relation to both presenting ASD severity and depression symptoms severity.

Third, a variety of different modifications were described within CBT treatment programs. However, there has been limited evidence related to the effectiveness of these modifications. Thus, researchers should complete a factor analysis to determine which modifications are most helpful. Additionally, a factor analysis of CBT elements is also recommended to determine which aspects are most helpful for participants.

Lastly, and possibly most importantly, while CBT was found to be effective across studies, there are significant need-to-treatment gap for mental health symptoms for typically

developing population (Reardon et al., 2017) and especially within the autistic population (Adams et al., 2020). Within typically developing populations, barriers to treatment often included family circumstances, attitudes towards services providers/mental health treatment, knowledge/understanding of mental health problems, and help-seeking process and the mental health system. Within the autistic population, individuals and families report barriers to treatment, including lack of therapist knowledge about ASD, not meeting access criteria for therapist, communication challenges, therapist rapport, long wait lists, cost, time, and transport issues (Adams et al., 2020). Thus, in addition to further studies evaluating CBT interventions themselves, the mental health field needs to invest in the training of qualified CBT therapy practitioners with competence in working with autistic individuals and with competence in assessing for and treating suicidal and other adverse events.

Conclusions

This study was the first known synthesis of data exploring CBT's effectiveness in reducing symptoms of depression for autistic individuals. The results of this review and meta-analysis indicate that CBT is an effective treatment for treating depression symptoms in autistic individuals. Thus, treatment providers may choose to use CBT for patients with co-occurring depression and ASD. However, there was considerable heterogeneity in the effect sizes between studies, and none of the moderator analyses were significant. Also, due to the dearth in studies explicitly addressing symptoms of depression, additional research needs to be conducted to determine if CBT is effective in treating depression symptoms in autistic individuals.

Regarding qualitative data analysis, a variety of different methods were used to alter the CBT programs to be more appropriate for autistic participants. The most commonly used modifications were use of visual aids, increased practice in emotional labeling, social skills

training, similar structure between treatment sessions, concrete/simplified language, in-vivo practice of skills, and psychoeducation specific to symptoms of autism. Few studies reported quantitative autism symptom severity for participants. Seven studies reported average ADOS-2 scores for participants, and five studies reported average SRS-2 scores for participants. Also, seven studies described their participants as being diagnosed with "high functioning" autism. Lastly, minimal data was provided regarding adverse events within the studies.

This study serves as an important summary of the potential treatment effects of CBT on depression symptoms in individuals with autism. It serves to increase awareness for autistic individuals, families, and practitioners across school, clinic, and hospital settings that depression is an important area of concern for the autistic population that can be addressed with therapy. Quality of life for individuals with autism is often compromised in many ways that socially isolate them from meaningful friendships to loneliness, disengagement, and depression (Asmus et al. 2017). This meta-analysis is one step towards trying to identify and communicate to the community that there are established treatments for depression that can be used to improve the quality of life for individuals with both autism and depression. Depression is a mental health condition that can impact individuals with autism from making and maintaining meaningful social connections. This study has set forth ways in which CBT treatment for depression is worthwhile for individuals with autism.

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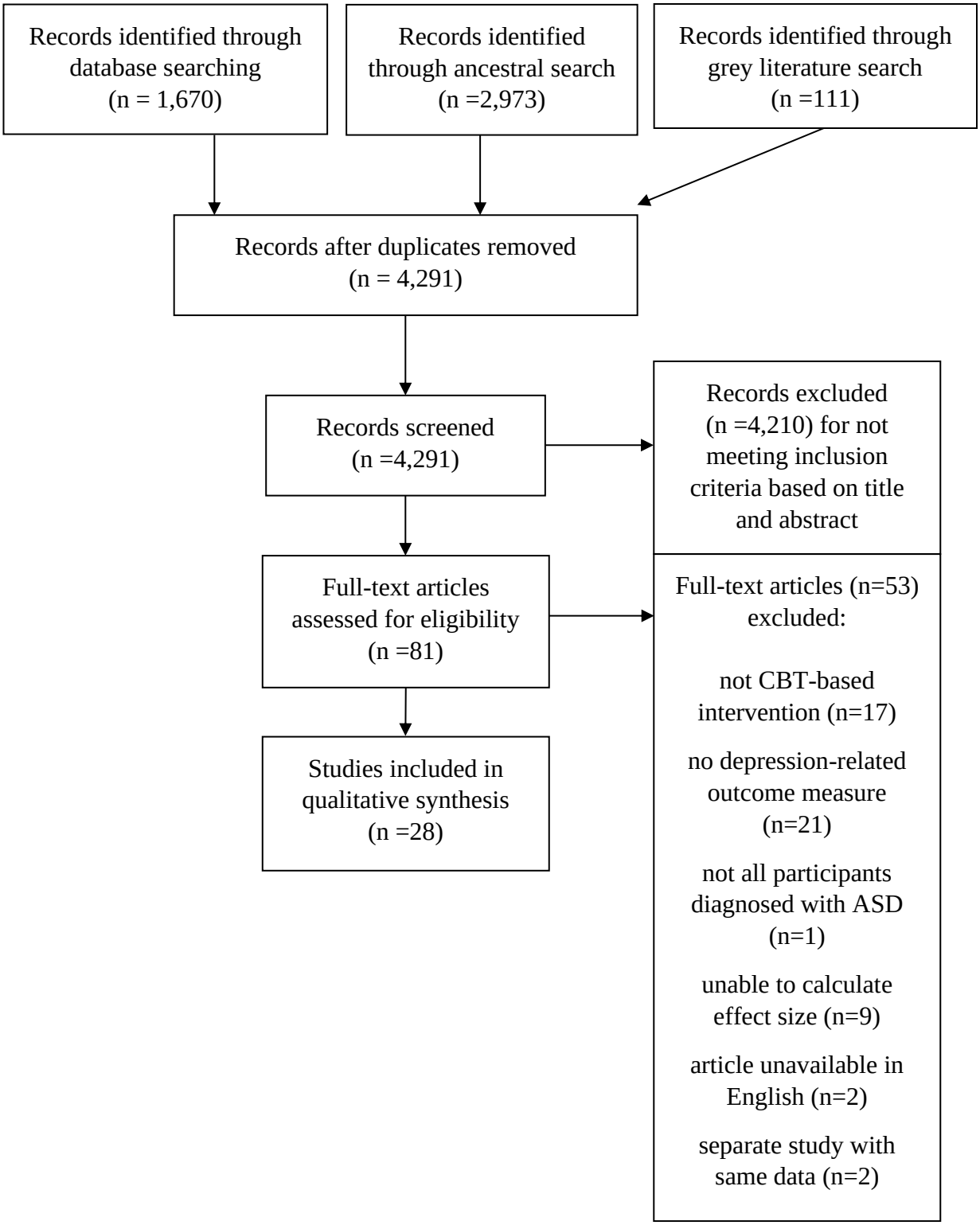
*Studies included in the meta-analysis

APPENDICES

Appendix A. Literature Search Flow Diagram



Appendix B: Coding Manual

The coding manual is divided into nine sections:

(1) Report characteristics (Table B1)

(2) Intervention characteristics (Table B2)

(3) Setting characteristics (Table B3)

(4) Participant demographics – Treatment Group (Table B4)

(5) Participant demographics – Control Group (Table B5)

(6) Research Design Characteristics (Table B6)

(7) Outcome Data (Table B7)

(8) Coder and coding process characteristics (Table B8)

Each section is presented in a table with the related coding variables, the variable descriptions or examples, and the quantity to be entered into the coding excel document.

Table B1

Report Characteristics

Coding Variable	Description & Example(s)	Quantity
Identification Number	The individual two-digit number assigned to each publication assigned during the initial screening (e.g., 002)	Enter the two-digit ID number in the column titled "ID"
First Author Last Name	The last name of the first author of the research study (ex., Gregus)	Enter the last name of the first author in the column titled "Author"
Year Published	The year published (e.g., 2022)	Enter the four-digit year of publication in the column titled "Year"
Type of Publication	The type of publication (ex. journal article).	In the column titled "Publication," enter: 1 = Journal article 2 = Doctoral dissertation 3=Unpublished data 4=Letter to Editor

Table B2

Intervention Characteristics

Coding Variable	Description & Example(s)	Quantity
CBT Program Type	Specify whether CBT included exposure for anxiety, exposure response prevention (ERP) for obsessive-compulsive disorder (OCD), or CBT without those aspects.	In the column titled, "IntType," enter CBT = CBT without ERP and/or exposure/ACT/DBT CBT+ERP=CBT with exposure response prevention for OCD CBT+Exp=CBT with exposure for anxiety
CBT Program Name	Name of the CBT program.	In the column titled, "IntName," enter the name of the CBT program.
Cognitive-Behavioral Therapy Core Elements Included in Intervention	The specific core elements included in the cognitive behavioral intervention: Psychoeducation (i.e., therapist provides information regarding emotions, bodily sensations, thoughts, behaviors, and the connections between each).	In the column titled "Intv:PsyEd" enter: 1 = Psychoeducation included 0 = Psychoeducation not identified in the study
	Behavioral activation (i.e., monitoring daily activities, activity scheduling, and reducing avoidance, "homework," etc.).	In the column titled "Intv:BA," enter: 1 = Behavioral activation included 0 = Behavioral activation not identified in the study
	Cognitive Restructuring (i.e., identifying/evaluating/responding to automatic thoughts, modifying automatic thoughts, identifying core beliefs, modifying core beliefs, acceptance of negative thoughts, cognitive diffusion, etc.)	In the column titled "Intv:CR," enter: 1 = Cognitive restructuring included 0 = Cognitive restructuring not identified in the study
	Skills Training (i.e., problem-solving, relaxation, role-playing, making decisions, etc.).	In the column titled "Intv:SK," enter: 1 = Skills training included 0 = Skills training not identified in the study

Group Size	Whether the intervention was implemented in an individual or a group format.	In the column titled, "Group#," enter: 1=Intervention was one-on-one 2=Intervention was in a group format
Type of Interventionist	The person implementing the intervention as identified in the article: Trained research assistant (graduate student, research team member, undergraduate, principal investigator without master's-level graduate training in mental health) Clinician (masters-level therapist, graduate-level therapist, combination of pre-licensed professionals and licensed clinicians) Other (unlicensed professional without master's-level graduate training in mental health)	In the column titled, "Interventionist," enter: 1 = researcher 2 = clinician 3 = other NR = not reported
Dosage	The total number of minutes of intervention received. If not provided, calculate by multiplying the number of intervention sessions by the length of sessions in minutes (e.g., 10 30-minute sessions = 300). If the number of sessions varies across participants, calculate the average of total intervention minutes.	In the column titled, "Dosage," enter the total number of intervention minutes. If there is not enough information provided in the article, enter NR.
Treatment Integrity	The total percentage of intervention components implemented as intended as reported in the article (e.g., treatment integrity, procedural fidelity, treatment fidelity).	In the column titled, "Integrity," enter the total percentage reported for treatment integrity. Note: do not include the percentage symbol (e.g., enter 85 if 85% treatment integrity is reported). If the treatment integrity is not reported, then enter NR.

ASD Modified	Presence of absence of program modification to meet the needs of autistic individuals.	In the column titled, “ASDMod,” enter: 1=Program modified to meet needs of autistic individuals 0=Program not modified to meet needs of autistic individuals

Table B3

Setting Characteristics

Coding Variable	Description & Example(s)	Quantity
Country	The country where the intervention study was implemented (e.g., United States of America).	In the column titled "Country," enter: 1 = United States of America 0 = Other If coded as other, in the column titled, "Country: Other," write the name of the country (e.g., England).
Setting	The type of setting where the intervention was implemented as identified in the article: Clinic (i.e., university clinic, interventionist clinic, academic center) Elementary/Middle/High School Online (i.e., self-guided online program)	In the column titled, "Setting," enter: 1 = Clinic 2 = Elementary/Middle/High School 3=Online NR = Not reported

Table B4
Participant and Sample Characteristics – Treatment Group

Coding Variable	Description & Example(s)	Quantity
Intellectual ability	Average full-scale intelligence quotient score for participants.	In the column titled "T-IQAvg" enter the average FSIQ standard score for participants in the treatment group.
Age	Average age of participant	In the column titled, "T-Age," enter the average age of the participants.
%Male	The percentage of participants who are male identifying.	In the column titled, "T-Male," enter the percentage of male participants in the treatment group baseline sample.
SES	The percentage of participants with high social-economic status (SES), as evidenced by income level over 100,000, parental graduate education for child studies, individual graduate education for adult studies, or qualitatively described SES status within the paper.	In the column titled, "T-SES," enter the percentage of participants with high SES status or NR if data is not reported in the treatment group baseline sample.
%Caucasian	The percentage of participants who identify as Caucasian/white.	In the column titled, "Tx-RE-C," enter the percentage of participants who identify as white/Caucasian within the baseline treatment sample.

Table B5

Participant and Sample Characteristics – Control Group

*****If the study does not have a treatment control group, then all of the information in this section should be coded "NA."

Coding Variable	Description & Example(s)	Quantity
Intellectual ability	Average full-scale intelligence quotient standard score for participants.	In the column titled "C-IQAvg" enter the average IQ score for participants in the control group.
Age	Average age of participant	In the column titled, "C-Age," enter the average age of the participants.
%Male	The percentage of participants who are male identifying.	In the column titled, "C-Male," enter the percentage of male participants in the control group baseline sample.
SES	The percentage of participants with high social-economic status (SES), as evidenced by income level over 100,000, parental graduate education for child studies, individual graduate education for adult studies, or qualitatively described SES status within the paper.	In the column titled, "C-SES," enter the percentage of participants with high SES status or NR if data is not reported in the control group baseline sample.
%Caucasian	The percentage of participants who identify as Caucasian/white.	In the column titled, "C-RE-C," enter the percentage of participants who identify as white/Caucasian within the baseline control sample.

Table B7

Research Design Characteristics

Coding Variable	Description & Example(s)	Quantity
ADOS-2 to confirm diagnosis	Whether or not the ADOS-2 was used to confirm the ASD/Asperger Syndrome/PDD-NOS diagnosis for all participants	In the columned titled, "ADOS," enter: 1=ADOS-2 used for all participants 0=ADOS-2 not used for all participants
Comparison Group	Whether or not a comparison group was established to compare the treatment group to.	In the column titled, "CompG," enter: 1=Comparison group present 0=Comparison group not present
Type of Comparison Group	The type of comparison group included in the study. No intervention/waitlist control Treatment as usual (TAU) Other, Non-CBT intervention No comparison Group	In the column titled, "TCompG," enter:" No Tx/waitlist control TAU Other NA=No comparison group
Group Equivalence	If there was a comparison group, whether or note group equivalence was established for pre-treatment depression levels.	In the column titled, "GEquiv," enter: 1=Group equivalence established 0=Group equivalence not established or described NA=No comparison group
Group Randomization	Whether or not participants were assigned to groups randomly or not.	In the column titled, "GRand," enter: 1=Participants assigned to groups randomly 0=Participants not randomly assigned to groups, or random assignment is not mentioned NA=No comparison group

Intellectual disability as exclusion criterion.	Whether or not intellectual ability was used as an exclusion criterion for the study.	In the column titled, "LowIQExc," enter: 0=If below average IQ was not used as an exclusion criterion. 1=If below average IQ was used as an exclusion criterion.
Depression Inclusion Criteria	Whether or not moderate-to-severe depressive symptoms were an inclusion criterion for the study.	In the column titled, "DepInc," enter: 0=Depressive symptoms were not an inclusion criterion. 1=Depression symptoms were an inclusion criterion.

Table B8

Outcome Data

Coding Variable		Quantity
Depression outcome measure	The standardized, norm-referenced measure used to assess depression. *Beck Depression Inventory, Second Edition (BDI-II)* *BDI-II Autism Specific T-score (BDI-II-ASD-T)* *Depression Anxiety Symptoms Scale (DAAS)* *Hospital Anxiety Depression Scale (HADS)* *Patient-Reported Outcomes Measurement Information Systems Depression Scale - Child (PROMIS – Dep-C)* *Information Systems Depression Scale - Parent (PROMIS – Dep-P)* *Adult Self Report Depressive Problems Subscale (ASR - D)* *Children's Depression Inventory, Second Editon, Parent (CDI-P)* *Children's Depression Inventory, Second Edition, Children Self-Report (CDI-C)* *Montgomery Asberg Depression Rating Scale, Self-Report (MADRS-S)* *Center for Epidemiological Studies Depression Scale (CES-D)* *Short-Form of the Mood and Feelings Questionnaire (SMFQ)* *Behavior Assessment System for Children, Second Edition (BASC-2)* *Hamilton Rating Scale for Depression (HAMD)* *Patient Health Questionnaire, Nineth Edition (PHQ-9)* *Beck Youth Inventories, Depression (BYI-D)* *Emotion Dysregulation Inventory – Reactivity Short Form Dysphoria (EDI-Dys)* *Revised Children's Anxiety and Depression Scale (RCADS-C)* *Revised Children's Anxiety and Depression Scale (RCADS-P)* *Anxiety Depression and Mood Scale, Depression Subscale (ADAMS-Dep)* *Automatic Thoughts Questionnaire (ATQ)* *Beck Hopelessness Scale (BHS)*	In the column titled "Dep OM," enter: BDI-II BDI-II-ASD-T DAAS HADS PROMIS-Dep-C ASR-D PROMIS-Dep-P CDI P CDI C MADRS-S CES-D SMFQ BASC-2 HAMD PHQ-9 BYI-D EDI-Dys RCADS-C RCADS-P ADAMS-D ATQ BHS

Control Group Participant Number Pre-Treatment	In the column titled, “c,pre,n,” enter the number of participants in the control group pre-treatment for the control group.
Control Group Average Depression Level Pre-Treatment	In the column titled, “c,pre,m,” enter the mean depression level pre-treatment for the control group.
Control Group Standard Deviation of Depression Level Pre-Treatment	In the column titled, “c,pre,stddev,” enter the standard deviation of the depression level pre-treatment for the control group.
Control Group Participant Number Post-Treatment	In the column titled, “c,post,n,” enter the number of participants in the control group post-treatment for the control group.
Control Group Average Depression Level Post- Treatment	In the column titled, “c,post,m,” enter the mean depression level post-treatment for the control group.
Control Group Standard Deviation of Depression Level Post-Treatment	In the column titled, “c,post,stddev,” enter the standard deviation of the depression level post-treatment for the control group.
Control Group Participant Number Follow-Up.	In the column titled, “c,FU,n,” enter the number of participants in the control group at post-treatment later follow-up for the control group.
Control Group Average Depression Level at Follow-Up.	In the column titled, “c,FU,m,” enter the mean depression level at post-treatment follow-up for the control group.
Control Group Standard Deviation of Depression Level at Follow-Up.	In the column titled, “c,FU,stddev,” enter the standard deviation of the depression level at post-treatment follow-up for the control group.
Control Correlation	In the column titled, “r,c,” enter the correlation (r) between the pre-test/ post-test depression data or the pre-test/follow-up depression data for the control group participants.
Treatment Group Participant Number Pre-Treatment	In the column titled, “t,pre,n,” enter the number of participants in the control group pre-treatment for the treatment group.

Treatment Group Average Depression Level Pre-Treatment	In the column titled, “t,pre,m,” enter the mean depression level pre-intervention for the treatment group.
Treatment Group Standard Deviation of Depression Level Pre-Treatment	In the column titled, “t,pre,stddev,” enter the standard deviation of the depression level pre-treatment for the treatment group.
Treatment Group Participant Number Post-Treatment	In the column titled, “t,post,n,” enter the number of participants in the control group post-treatment for the treatment group.
Treatment Group Average Depression Level Post- Treatment	In the column titled, “t,post,m,” enter the mean depression level post-intervention for the treatment group.
Treatment Group Standard Deviation of Depression Level Post-Intervention	In the column titled, “t,post,stddev,” enter the standard deviation of the depression level post-treatment for the treatment group.
Treatment Group Participant Number Follow-Up.	In the column titled, “t,FU,n,” enter the number of participants in the control group at post-intervention later follow-up for the treatment group.
Treatment Group Average Depression Level at Follow-Up.	In the column titled, “t,FU,m,” enter the mean depression level at post-intervention follow-up for the treatment group.
Treatment Group Standard Deviation of Depression Level at Follow-Up.	In the column titled, “t,FU,stddev,” enter the standard deviation of the depression level at post-treatment follow-up for the treatment group.
Time at Follow-up	In the column titled, “FU” enter: the number of months after the intervention concluded when the data was collected, or enter NA if that data reported is pre and post.
Treatment Correlation	In the column titled, “t, r,” enter the correlation (r) between the pre-test/ post-test depression data or the pre-test/follow-up depression data for the treatment group participants.

Pre-Tx qualitative depression description	Record the qualitative depression level before treatment, based on standardized measure documentation. 0=Average 1=Mild 2=Moderate 3=Severe

Table 9

Coder and Coding Process Characteristics

Coding Variable	Description & Example(s)	Quantity
Date Coded	The date when the article was coded	In the column titled, "CDate," enter: two-digit month – two-digit date – four-digit year (e.g., 10/18/2022)
Coder	Three-letter initials of study coder (ex. Kelly Gregus=KG)	In the column titled, "CDr," enter the two-letter initials of the coder.
Date Double Coded	The date when the article was double coded	In the column titled, "DCDate," enter: two-digit month – two-digit date – four-digit year (e.g., 01/20/2023)
Double Coder	Three-letter initials of study double coder (ex. Kelly Gregus=KG)	In the column titled, "DCDr," enter the two-letter initials of the coder.

Appendix C: Descriptive Results of Included Studies

Appendix C is divided into eight sections:

(1) Report characteristics (Table C1)

(2) Intervention characteristics (Table C2)

(3) Setting characteristics (Table C3)

(4) Participant demographics – Control Group (Table C4)

(5) Participant demographics – Treatment Group (Table C5)

(6) Research Design Characteristics (Table C6)

(7) Outcome Characteristics (Table C7)

Table C1.

Descriptive Results of Report Characteristics

Study #	Study (Author(s), Date)	Type of Publication
1	Russell et al., 2008	Letter to the Editor
2	Russell et al., 2013	Peer-Reviewed Article
3	Hesselmark et al., 2014	Peer-Reviewed Article
4	McGillivray & Evert 2014	Peer-Reviewed Article
5	Pahnke et al., 2014	Peer-Reviewed Article
6	Langdon et al., 2016	Peer-Reviewed Article
7	Santomauro et al., 2016	Peer-Reviewed Article
8	Habayeb et al., 2017	Peer-Reviewed Article
9	Mackay et al., 2017	Peer-Reviewed Article
10	Sizoo & Kuiper 2017	Peer-Reviewed Article
11	Spain et al., 2017	Peer-Reviewed Article
12	Conner et al., 2019	Peer-Reviewed Article
13	Nakagawa et al., 2019	Peer-Reviewed Article
14	Pahnke et al., 2019	Peer-Reviewed Article
15	Wise et al., 2019	Peer-Reviewed Article
16	Blakely-Smith et al., 2020	Peer-Reviewed Article
17	Flygare et al., 2020	Peer-Reviewed Article
18	Gaigg et al., 2020	Peer-Reviewed Article
19	Russell et al., 2020	Peer-Reviewed Article
20	Bemmer et al., 2021	Peer-Reviewed Article
21	Capriola-Hall et al., 2021	Peer-Reviewed Article
22	Lee 2021	Approved Dissertation
23	Balci et al., 2022	Peer-Reviewed Article
24	Bemmouna et al., 2022	Peer-Reviewed Article
25	Kuroda et al., 2022	Peer-Reviewed Article
26	Shochet et al., 2022	Peer-Reviewed Article
27	Wickberg et al., 2022	Peer-Reviewed Article
28	Schwartzman 2023	Unpublished Data

Table C2.

Descriptive Results of Studies Included in Quantitative Synthesis: Intervention Characteristics

First Author	Year	Intervention Name	PE	BA	CR	ST	+NonDep	Group#	Interventionist	Dosage (min)	% Tx Integrity	ASD Mod
Russell	2008	CBT	Y	Y	Y	Y	Y	Individual	Clinician	NR	NR	N
Russell	2013	CBT for OCD	Y	Y	Y	Y	Y	Individual	Clinician	1200	NR	Y
Hesselmark	2014	CBT	Y	Y	Y	Y	N	Group	Clinician	6480	NR	Y
McGillivray & Evert	2014	Think well, feel well, be well	Y	Y	Y	Y	N	Group	Clinician	1080	NR	Y
Pahnke	2014	ACT	Y	Y	Y	Y	N	Group	Clinician	858	NR	Y
Langdon	2016	CBT	Y	Y	Y	Y	Y	Group	Clinician	1440	NR	Y
Santomauro	2016	Exploring Depression	Y	Y	Y	Y	N	Group	Clinician	660	NR	Y
Habayeb	2017	RBP	Y	Y	N	Y	N	Group	Clinician	720	NR	Y
Mackay	2017	RAP-A-ASD	Y	Y	Y	Y	N	Individual	Clinician	550	93	Y
Sizoo & Kuiper	2017	CBT	Y	Y	Y	Y	N	Group	Clinician	1170	100	Y
Spain	2017	CBT	Y	Y	Y	Y	Y	Group	Clinician	1320	NR	Y
Conner	2018	EASE	Y	Y	Y	Y	N	Individual	Clinician	760	86.36	Y
Nakagawa	2019	CBT	Y	Y	N	N	Y	Individual	Clinician	NR	NR	Y
Pahnke	2019	Neuro ACT	Y	Y	Y	Y	N	Group	Clinician	2160	NR	Y
Wise	2019	TALAA	Y	Y	Y	Y	Y	Individual	Clinician	960	NR	Y
Blakeley-Smith	2020	Facing Your Fears	Y	Y	Y	Y	Y	Group	NR	1260	NR	Y
Flygare	2020	CBT	Y	Y	Y	Y	Y	Individual	Clinician	NR	NR	Y
Gaigg	2020	Serenity Online Program	Y	Y	Y	Y	N	Individual	Other	NR	NR	N
Russell	2020	GSH	Y	Y	N	N	N	Individual	Clinician	390	NR	Y
Bemmer	2021	Engage Program	Y	Y	N	Y	Y	Group	Clinician	1200	NR	Y
Capriola-Hall	2021	STEPS	Y	Y	Y	Y	N	Individual	Clinician	1050	NR	Y

Lee	2021	SIERA	Y	Y	Y	Y	N	Group	Clinician	810	99	Y
Balci	2022	COMET	N	Y	Y	Y	N	NR	Clinician	315	88	N
Bemmouna	2022	DBT	Y	Y	Y	Y	N	Group	Clinician	NR	NR	Y
Kuroda	2022	Cat-Kit & CBT	Y	Y	Y	Y	N	Group	Clinician	800	NR	Y
Shochet	2022	RAP-A-ASD	Y	Y	Y	Y	N	Group	Clinician	550	87.27	Y
Wickberg	2022	CBT	Y	Y	Y	Y	Y	Individual	Clinician	1680	NR	Y
Wickberg	2022	iCBT	Y	Y	Y	Y	Y	Individual	Clinician	NR	NR	Y
Schwartzman	2023	CBT for Dep	Y	Y	Y	Y	N	Group	Clinician	1080	NR	Y

CBT=cognitive behavioral therapy; OCD=obsessive-compulsive disorder; ACT=acceptance and commitment therapy; RBP=resilience builder program; RAP-A-ASD=resourceful adolescent program, adolescent version, autism version; EASE= Emotional Awareness and Skills Enhancement, TALAA=treatment of anxiety in late adolescence with autism; GSH=guided self-help; STEPS= The Stepped Transition in Education Program for Students with ASD; SIERA= Skills Improvement on Emotion Regulation for Adults; COMET= Competitive Memory Training; DBT=dialectical behavioral therapy; Dep=depression; PE=psychoeducation; BA=behavioral activation; CR=cognitive restructuring; ST=skills training, +NonDep=presence or absence of non-depression-related CBT elements; ASD=autism spectrum disorder; Y=yes; N=no

Table C3.

Descriptive Results of Studies Included in Quantitative Synthesis: Setting Characteristics

First Author	Year	Country	Setting
Russell	2008	UK	Clinic
Russell	2013	UK	NR
Hesselmark	2014	Sweden	Clinic
McGillivray & Evert	2014	Australia	NR
Pahnke	2014	Sweeden	School
Langdon	2016	UK	NR
Santomauro	2016	Australia	NR
Habayeb	2017	USA	Clinic
Mackay	2017	Australia	School
Sizoo & Kuiper	2017	Netherlands	NR
Spain	2017	UK	NR
Conner	2018	USA	Clinic
Nakagawa	2019	Japan	Clinic
Pahnke	2019	Sweden	Clinic
Wise	2019	USA	NR
Blakeley-Smith	2020	USA	Clinic
Flygare	2020	Sweden	NR
Gaigg	2020	UK	Online
Russell	2020	UK	Clinic
Bemmer	2021	Australia	NR
Capriola-Hall	2021	USA	NR
Lee	2021	USA	Online
Balci	2022	Netherlands	Clinic
Bemmouna	2022	France	NR
Kuroda	2022	Japan	Clinic
Shochet	2022	Australia	School
Wickberg	2022	Sweden	CBT (Clinic)
Wickberg	2022	Sweden	iCBT (Online)
Schwartzman	2023	USA	Clinic

Table C4.

Descriptive Results of Studies Included in Quantitative Synthesis: Participant Characteristics – Control Group

First Author	Year	Avg FSIQ	Avg Age	%Male	% High SES	% Caucasian
Russell	2008	95.5	32.1	NR	NR	NR
Hesselmark	2014	NR	31.8	60	39	NR
McGillivray & Evert	2014	NR	20.5	81.3	18.8	NR
Pahnke	2014	NR	16.8	92.31	NR	NR
Langdon	2016	104.83	38.7	58	31	100
Santomauro	2016	NR	15.5	NR	NR	NR
Mackay	2017	NR	11.77	92.3	NR	NR
Gaigg	2020	117.6	45.7	85.71	NR	NR
Russell	2020	NR	40.2	77	NR	94
Capriola-Hall	2021	NR	19.63	81.25	NR	75
Balci	2022	93.77	11.84	84.62	NR	NR
Kuroda	2022	104.9	29.6	72.41	NR	NR

Avg=Average, FSIQ=Full-scale intelligence quotient standard score, SES=social-economic status.

Table C5.

Descriptive Results of Studies Included in Quantitative Synthesis: Participant Characteristics – Treatment Group

First Author	Year	Avg FSIQ	Avg Age	% Male	% High SES	% Caucasian
Russell	2008	95.5	23.8	NR	NR	NR
Russell	2013	102.5	28.6	NR	NR	NR
Hesselmark	2014	NR	31.9	49	40	NR
McGillivray & Evert	2014	NR	20.27	73.1	7.7	NR
Pahnke	2014	NR	16.2	60	NR	NR
Langdon	2016	106.18	33.1	46	38	100
Santomauro	2016	NR	16	NR	NR	NR
Habayeb	2017	NR	10	82.1	76.9	66.7
Mackay	2017	NR	11.94	87.5	NR	NR
Sizoo & Kuiper	2017	NR	35.1	NR	NR	NR
Spain	2017	NR	31	100	44.44	83.3
Conner	2018	98.47	14.94	88.2	NR	82.4
Nakagawa	2019	102.68	33.16	47.74	NR	NR
Pahnke	2019	NR	49	50	NR	NR
Wise	2019	99.71	17.14	57.14	NR	85.57
Blakeley-Smith	2020	58.3	15.92	73.9	43.48	56
Flygare	2020	NR	23.84	42.1	NR	NR
Gaigg	2020	116.7	40.3	88.89	NR	NR
Russell	2020	NR	35.3	69	NR	94
Bemmer	2021	106.23	22.3	56.52	NR	NR
Capriola-Hall	2021	NR	19.87	68.75	NR	87.5
Lee	2021	NR	21.1	83.3	NR	NR
Balci	2022	102.82	12.18	72.72	NR	NR
Bemmouna	2022	108.8	27.71	57	0	100
Kuroda	2022	110.2	32.7	64.52	NR	NR
Shochet	2022	NR	11.84	80	0	NR
Wickberg	2022	NR	14.3	59	6	NR
Schwartzman	2023	NR	13.9	62	0	NR

Avg=Average, FSIQ=Full-scale intelligence quotient standard score, SES=social-economic status.

Table C6.

Descriptive Results of Studies Included in Quantitative Synthesis: Research Design Characteristics

First Author	Year	ADOS	Tx Control Group?	Details Tx Control Group	Group Equivalence Established?	Group Randomization?	Low FSIQ Exclusion	Depression Inclusion
Russell	2008	No	Yes	TAU	Yes	No	Yes	No
Russell	2013	Yes	No	NA	NA	NA	Yes	No
Hesselmark	2014	Yes	Yes	Other	Yes	Yes	Yes	No
McGillivray & Evert	2014	No	Yes	No Tx/WLC	Yes	No	No	No
Pahnke	2014	No	Yes	No Tx/WLC	Yes	Yes	Yes	No
Langdon	2016	No	Yes	No Tx/WLC	Yes	Yes	Yes	No
Santomauro	2016	No	Yes	No Tx/WLC	Yes	Yes	Yes	Yes
Habayeb	2017	No	No	NA	NA	NA	No	No
Mackay	2017	No	Yes	TAU	Yes	Yes	Yes	No
Sizoo & Kuiper	2017	No	No	NA	NA	NA	Yes	No
Spain	2017	No	No	NA	NA	NA	No	No
Conner	2018	Yes	No	NA	NA	NA	Yes	No
Nakagawa	2019	No	No	NA	NA	NA	Yes	No
Pahnke	2019	No	No	NA	NA	NA	Yes	No
Wise	2019	Yes	No	NA	NA	NA	Yes	No
Blakeley-Smith	2020	Yes	No	NA	NA	NA	No	No
Flygare	2020	No	No	NA	NA	NA	No	No
Gaigg	2020	Yes	Yes	No Tx/WLC	Yes	Yes	No	No
Russell	2020	No	Yes	TAU	Yes	Yes	No	Yes
Bemmer	2021	No	No	NA	NA	NA	Yes	No
Capriola-Hall	2021	Yes	Yes	TAU	Yes	Yes	Yes	No
Lee	2021	No	No	NA	NA	NA	Yes	No
Balci	2022	No	Yes	TAU	Yes	Yes	Yes	No
Bemmouna	2022	No	No	NA	NA	NA	Yes	Yes
Kuroda	2022	Yes	Yes	No Tx/WLC	Yes	Yes	Yes	No
Shochet	2022	No	No	NA	NA	NA	Yes	No
Wickberg	2022	No	No	NA	NA	NA	Yes	No
Schwartzman	2023	No	No	NA	NA	NA	Yes	No

ADOS=Autism Diagnostic Observation Schedule, Second Edition; TAU=treatment as usual; No tx/WLC=no treatment/waitlist control group; Low FSIQ Exclusion=whether low FSIQ was an exclusion factor within studies; Depression Inclusion=whether depression was a listed inclusion factor for study.

Table C7.

Descriptive Results of Effect Sizes

Study ID	ES ID	First Author	Year	Depression Outcome Measure	Pre-Treatment Depression Level	ES Estimate (SMD)	Sample Variance (v)
1	1	Russell	2008	BDI	Mild	-0.20	0.25
2	2	Russell	2013	BDI	Mild	-0.03	0.06
2	3	Russell	2013	BDI	Mild	0.09	0.08
3	4	Hesselmark	2014	BDI	Mild	-0.08	0.08
4	5	McGillivray & Evert	2014	DAAS	Moderate	-0.31	0.12
4	6	McGillivray & Evert	2014	DAAS	Severe	-1.04	0.07
4	7	McGillivray & Evert	2014	DAAS	Severe	-1.36	0.16
4	8	McGillivray & Evert	2014	DAAS	Severe	-1.31	0.18
4	9	McGillivray & Evert	2014	ATQ	Mild	-0.14	0.12
5	10	Pahnke	2014	BYI-D	Mild	-0.15	0.14
5	11	Pahnke	2014	BYI-D	Mild	-0.52	0.11
6	12	Langdon	2016	HAM-D	Moderate	-0.27	0.09
6	13	Langdon	2016	HAM-D	Moderate	-0.44	0.09
6	14	Langdon	2016	HAM-D	Severe	-0.41	0.10
7	15	Santomauro	2016	BDI	Severe	-0.03	0.17
7	16	Santomauro	2016	DAAS	Severe	-0.85	0.06
8	17	Habayeb	2017	BASC	Mild	0.09	0.06
9	18	Mackay	2017	CDI-C	Mild	0.00	0.13
9	19	Mackay	2017	CDI-C	Mild	0.21	0.13
10	20	Sizoo & Kuiper	2017	HADS-D	Moderate	-0.62	0.05
10	21	Sizoo & Kuiper	2017	HADS-D	Moderate	-0.56	0.04
11	22	Spain	2017	HADS-D	Mild	0.00	0.09
12	23	Conner	2018	PROMIS-Dep-P	Average	-1.13	0.11
12	24	Conner	2018	PROMIS-Dep-C	Average	-0.34	0.10

13	25	Nakagawa	2019	BDI	Mild	0.23	0.16
14	26	Pahnke	2019	BDI	Moderate	-0.40	0.20
14	27	Pahnke	2019	BDI	Moderate	-0.46	0.04
15	28	Wise	2019	HAM-D	Average	-0.15	0.05
16	29	Blakeley-Smith	2020	ADAMS-Dep	Average	-0.60	0.05
17	30	Flygare	2020	MADRS-S	Severe	-0.40	0.04
17	31	Flygare	2020	MADRS-S	Severe	-0.39	0.05
18	32	Gaigg	2020	HADS	Average	-0.05	0.05
18	33	Gaigg	2020	HADS	Average	0.01	0.02
18	34	Gaigg	2020	HADS	Average	-0.13	0.07
19	35	Russell	2020	PHQ-9	Moderate	-1.23	0.05
19	36	Russell	2020	BDI	Severe	-0.86	0.04
19	37	Russell	2020	HAM-D	Mild	-0.45	0.15
20	38	Bemmer	2021	DAAS	Moderate	-0.27	0.17
21	39	Capriola-Hall	2021	ASD-D	Mild	-0.64	0.19
22	40	Lee	2021	EDI-Dys	Mild	-0.55	0.19
23	41	Balci	2022	CDI-C	Mild	-0.44	0.07
24	42	Bemmouna	2022	BDI-ASD-T	Moderate	-0.43	0.04
24	43	Bemmouna	2022	BDI-ASD-T	Moderate	-0.37	0.09
24	44	Bemmouna	2022	BHS	Moderate	-1.00	0.04
24	45	Bemmouna	2022	BHS	Moderate	-0.83	0.02
25	46	Kuroda	2022	CES-D	Moderate	-0.15	0.04
25	47	Kuroda	2022	CES-D	Moderate	0.23	0.06
26	48	Shochet	2022	CDI-C	Mild	-0.08	0.09
26	49	Shochet	2022	CDI-C	Mild	-0.11	0.05
26	50	Shochet	2022	CDI-C	Mild	-0.01	0.09
26	51	Shochet	2022	CDI-C	Mild	-0.26	0.11
26	52	Shochet	2022	CDI-P	Severe	-0.45	0.04
26	53	Shochet	2022	CDI-P	Severe	-0.52	0.05
26	54	Shochet	2022	CDI-P	Severe	-0.19	0.01
26	55	Shochet	2022	CDI-P	Severe	-0.58	0.07

27	56	Wickberg	2022	SMFQ	Mild	-0.46	0.12
27	57	Wickberg	2022	SMFQ	Mild	-0.34	0.18
27	58	Wickberg	2022	SMFQ	Mild	-0.70	0.03
27	59	Wickberg	2022	SMFQ	Mild	-0.62	0.03
28	60	Schwartzman	2023	RCADS-C	Mild	-0.63	0.02
28	61	Schwartzman	2023	RCADS-C	Mild	-0.70	0.05
28	62	Schwartzman	2023	RCADS-P	Mild	-0.28	0.04
28	63	Schwartzman	2023	RCADS-P	Mild	-0.29	0.03

BDI=Beck Depression Inventory, Second Edition; BDI-ASD-T=BDI-II autism specific T-score; DAAS=Depression and Anxiety Scale; HAM-D=Hamilton Depression Rating Scale; HADS=Hospital Anxiety and Depression Scale, Depression Subscale; CDI=Children's Depression Inventory, Second Edition; ADAMS=Anxiety and Depression and Mood Scale, Depression Subscale; ASR-D=Adult Self-Report, Depressive Problems; ATQ=Automatic Thoughts Questionnaire; BASC=Behavior Assessment System for Children, Depression Subscale; BHS=Beck Hopelessness Scale; BYI-D=Beck Youth Inventories, Depression; CES-D=Center for Epidemiological Studies, Depression Scale; EDI-Dys=Emotion Dysregulation Inventory – Reactivity Short Form, Dysphoria Subscale; MADRS-S=Montgomery Asberg Depression Rating Scale, Self-Report; PHQ-9=Patient Health Questionnaire, Nineth Edition; PROMIS-Dep=Patient Reported Outcomes Measurement Information Systems, Depression Subscale; RCADS=Revised Children's Anxiety and Depression Scale, Depression Subscale; SMFQ=Short-Form of the Mood and Feelings Questionnaire; -C=Child-report; -P=Parent Report.