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Interventions for Transition-Age Youth with Disabilities: A Meta-Analysis of Group Design Studies

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Abstract

This meta-analytic review investigated interventions for transition-age youth diagnosed with autism, intellectual disability, or extensive support needs. Nineteen group design studies with 215 effect sizes met inclusion criteria. A robust variance estimation procedure that accounts for the clustering effect sizes within studies was used to synthesize effect sizes within each intervention and outcome type. Occupational Therapy/Physical Therapy interventions have significant and positive effects on gross motor outcomes ($g = 0.73$, $p < 0.01$). All remaining interventions and outcomes could not be synthesized due to a limited number of studies, but are further described in a narrative manner. Recommendations for future research include improving the methodological quality of intervention studies and further analyzing the effects of interventions for transition-age youth.

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Interventions for Transition-Age Youth with Disabilities: A Meta-Analysis of Group Design Studies

The Individuals with Disabilities Education Act (IDEA, 2004) is a legislative mandate designed to guarantee educational opportunities for students with disabilities. This law outlines the necessary steps to prepare students for transition from high school to "post-school activities, including postsecondary education, vocational education, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation" (IDEA, 2004). Special educators are now required to develop appropriate goals and corresponding support strategies for all students receiving special education services that will assist them with their transition to adulthood. Although special educators have primarily assumed responsibility for implementation of transition services, researchers have argued for collaboration between general and special educators, and alignment of academic and transition-focused instruction (Morningstar et al., 2012). Despite these advances, students with disabilities consistently lag behind their peers in terms of rates of employment, post-secondary school attendance, independent living, and opportunities for success within the community (Newman et al., 2011; Roux et al., 2013).

Previous studies asked caregivers about their children's participation in each of these post-secondary domains to better understand the institutions that do not have sufficient representation of individuals with disabilities. For example, Taylor and Seltzer (2011) surveyed 66 parents who had children with a primary diagnosis of autism and recently graduated high school. Forty-nine of the autistic[1] young adults had a co-occurring intellectual disability (ID), and the remaining 17 did not. Parents' responses revealed that 24% of autistic young adults without a co-occurring ID were disconnected from educational, employment, and community sectors, resulting in less than 10 hours a week of day time activities. Similarly, Carter and colleagues (2012) reported that only a quarter of individuals with autism, ID, or multiple disabilities were employed within the first two years post high school. Multiple studies have shown that this phenomenon of disengagement from post-secondary education or employment is most prevalent during the first two to four years following high school (Carter et al., 2012; Shattuck et al., 2012; Wei et al., 2015), which could be due to a lack of transition supports or opportunities that made employment or education inaccessible (Sosnowy et al., 2017). These findings illustrate the discontinuity of service provisions

[1] The autistic community and their families have expressed a preference for identity first language (Kapp et al., 2013; Kenny et al., 2015); therefore, throughout the current paper I will use identity-first language to refer to autistic adolescents and young adults. However, when discussing individuals with ID or extensive support needs throughout the manuscript, I will use person-first language. Neither of these communities has expressed the same preference for identity-first language.

following high school exit and reveal the importance of parsing out the transition-needs of adolescents with various disability diagnoses in an effort to improve the shift from high school to post-secondary settings.

Transition Needs of Students with Autism, Intellectual Disability, and Extensive Support Needs

Federal regulations offer general guidance on the implementation of transition planning for students with disabilities, such that there should be an emphasis on the individual interests, strengths, and visions of the student for life beyond high school (IDEA, 2004). Researchers confirmed the importance of establishing programming and opportunities within high schools that align with the interests and strengths of autistic students (Kuo et al., 2018; Lee & Carter, 2012) or students with extensive support needs (Carter, Brock, & Trainor, 2014). For example, teachers rated students as having strengths in leisure activities, relationships, and communication, which could be further developed during transition planning to improve participation in community activities and employment opportunities (Carter et al., 2014).

Researchers have also described the lack of communication that exists between high schools and various adult agencies, which may be contributing to the gap in services immediately following graduation for autistic students (Griffiths et al., 2016; Kuo et al., 2018), students with ID (Gauthier-Boudreault et al., 2017; Kaehne & Beyer, 2014) and students with extensive support needs (Jacobs et al., 2018). In particular, caregivers of students described the institutional silos that exist among professionals associated with the transition process (Gauthier-Boudreault et al., 2017). Therefore, it is essential for collaboration to occur amongst formal and informal stakeholders (e.g., student, family members, high school personnel, job coaches) in an effort to ensure student needs are met and post school opportunities are promoted (Griffiths et al., 2016; Lee & Carter, 2012; Roberts, 2010). A multidisciplinary team can identify the goals of the student, as well as supports and services that will be needed throughout various aspects of adulthood (Hendricks & Wehman, 2009).

Although there is significant overlap regarding the transition needs of autistic students, students with ID and students with extensive support needs, researchers have identified specific areas that should be targeted during autistic students' transition planning. For example, while working with autistic students, there should be a focus on communication and functional skills that promote independence (e.g., daily living skills, time management) (Roberts, 2010). Furthermore, self-advocacy should be encouraged through active involvement in the IEP process, and educating students about their rights, accommodations, and supports that are available within post-secondary settings (Roberts, 2010). Lastly, Lee and Carter (2012) described elements of transition planning (e.g., hands-on

work experiences, career development) that can foster the attainment of meaningful work opportunities. Synthesizing intervention research that is available for transition-age youth with disabilities will aid in determining the types of interventions that have had positive effects on meaningful student outcomes.

Prior Reviews of Transition-Age Interventions

A comprehensive systematic review has recently been conducted that identified evidence-based practices and predictors promoting positive post-school outcomes for students with disabilities between 12 and 22 years old (National Technical Assistance Center on Transition [NTACT], 2020). Researchers have begun to further explore the effective interventions that have been established for students with specific disability diagnoses (Test et al., 2020). However, as recommended by Rowe and colleagues (2020), a meta-analytic review could aid in the determination of whether particular intervention approaches (e.g., peer-assisted instruction/support, Person-centered-planning, Project Search) are effective in promoting transition-specific outcomes.

Lee, Wehmeyer, and Shogren (2015) conducted a meta-analytic review of studies that implemented the Self-Determined Learning Model of Instruction (SDLMI) intervention with students who had a disability diagnosis. This intervention strategy provides guidance to teachers on how to best support students and enhance their self-determination. This meta-analytic review included single case intervention designs, and synthesized the outcome data with the percentage of non-overlapping data (PAND). The researchers concluded that SDLMI may be an effective intervention for improving students' access to the general education curriculum, and promoting positive transition-related outcomes for adolescents. However, Lee and colleagues (2015) did not attempt to evaluate the methodological quality of the studies; therefore, it would not be possible to discern whether the overall effectiveness was due to the intervention itself or the biases that were introduced from poor quality studies. A recent meta-analytic review was conducted to determine the effect of interventions that targeted self-determination outcomes for students with disabilities, and investigated the quality of studies that were included in the analysis (Burke et al., 2020).

Roth and colleagues (2014) used a similar statistical approach to Lee et al. (2015); however, the researchers conducted a meta-analysis exclusively on behavioral interventions for autistic adolescents and adults. The paper suggested that behavioral interventions yielded a medium to high effect size for a variety of outcomes (e.g., academic and vocational skills). However, the researchers acknowledged that these findings might not be a comprehensive analysis of all behavioral interventions, for the study omitted group designs. This methodological decision makes it difficult to interpret summary effect sizes for the syntheses of single case designs (SCD).

De Bruin and colleagues (2013) conducted a meta-analytic review of interventions for autistic adolescents between 12 and 22 years old. This analysis targeted select school-based interventions that used video modeling, self-management techniques, or manipulated the antecedent or consequence that was assumed to be the primary cause of either appropriate or problem behavior. Within this analysis, the researchers identified literature focused solely on transition interventions with a behavioral emphasis. Although the researchers concluded that these interventions likely have positive outcomes, they acknowledged the need for future research that integrates these intervention methods into the general education classroom to better understand whether they have meaningful impacts on the lives of autistic adolescents. This review had several limitations in the procedures and analysis. First, synthesis of transition literature that only focuses on behavioral interventions does not permit a full analysis of the variety of intervention approaches available for transition-age youth. Second, group designs were excluded from the analysis because the ages of the participants exceeded what was described in the inclusion criteria; however, these studies would have otherwise met the inclusion criteria. Lastly, this analysis did not consider the characteristics of the outcomes that were measured.

As far as I am aware, there are no systematic or meta-analytic reviews that investigated the impact of all transition-age interventions for students with a primary diagnosis of ID or extensive support needs. However, several researchers aimed to understand the impact of transition-age interventions on specific outcomes for secondary students with disabilities. For example, Hughes and colleagues (2012) explored the impact of interventions focused on social interaction outcomes for secondary students diagnosed with autism and/or ID. Additionally, researchers have conducted systematic reviews that investigated the impact of group fitness interventions on the physical activity of individuals with developmental disabilities (Healy et al., 2018; Johnson, 2009).

The current meta-analysis aims to contribute to this literature for transition-age students with disabilities by expanding the types of interventions included in the synthesis. The recent call for alignment of academic and transition-focused instruction within secondary schools inspired the need to review (Morningstar et al., 2012) all interventions designed for transition-age youth diagnosed with autism, ID, or extensive support needs, rather than focus specifically on interventions that teach transition-based competencies. In addition to capturing a broad scope of intervention types designed for transition-age youth, this study aims to include data from non-peer-reviewed studies. Further, the current meta-analytic review narrows the criteria for inclusion and only considers quasi-

experimental or randomized controlled trials. Randomized controlled trials (RCT) are considered the 'gold standard' for intervention research due to the randomization of participants to control and treatment groups. This is the best way to guarantee group equivalency prior to the intervention, and ensure that any change in outcome is due to the intervention provided to participants (Hariton, & Locascio, 2018). In quasi-experimental design research, the non-random assignment to treatment and control conditions introduces a number of alternate explanations that could contribute to the changes in outcomes. However, quasi-experimental designs still allow for causal inferences to be made in situations where participants have self-selected or have been placed in an intervention or control group (Shadish et al., 2002). Additionally, the methodological quality of each study is assessed to determine whether the outcomes could potentially be biased due to the inclusion of poor quality studies. Further, this analysis seeks to determine if there are certain participant characteristics and types of outcomes that are more readily influenced by interventions for transition-age youth than others.

Participant Characteristics

Researchers have previously discussed the varying outcomes of transition-age autistic adolescents with and without a co-occurring ID. They found that individuals who were more cognitively abled had an increased likelihood of entering into post-secondary education opportunities, while those with ID had opportunities to secure adult day services (Taylor & Seltzer, 2011; Volkmar et al., 2017). Given the differing experiences of these two groups, it is possible that the cognitive abilities (i.e., IQ) of adolescents with disabilities could moderate the effects of transition interventions.

Outcome Characteristics

Yoder and colleagues (2013) conducted a best-evidence synthesis of social communication interventions for young autistic children, and outlined two key characteristics of outcome measures that can influence the likelihood of finding a significant intervention effect; the proximity of the outcome to what is directly taught or addressed in the intervention, and the boundedness of the outcomes to the intervention context.

Proximity of Outcomes

An outcome is considered proximal if the variable measured post-intervention was directly taught or prompted by the intervention, and distal if the variable is developmentally beyond what was taught or prompted by the intervention (Sandbank et al., 2020; Yoder et al., 2013). To provide evidence that an intervention impacts behaviors beyond the treatment target, it is necessary for researchers to examine how interventions impact distal

outcome measures. However, it is expected that effect sizes will be larger for proximal than for distal outcomes because an intervention is more likely to demonstrate change on a skill that is explicitly targeted by the intervention (Yoder et al., 2013).

Boundedness of Outcomes

Boundedness refers to the similarities between the intervention context and the context in which the outcome is measured. The outcome is considered context-bound if the measurement contexts share features with the intervention context, and generalized if the measurement context differs on important dimensions from the treatment context (e.g., interaction partner, materials, and activities) (Sandbank et al., 2020; Yoder et al., 2013). It is expected that effect sizes will be larger for context-bound than for generalized outcomes, because the adolescent is more likely to associate the outcome being measured with the highly controlled environment in which it was taught. However, it is likely that context-bound outcomes are not particularly meaningful effects, because the adolescent may not be able to generate the specific outcome with various interaction partners and without the provision of prompts. Therefore, it is necessary to examine the proximity and boundedness of outcomes included in the current meta-analysis, to determine if these characteristics influence intervention effects.

The Current Study

The purpose of this meta-analysis was to examine the effects of interventions for transition-age youth diagnosed with autism, ID, or extensive support needs. The current study aimed to address three research questions:

1. Are the effect sizes of interventions designed for transition-age youth (ages 14-22) with autism, ID, or extensive support needs statistically significant and positive within each intervention and outcome type?
2. Are effect sizes significantly larger for proximal as compared to distal outcomes?
3. Are effect sizes significantly larger for outcomes measured in the same context as the intervention (context-bound) versus outcomes that are measured in contexts that differ from the intervention (generalized)?

A follow-up, exploratory analysis was conducted that aimed to address a fourth research question:

4. Are effect sizes of interventions designed for transition-age youth with autism, ID, or extensive support needs moderated by IQ?

Method

Search Strategy and Databases

Appendices are available at https://osf.io/t75av/?view_only=5af9ea48338f45dfb9e22c416e5424c4 (REDACTED FOR REVIEW). Multiple literature search methods were employed to identify all relevant studies that conducted an intervention for transition-age adolescents with autism, ID, or extensive support needs. Electronic databases were the primary method to search for published journal articles and dissertations/theses. The databases that were searched individually include: ERIC, Education Source, PsycINFO, Medline and ProQuest Dissertations and Theses. Search terms that represented disability diagnosis, age of participants, and study design were used. The exact Boolean strings used and the number of documents retrieved from each database is included in Appendix A. The initial search was conducted in June 2018 and resulted in a total of 5,673 peer-reviewed articles or dissertations/theses. An updated search was conducted in March 2020, and resulted in an additional 9,046 documents. A total of 14,719 peer-reviewed articles or dissertations/theses resulted from both database searches. The articles that were retrieved from the initial search were exported from the databases into RefWorks, where duplicated files could be eliminated. After duplicates were removed, 12,859 files remained. Given that the peer-reviewed journal, *Autism*, was not included in the electronic databases above, a hand search was conducted for all available online issues (July 1997-February 2020).

Meta-analyses that only include published literature can bias results so that synthesized effects are larger than the 'true' effect (Borenstein et al., 2009). This is referred to as the 'file drawer effect' or 'publication bias'. Therefore, incorporating datasets from unpublished "grey literature," which refers to data or studies not published in peer-reviewed journals, is important for the purposes of meta-analyses to ensure that the effect sizes do not reflect publication bias. It is often assumed that grey literature is of poorer quality and should therefore be excluded from the analysis; however, this claim is unwarranted (Borenstein et al., 2009). Attempts to locate "grey literature" were employed through a search of conference proceedings from the *International Society for Autism Research, Council for Exceptional Children,* and *American Association on Intellectual and Developmental Disabilities*. A list of researchers who previously presented on the topic of transition-age interventions was generated (n = 77). Emails were sent out to researchers whose contact information was provided or located (n = 50). Two researchers responded with a peer-reviewed article that was published in 2018. For studies or datasets that did not report outcomes or statistical information necessary to conduct the analysis, an email was also sent to the primary investigator requesting appropriate information (n = 17). Three researchers responded with relevant statistical information. The data accessed through these methods were categorized as "grey literature."

Inclusion Criteria

Abstrackr software was used to screen titles and abstracts that were located through the database search (Wallace et al., 2012). Each article was first reviewed for the following inclusion criteria: (a) published between 1970 – March 2020; (b) written in English; (c) used RCT or quasi experimental designs that included a treatment and control group of participants; (d) studies included adolescents and young adults between the ages of 14 and 22, or who were reported to be in high school; and (e) participants were described as having a confirmed diagnosis of autism (including autistic disorder, Asperger's syndrome, and Pervasive Developmental Disorder Not Otherwise Specified), ID, or extensive support needs. During abstract review, 12,608 studies did not meet the criteria and were eliminated from the meta-analysis. Articles that appeared to meet the inclusion criteria went on for a complete review of the text. Figure 1 illustrates the search process and provides reasons that studies were excluded from the meta-analysis.

Coding Procedures

Study-level characteristics, outcome-level characteristics, and risk of bias information was retrieved from each included study and coded.

Study-level Characteristics

General study-level characteristics extracted from each study included: (a) full citation in APA format, (b) year of publication, (c) source, and (d) design type. The source of the study was determined by whether it was a peer-reviewed journal article, dissertation or theses, or unpublished data provided by the researcher. For purposes of the analysis, dissertations/theses and unpublished data were collectively considered "grey literature." Throughout this paper outcomes included in peer-reviewed journals will be referred to as elements of "studies," and grey literature outcomes will be referred to as elements of "datasets." Datasets are collections of effect sizes that share a participant sample, but are not published in a peer-reviewed journal. The design type was reported as a quasi-experimental design or RCT.

Variables that represented the participant sample were consistent within each study and were therefore categorized as study-level characteristics. These features that were coded include: (e) primary disability status (autism, ID, or extensive support needs), (f) co-occurring disabilities, (g) chronological age, and (h) mental age. Although it was not required that all participants included in a given study have a diagnosis of autism, ID or extensive support needs, it was necessary for statistical information to be presented separately for participants with

at least one of these diagnostic labels. Chronological age (CA) and the mental age (MA) of the participants were reported in months. If the average MA was not reported in the study, it was calculated by using the following formula, IQ = (MA/CA)*100. Additionally, (i) percent of male participants, (j) intelligence quotient (IQ), and (k) names of assessments used to derive the IQ and MA were also reported. The race of participants was extracted from included studies following analysis. Variables focused on the intervention were also characterized as study-level characteristics, and include: (l) name of the intervention, (m) intervention type, (n) setting of the intervention, (o) interventionist who administered the intervention, and (p) target participant. The duration of the intervention was extracted from included studies following analysis. If sufficient information was provided, the total number of intervention hours was calculated. Otherwise, any information the authors provided regarding the duration of the intervention would be extracted and included within the current study.

Following the preliminary search of studies, an inductive method was used to categorize the interventions into five distinct types: (a) Social Cognitive, (b) Interactional, (c) Behavioral, (d) Occupational Therapy/Physical Therapy (OT/PT), and (e) Person-Centered Planning. Studies were characterized into each of these intervention types based on the principles and mechanisms that guide the intervention. More specifically, intervention types were classified based on the framework that underpinned the direct support provided to the student. However, it must be noted that researchers associated with each included study do not necessarily identify the intervention as belonging to one of these five categories.

Social Cognitive Interventions. Social cognitive interventions aim to address differences in engagement through didactic lessons that break down social interaction into discrete skills, and attempt to change the way students think about how they engage with their interaction partners (Laugeson et al., 2015). Interventions were considered social cognitive if direct instruction or modeling was used to improve the social skills of the student.

Interactional Interventions. Interactional interventions also aim to improve and scaffold social interactions of adolescents with disabilities. However, the procedures that are used to guide social interactions and the mechanism by which these interventions are deemed effective differ from social cognitive interventions. Interactional interventions are implemented in the social context alongside peers without disabilities, to promote more naturalistic relationships. The Peer Network model is an example of an interactional intervention. An adult teaches peers without disabilities how to support their peers with disabilities, engage them in conversation, and provide them with constructive feedback. The adolescents with disabilities and their peers without disabilities are

placed in a group and participate in an activity together. The adult is typically available to scaffold interactions, but allows the interactions between classmates to naturally unfold (Hochman et al., 2015).

Behavioral Interventions. Interventions that seek to introduce new behaviors into an individual's repertoire are most often conducted in a one-on-one format. An adult typically guides the sessions and provides the student with reinforcement following a correct response or behavior to increase the likelihood that they will engage in that behavior in the future (Charlop-Christy, & Haymes, 1998). An analysis of the antecedent, behavior, and consequence are integral components that collectively guide behavioral interventions. To alter any given behavior there must be an in-depth exploration of what happened before and after the behavior that could have contributed to its' development. Behavioral interventions included in the meta-analysis were primarily adult-led, and focused on prompting, shaping, and extrinsic reinforcement to change adolescents' behaviors. Project Search is a comprehensive intervention that aims to secure competitive employment opportunities for students through the provision of internship opportunities and collaboration with adult agencies. However, this particular intervention was classified as a behavioral intervention based upon the direct supports that were provided to students. For example, discrete trials, self-management techniques, and reinforcement were used to support students with disabilities in various internship placements (Wehman et al., 2014; Wehman et al., 2017; Wehman et al., 2019).

OT/PT Interventions. OT interventions are designed to help individuals with disabilities across various stages of their life. In particular, this approach promotes improvement in daily activities that are meaningful to the individual, and facilitates participation across various situations or contexts (About Occupational Therapy, 2019). PT interventions typically introduce individuals with disabilities to stationary bikes, weights, or various forms of machinery, in an effort to decrease weight, boost cardiovascular functioning, and increase stamina (Ringenbach et al., 2016). For the purposes of the current meta-analysis, studies that implemented an OT or PT intervention were combined into one category. OT/PT interventions focused on adolescent motor skills (e.g., muscular strength, performance of daily living activities, balance, and sports performance) to improve areas of the adolescents' life.

Person-Centered Planning Interventions. A person-centered planning intervention is a systematic way of establishing a support system for adolescent students who receive special education services. Miner and Bates (1997) outlined the steps of engaging in a person-centered planning intervention. An integral component of the intervention is that the student guides the intervention with the help and facilitation from family members and school staff. These interventions are designed to encourage participation from the student while also promoting flexibility.

For instance, group meetings are typically held within the families' home, to provide a more comfortable and naturalistic setting for the student. In addition, the length of participation and the modality in which the students participate can vary depending on the needs of the student (Hagner et al., 2014; Miner & Bates, 1997). This meta-analysis categorized person-centered planning interventions as group training sessions that were primarily guided by the adolescent, and focused on outlining steps the adolescent will take as they transition to adulthood.

The interventionist who administered the intervention was coded based on how the intervention was administered at least 50% of the time.

Outcome-level Characteristics

For categorization of outcomes and examples, see Appendix B. Several indicators were coded that characterize the nature of the outcome measured post-intervention. The proximity of the outcome to the intervention was coded as a dichotomous variable. If the outcome measured was a skill directly taught or prompted by the intervention, it was considered proximal. On the other hand, if the outcome measured was a skill developmentally beyond what was taught in the intervention, it was coded as distal. An outcome was also characterized by its' boundedness to the intervention. An outcome was considered context-bound if the interventionist directly measured or elicited the outcome. The outcome was also considered context-bound if the interventionist differed from the assessor, but the materials and setting were the same in both the intervention and measurement contexts. The outcome was considered generalized if the interventionist did not interact with the participant during outcome measurement, and the context differed in terms of the setting and materials available.

Effect Size Information

The following effect size information was taken from the text of the studies: treatment and control group means and standard deviations for post-intervention outcomes, and corresponding sample sizes. This statistical information was used to estimate the standardized mean difference.

Risk of Bias Measures

The Cochrane Collaboration assessment tool was used to determine the risk of bias associated with each included outcome. This tool was used because biases can result in the under or overestimation of intervention effects (Higgins & Altman, 2008). Sequence generation bias refers to how participants were allocated to treatment and control groups. If the study was described as a quasi-experimental design, sequence generation bias was coded as "NA." If the investigators describe a random component in the sequencing process (i.e., flipping a coin, using a

random number table), sequence generation bias was coded as "low." Lastly, if the randomization process described was inadequate and not random, then sequence generation bias was coded as "high." Allocation concealment bias refers to the technique used to ensure that researchers could not influence the assignment of participants to intervention or control groups (Higgins & Altman, 2008). This risk of bias measure was coded similar to sequence generation bias described above. Studies that were not RCTs were coded as "NA," intervention allocations that likely could not be foreseen by the researchers, in, before, or during concealment were coded as "low," and intervention allocation that was not properly concealed ahead of participant recruitment was coded as "high." Studies that did not describe the process for determining sequence generation and allocation concealment biases were coded as "unclear." Selective reporting bias was considered "low" if the researchers indicated a clear rationale for testing all outcomes, and there was no reason to suspect that researchers selectively reported outcomes. If there was reason to believe that the researchers selectively reported particular outcomes to highlight in the report, "high" bias was indicated. Performance bias is the extent to which participants, family members, and personnel were aware of group allocation. If these individuals were not aware of the group assignment, then performance bias was coded as "low." A low performance bias could only be achieved if the study specifically stated it was "double-blind." If participants, family members, and personnel were aware of group allocation, performance bias was coded as "high." Detection bias indicates the ignorance of assessors and coders to group assignment. This indicator was coded as "low" if the outcome was assessed outside the context of the treatment, and assessors and coders were not aware of group assignment. On the other hand, if the outcome was parent-rated, teacher-rated, or a self-report measure, and these individuals were aware of group assignment, then detection bias was coded as "high." The final risk of bias measure developed by Cochrane Collaboration is incomplete outcome data. If the attrition, or rate at which participants dropped out of the study was below 20%, attrition bias was rated as "low," and if the attrition rate was above 20%, attrition bias was rated "high."

Reliability

The author screened each abstract to determine if the study met inclusion criteria. When a list of possible included studies was generated (n = 251), a tracking form was developed with fifty sets of five articles. Although quality standards for systematic reviews indicate that all studies should be double coded (Higgins & Altman, 2008), it was decided a priori that a subset (20%) of studies or datasets would be double coded to produce an inter coder agreement statistic, which could then be generalized to the remaining studies (Hallgren, 2012).

During the first round of coding, the primary coder thoroughly read through the possible included studies and coded each of the 251 articles. The secondary coder, a trained doctoral student, chose one article from each set of five possible included studies, so that 20% would be double coded for calculating reliability statistics. The main coder was unaware of which files were selected for reliability coding. Then, the primary and secondary coder both examined their respective studies to determine if they should be included. Study inclusion disagreements were resolved through a consensus discussion with both coders. If it was decided that the study met inclusion criteria, the coding procedure outlined in the previous section was used to categorize the study features based on study and outcome-level characteristics, effect size information, and risk of bias measures.

This first round of coding that included study and outcome-level characteristics, effect size information, and risk of bias measures, was not successful in ensuring that 20% of included studies were double coded for calculating reliability statistics. This was because most of the studies were excluded for various reasons. Therefore, a third researcher selected an additional 10 included studies for the secondary coder to code. With this final selection, the primary and secondary coder overlapped their study-level, outcome-level, effect size information, and risk of bias coding on a total of 53% of the included studies.

Reliability was calculated on study and outcome-level characteristics, effect size information, and risk of bias measures that were included in the analysis (see Appendix C for variable agreement statistics). Individual intraclass correlation coefficients (ICCs) from two-way random effects models for continuous variables were calculated, and were 1.00, which is an indication of excellent reliability (Koo & Li, 2016). Kappa coefficients were computed to assess agreement between the primary and secondary rater on coded categorical variables, and ranged from 0.78 to 1.00. The benchmarks that were used to interpret reliability were based on the criteria developed by Cohen (1988). A kappa value between 0.60 and 0.79 was moderate, 0.80 and 0.90 was strong, and above 0.90 was considered almost perfect agreement (McHugh, 2012). The kappa values generated for interrater reliability were moderate to perfect for this meta-analytic review. A majority of the disagreements were because one coder identified that a study should be excluded while the other coder indicated that the study should be included. This impacted all subsequent coding for that study. Any codes that were discrepant between coders were resolved through a consensus discussion between the primary and secondary coder. The first author can be contacted for a detailed list of disagreements between coders.

Statistical Analysis

The purpose of this study was to determine the impact of transition-age interventions on all outcomes measured across intervention and control groups. Due to the vast differences in outcome types that were measured within the included studies, the standardized mean difference between the intervention and control group was used so effect sizes on one outcome type could be compared to effect sizes on another outcome type. In addition, the standardized mean difference was also used to synthesize effects within a single outcome type that were assessed with different measurement procedures (Borenstein et al., 2009). To calculate the standardized mean difference (Cohen's d), relevant statistical information was extracted from the studies and entered into the Campbell Collaboration online calculator. This software was designed to generate Cohen's d, the variance of Cohen's d, and 95% confidence intervals around Cohen's d (Wilson, n.d). The Cohen's d statistic is associated with an upward bias for small sample sizes; therefore it was necessary to correct for the bias by computing Hedge's g (Hedges, 1981).

The current meta-analysis was in violation of the assumption of independence, because included studies contributed multiple effect sizes that are not statistically independent from one another. To account for the dependence within studies, previous research has suggested either randomly choosing an effect size to represent a particular study, or averaging together the effect sizes within a construct in a study (Lipsey & Wilson, 2001). Neither of these options is sufficient because both ignore or reduce information that could be potentially meaningful (Lipsey & Wilson, 2001). Therefore, robust variance estimation (RVE) was used to compute effect sizes (Hedges, et al., 2010), using the robumeta macro in Stata, which adjusts standard errors to account for the clustering of effect sizes within studies (StataCorp, 2017). To determine if intervention effects on each outcome type was statistically significant, the significance threshold was set at $p < 0.01$ (Tanner-Smith & Tipton, 2014).

After analyzing the impact of each intervention type on the associated outcomes, RVE meta-regressions were conducted to determine whether effect sizes differed according to the proximity and boundedness of the outcomes (López-López et al., 2017). To determine publication bias, a third meta-regression was conducted to determine whether effect sizes differed according to the source of the study (e.g., published or unpublished). Finally, an exploratory meta-regression was conducted to determine whether effect sizes were moderated by the IQ of the participants. Because IQ was negatively skewed, the data was log-transformed prior to analysis. Again, based upon recommendations from Tanner-Smith and Tipton (2014) regarding small sample corrections, the significance threshold was set at $p < 0.01$.

Results

Study Characteristics

From the 251 studies that went through a full-screening process, 19 studies or datasets (*k),* with 215 *(n)* effect sizes met inclusion criteria. Tables 1 and 2 summarize the participant and intervention characteristics of all included articles and datasets. Thirteen of the studies were from peer-reviewed journal articles, 2 datasets were from dissertations, and 4 were from unpublished sources. The six collective datasets from dissertations and unpublished sources are categorized as "grey literature." All of these datasets were derived from peer-reviewed journal articles within the screening process; however, the statistical information used to compute an effect size was not published within the literature. Therefore, for the purposes of this meta-analysis we describe these datasets as unpublished.

Forty-seven percent of the included articles and datasets were based on an intervention for adolescents diagnosed with ID, 47% included interventions for autistic individuals, and a single study (6%) included individuals with extensive support needs. The total sample size across all disability diagnoses was 874 participants. Across studies, the pooled sample of participants had a chronological age ranging from 15.1 to 19.9 years, a mental age ranging from 5.6 to 15.6 years, and an IQ between 30.1 and 102.1. Furthermore, eight datasets reported the race of participants, which ranged from 51.0 to 95.1 percent Caucasian. OT/PT interventions were implemented most frequently among the interventions that were included in the analysis (k = 7), followed by social cognitive (k = 5), behavioral (k = 4), person-centered planning interventions (k = 2), and interactional interventions (k = 1). The type of intervention that participants received varied significantly by outcome. For instance, a majority of studies that implemented OT/PT interventions measured gross motor outcomes (k = 6); however, social cognitive interventions most often included a measure of social behavior (k = 4). Throughout each of the interventions, an interventionist administered the protocol to the adolescent participants. Clinicians (k = 9) primarily delivered the interventions; however, in some cases, peers (k = 3), computer instruction (k = 2), teachers (k = 2), and employers/job coaches (k = 3) administered the intervention. The outcome measures associated with each of the datasets are listed in Table 2.

Interventions and outcomes included in synthesis

Using RVE, effect sizes were generated for each outcome within each intervention type. These findings are displayed in the forest plot in Figure 2 and in Table 3. When using RVE, researchers have suggested effect size estimates should only be generated with more than five studies to prevent increased risk of a Type I error. However, if five or fewer studies are used to synthesize results, it is recommended that the results should be interpreted with caution (Tipton, 2015). Due to the small number of effect sizes within intervention and outcome types, this study

includes summary estimates based on four or more studies, for the results may still be informative. Although this information is provided, the interventions and outcomes with asterisks should be interpreted with caution.

The only intervention and outcome types that reached statistical significance were OT/PT interventions measuring gross motor outcomes ($k = 6$, $n = 69$). The synthesized effect size across studies was $g = 0.73$, $p = 0.005$. All additional interventions and outcome types included in the forest plot had insignificant results. The synthesized effect size across OT/PT interventions measuring physical characteristic outcomes was $g = 0.09$, $p = 0.054$. The synthesized effect size across social cognitive interventions measuring all social behavior outcomes was $g = 1.00$, $p = 0.108$. As a post hoc analysis, social behavior was further broken down into outcomes that specifically measured prosocial behavior or internalizing/externalizing behaviors, both of which were insignificant. The synthesized effect size across social cognitive interventions measuring prosocial behavior was $g = 1.05$, $p = 0.096$, and the effect size for internalizing/externalizing behavior was $g = 0.33$, $p = 0.207$. The results from this post-hoc analysis are inconclusive because only two studies investigated the impact of social cognitive interventions on internalizing and externalizing behaviors.

Publication Bias Analysis

The meta-regression determined that source was not a significant moderator of effect size ($\beta = -0.055$, $p = 0.86$) suggesting that publication bias was negligible. With about a third of the studies categorized as grey literature, the author can be confident that the publication status did not moderate the effect size.

Moderator Analyses

The proximity and boundedness of outcomes were analyzed using meta-regressions, to determine if these variables moderated the effect size. All results were insignificant, demonstrating that the study features did not impact the synthesized effect size. Table 4 provides coefficients, standard errors, and confidence intervals for each of the meta-regression models that were analyzed.

The meta-regression determined that proximity was not a significant moderator of effect size ($\beta = -0.450$, $p = 0.16$). As expected, effect sizes were larger for proximal rather than distal outcomes, but not significantly so. In addition, the meta-regression that investigated whether effect sizes differed based on the boundedness of the outcome was also insignificant ($\beta = -0.237$, $p = 0.16$). As hypothesized, effect sizes were larger for context-bound rather than generalized outcomes, but the significance threshold was not met. The final meta-regression determined that IQ was not a significant moderator of effect size ($\beta = 0.006$, $p = 0.43$).

Risk of Bias Measures

Figure 3 depicts aggregates of study risk of bias measures across all 215 outcomes, which are reported as the percent of the total number of outcomes included in the estimation of summary effects.

Sequence generation bias and allocation concealment were both reported low for about 53% of the outcomes, which indicates that about half of the outcomes were from studies that reported random assignment of participants to intervention and control conditions, and researchers were not aware of participant assignment to conditions. For both of these measures, a third of outcomes (32%) had unclear risk of bias. Most investigators did not appropriately describe how random assignment or allocation concealment was accomplished. Selective reporting was low for all of the outcomes. On the other hand, performance bias was coded as high risk of bias for all outcomes. This can be attributed to the difficult nature of keeping participants and parents unaware of the intervention they received. Performance bias was not considered an important risk of bias measure because it was not possible to implement an intervention without the knowledge of the participant or their parents. Detection bias was reported as high for 62% of the outcomes, which indicates that assessors and coders were aware of group assignment for a majority of outcomes. Lastly, 81% of outcomes had low attrition bias, which demonstrates that most studies did not have more than 20% of participants excluded from the analysis. Risk of bias measures for each study are represented in Appendix D. The risk of bias measures for studies that contributed to summary effect estimates will be discussed below.

Social Cognitive Interventions

One of the four (25%) included social cognitive interventions was a quasi-experimental design, and therefore had high sequence generation bias and allocation concealment bias. Out of the remaining three included social cognitive intervention studies, two (67%) were clear about the procedures that were used to randomly assign participants to treatment and control groups. In addition, these studies had low allocation concealment bias, which ensured that the researchers who randomized participants were not aware of their assigned group prior to assignment (Kuehnel, 2013; Matthews et al., 2018). However, one issue that remained consistent across all social cognitive interventions was the lack of naïve assessors and coders. Lastly, the study conducted by Matthews and colleagues (2018) had incomplete outcome data, but provided all statistical information that was requested.

Occupational Therapy/Physical Therapy Interventions

Four of seven studies (57%) had several issues related to the study design quality. One of these four studies

(25%) was categorized as a quasi-experimental design, and had high sequence generation bias and allocation concealment bias (Elmahgoub, 2011). In the remaining three studies (75%), it was difficult to determine whether sequence generation bias or allocation concealment bias was present due to the lack of clarity in describing the procedures of the intervention. In addition, in all four of these studies that had issues related to study design quality, there was a lack of naïve assessors and coders that measured the outcomes post-intervention (Mikolajczk & Jankowicz-Szmanska et al., 2015a, 2015b; Ringenbach, et al., 2016).

Interventions and Outcomes that did not Contribute to Summary Effect Estimates

Overall, eleven studies had intervention and outcome combinations not included in the analysis, due to the presence of too few studies. Appendix E identifies the characteristics of the intervention and outcome types in each study, as well as their associated effect sizes.

Social Cognitive Interventions

Although social cognitive interventions most often assessed social behavior, several studies also measured the performance of participants on daily living and communication skills, autism symptomology, and empathy (Adibsereshki et al., 2016; DaWalt et al., 2018; Kajganich, 2013). Social cognitive interventions that measured autism symptomology showed negative effects g = -1.59 (DaWalt et al., 2018); however, effect sizes associated with daily living and communication skills that were assessed by the Vineland Adaptive Behavior Scales (VABS) were positive and large g = 0.64 to 1.14 (Baraheni, 2004; Adibsereshki et al., 2016). The Model Me Friendship intervention that was implemented by Kajganich (2013) used videos that directly taught concrete rules for navigating social interactions with peers. Measures of empathy showed positive and negative, small effects; g = -0.04 to 0.11.

Interactional Interventions

A single interactional intervention was included in the meta-analysis. Asmus and colleagues (2017) implemented a Peer Network Intervention, which established social groups that included a student with a diagnosed disability and several peers without disabilities. The goal of the intervention was for students to improve social interactions through engagement in a naturalistic setting, without explicit rules to structure the intervention. Social behavior was measured with a teacher report that indicated the average number of social activities the student was engaged in, and the effect size was negative, g = -0.07.

Occupational Therapy/Physical Therapy Interventions

Ringenbach and colleagues (2016) assigned participants to either an assisted cycling therapy or a voluntary cycling intervention. Both interventions used a stationary bike for exercise purposes; however, the assisted cycling therapy intervention ensured that the participants were cycling at a particular pace. Participants who were assigned to the voluntary cycling intervention received instructions to pedal at a rate comfortable to them. The executive functioning of the participants in both conditions was measured post-intervention, and results revealed eighteen positive and negative effects for both the assisted cycling condition g = -0.69 to 0.71 and the voluntary condition g = -0.45 to 0.67.

Behavioral Interventions

Interventions for adolescents with disabilities often use behavioral strategies to target academic and employment outcomes (Cartwright, 1971; Wehman et al., 2012; Wehman et al., 2019). In particular, Project SEARCH is a community-based employment program for students with disabilities preparing to transition into the workforce. Throughout the internship program, if a student displays any form of "problem behavior," the staff members convene to discuss strategies to reinforce positive behavior, and alter the environment to decrease the negative behavior (Wehman et al., 2012). Employment outcomes that were measured include: the percent of participants who were employed and earned wages, the number of hours worked, and the amount of support received post graduation. The effect sizes ranged from small to large, g = 0.12 to 3.03. On the other hand the study that implemented behavioral strategies and measured the academic outcomes of the participants had positive and negative effect sizes ranging from g = -1.51 to 0.38 (Cartwright, 1971).

Person-Centered Planning Interventions

These intervention approaches sought to foster self-determination, community inclusion, and improve students' ability to make career related decisions, which are outcomes that are associated with a better quality of life (Hagner et al., 2012; Menchetti & Garcia, 2003). A Family-Centered Transition intervention consists of a person-centered planning component in which intervention facilitators support the student and their family in the development of a transition plan. Participants and contributing stakeholders discuss the students' strengths, weaknesses, visions for life beyond high school, and any barriers that may limit the individual's ability to successfully achieve their goals. Outcomes that were measured include: students' expectations of their future, self-determination, and career decision-making ability. Effect sizes associated with person-centered planning interventions were positive and ranged from g = 0.30 to 2.11.

Discussion

For the last few decades, there has been an increase in awareness regarding the difficulties that many transition-age youth with disabilities face as they prepare for the changes associated with adulthood. Therefore, researchers have begun to implement various interventions that target transition related outcomes such as self-determination (Algozzine et al., 2001), employment, and social skills (Murray & Doren, 2013). The purpose of this meta-analysis was to examine all interventions for transition-age youth with autism, ID, or extensive support needs, and determine the effectiveness of each intervention and outcome type. The intervention types for which there were a sufficient number of effect sizes to generate a summary effect will be discussed first, followed by studies for which summary effects could not be generated due to the limited number of studies available. In addition, implications of study quality will also be discussed.

Summary Effects by Intervention Type

Social Cognitive Interventions

The current meta-analysis indicated that the synthesized effect of social cognitive interventions on social behavior was insignificant. Several possible explanations will be discussed. First, the four studies that contributed effect sizes to the summary effect estimate for social cognitive interventions varied in their implementation procedures and their measurement of social behavior outcomes. For example, the Bar-On intervention explicitly taught participants how to identify emotions, improve sharing skills, and offer help to others (Adibsereshki et al., 2016). However, other studies included in the meta-analysis used video-modeling components (Kuehnel, 2013) or peer mentors to remind participants how to navigate social situations (Matthews et al., 2018). Although social behavior was further parsed out into prosocial and internalizing/externalizing behavior as an attempt to increase precision in determining the effectiveness of the outcome variables, summary effects could not be generated due to a limited number of studies within each type. Therefore, one explanation for the insignificant effect of social cognitive interventions on social behavior outcomes could be the lack of power to detect a significant effect.

Across studies, there was variability in the duration of interventions (i.e., ranging from approximately 2 to 21 hours) and disability diagnoses of participants. For example, the Bar-On intervention was conducted with participants diagnosed with ID (Adibsereshki et al., 2016) and all other studies implemented social cognitive interventions with autistic adolescents (DaWalt et al., 2018; Kuehnel, 2013; Matthews et al., 2018). It is possible

that intervention duration or disability diagnoses moderate the relationship between social cognitive interventions and social behavior outcomes, making it difficult to interpret the synthesized effect size.

Lastly, the insignificant effect of social cognitive interventions on social behavior outcomes is consistent with criticisms of the approach, which question their effectiveness and potential for producing meaningful outcomes. The expectations emphasized through social skills curricula are based on social norms that are not always relevant to adolescents, and adolescents with disabilities in particular. Although social cognitive interventions claim to improve social interactions, these interventions were recently critiqued for promoting inauthentic relationships, and for encouraging adolescents without disabilities to 'pass' as neurotypical (Bottema-Beutel et al., 2018). A possible explanation for why the social cognitive interventions included in this meta-analysis are not effective is that social interaction does not rely on the social cognitive skills promoted within the intervention.

Risk of Bias Assessment. For studies that implemented social cognitive interventions and measured outcomes that could be synthesized, the most problematic risk of bias assessment was the lack of assessors and coders that were naïve to group assignment. The assessor or coders' awareness could unintentionally influence the outcome; therefore, it is necessary for future research to incorporate measures that are assessed and coded by researchers who are unaware of group assignment.

Occupational Therapy/Physical Therapy Interventions

The four OT/PT interventions that measured both physical characteristics and gross motor outcomes were conducted in the physiotherapy wing of a special education school, and were similar in their implementation. Two of the studies used a dual-task rehabilitation technique that required participants to multitask. For instance, the adolescents were taught to take off their shoes while sitting on a stability ball (Mikolajczk & Jankowicz-Szmanska, 2015a, 2015b). The other two studies implemented an aerobic training for participants that introduced several fitness exercises such as cycling, walking, and stepping (Boer et al., 2014; Elmahgoub et al., 2011). OT/PT interventions that targeted physical characteristics of the participants resulted in insignificant effect sizes. It is possible that the insignificant effect is a result of the four studies that measured height as an outcome variable (Boer et al., 2014; Elmahgoub et al., 2011; Mikolajczk & Jankowicz-Szmanska, 2015a, 2015b). When height was removed from the analysis, OT/PT interventions measuring physical characteristics (e.g., weight, BMI) ($k = 4$, $n = 26$) reached significance. The synthesized effect size across these studies was $g = 0.16$, $p = 0.02$; therefore, it is unlikely that an OT/PT intervention will impact the height of the adolescent post-intervention.

In addition to the four studies above that also measured gross motor outcomes, a progressive resistance-training program was implemented in a community exercise facility that focused on weight training, and a balance intervention was also conducted and included in the meta-analysis (Lee et al., 2016; Shields et al., 2013). The OT/PT interventions that targeted adolescent motor skills and measured gross motor outcomes resulted in a significant synthesized effect size. A moderator analysis that examined the proximity of outcomes on only OT/PT interventions could not be conducted; however, it is possible that the proximal nature of all sixty-nine gross motor outcomes could have contributed to the significant effect of the intervention.

Risk of Bias Assessment. Three of the seven studies represented in the OT/PT literature demonstrated low risk of bias across all important indicators, and modeled methodological designs that should be used for future intervention research (Boer et al., 2014; Lee et al., 2016; Shields et al., 2013). Among the remaining OT/PT studies, there were risk of bias assessments that could be further improved. In particular, studies did not adequately describe how participants were randomly assigned to treatment and control groups, and did not discuss whether allocation to treatment and control groups was concealed. Future research should make an active effort to thoroughly describe the procedures associated with random assignment and treatment allocation.

Proximity and Boundedness of Outcomes

The proximity and boundedness of outcomes did not moderate effect sizes; however, it could be possible that additional studies are needed to show significance.

Interventions and Outcomes that did not Contribute to Summary Effect Estimates

Given the increased effort on behalf of policymakers to prepare students with disabilities for the transition from high school to adulthood (IDEA, 2004), the results of this study raise many concerns. In particular, the intervention and outcome categories for which there were too few studies to generate summary effects were those most relevant to the transition period. Person-centered planning interventions aim to engage the adolescent, family members, friends, school personnel, and members of the community in an effort to collectively support the student with disability in a discussion of their strengths, weaknesses, and future expectations. In addition, person-centered planning interventions are commonly implemented for students near the end of high school, in an effort to engage them in the transition process and improve their self-determination, employment, or life skills. Each of these outcomes can be influential in promoting post-secondary achievement. However, because it was not possible to synthesize person-centered planning interventions or the three key outcomes listed above, no interpretation could be

made regarding whether these outcomes improved for adolescents with disabilities. The lack of research available on transition-specific interventions and outcomes demonstrates the need for more group design research that focuses specifically on the implementation of interventions for transition-age students. It may be the case that a limited number of group design studies are available due to the difficulty in recruitment of transition-age youth with autism, ID, and extensive support needs. To compensate for the lack of participants available to participate in such studies in a single area or institution, researchers should consider collaborating across sites to increase the sample sizes in a given study.

Limitations

There are several limitations that should be considered when interpreting the results of this study. First, risk of bias measures associated with each included study were examined, to determine the studies that represented high methodological rigor. Only three OT/PT intervention studies demonstrated low bias across the five identified important risk of bias assessments. The remaining sixteen datasets displayed high risk of bias on at least one assessment.

Second, the limited number of interventions that focused on transition-age youth made it impossible to generate summary effects for some outcomes (e.g., social cognitive interventions that measured autism symptomology, daily living skills, communication skills and empathy). It was also not possible to compare effect sizes across several intervention types, as no two intervention types assessed the same outcomes.

Third, the inclusion of adolescents diagnosed with autism, ID, and extensive support needs creates a heterogeneous sample with a range of characteristics (e.g., IQ, mental age) and support needs. Ideally, a moderator analysis would have been conducted to determine whether effect sizes differed based on the disability diagnosis of the participants; however, the small number of studies that included participants with extensive support needs did not permit a posthoc analysis to be conducted (Borenstein et al., 2009).

Fourth, it is possible that the inclusion criteria for interventions used in the current meta-analysis was too restrictive in terms of the diagnosed disabilities and age range of participants. The current study chose to focus on intervention programs delivered while adolescents still received school services; however, this disregards the interventions designed to assist students after they transitioned to employment, post-secondary education, or other adult service programs (Burke et al., 2018). Furthermore, limiting the inclusion criteria to participants between the ages of 14-22 years old resulted in the exclusion of intervention studies that targeted self-determination skills, a

construct that is critical to teach transition-age youth with disabilities (Shogren et al., 2018). The lack of consistency regarding how to characterize transition-age youth could be contributing to the small number of studies that were examined and synthesized in the current analysis.

Fifth, as specified within the methods section, the authors classified the interventions based upon the direct support that was provided to the participants. However, this may be problematic as it is possible that the implementers did not categorize the interventions in the same manner or may have described the intervention as encompassing more than one intervention type.

Finally, this study did not consider SCDs, which may provide important information about transition programming for youth with disabilities. The decision to restrict the inclusion criteria to group design research was made because it is often not possible to determine if the intervention has influenced generalized change in the participant outside the intervention context. Though generalization probes are sometimes used to make an assertion about generalizability of the intervention effects, these measurement contexts are often not examined at baseline; therefore, it would not be possible to determine whether there is a relation between the intervention and the outcome being measured (Bottema-Beutel & Crowley, 2020). While there are clear benefits to including only group design research in the current meta-analytic review, SCDs are often used with participants diagnosed with extensive support needs because the sample size is often too small to conduct a RCT. Furthermore, the needs of the participants may vary, requiring an intervention strategy adapted to meet the needs of a single participant (Krasny-Pacini & Evans, 2018). With the decision to exclude SCDs, the findings of this meta-analytic review may not be comprehensive of all interventions for transition-age youth with autism, ID, and extensive support needs.

Recommendations for Future Research

The amount of literature and supports available is far greater for children with disabilities than adolescents and adults with disabilities who are preparing to transition to adulthood. Prior to conducting this review, the author was unable to locate systematic reviews or meta-analyses investigating the effects of interventions for children diagnosed with ID or extensive support needs. However, a recent systematic review identified early intervention studies for children with autism or at-risk for autism resulted in 48 RCTs since 2010 (French & Kennedy, 2018). In contrast, only nineteen group design studies that focused on interventions for transition-age youth could be located across the three disability categories since 1970. This discrepancy is concerning, and demonstrates that there is little research to draw from to inform service provision as individuals with disabilities prepare for adulthood. Therefore, it

is necessary for researchers who are interested in interventions for transition-age youth to begin conducting group design research.

Second, the results from this meta-analysis were surprising because although they focused on all interventions implemented for transition-age students, there were very few included interventions that focused on transition-related outcomes such as employment and self-determination. Occupational therapy/Physical therapy interventions are necessary for many students with disabilities; however, interventions that target employment and self-determination outcomes should be implemented within secondary education as well. These interventions aim to empower transition-age youth with disabilities, and help them become active participants in their future (Hendricks & Wehman, 2009).

Transition outcomes have differed tremendously for adolescents and adults with diagnosed disabilities depending on their gender, age, race, class, and level of supports they receive. As discussed previously, it is likely that autistic individuals who are male, older, and from higher income families will receive more employment opportunities than their younger, female, and low-income peers (Carter et al., 2012; Roux et al., 2013; Shattuck et al., 2012). In addition, the availability of service provisions tends to favor white adolescents from higher-income families, resulting in fewer opportunities for those individuals not included in these demographic categories. Future research must aim to provide insight on how to reduce these disparities (Eilenberg et al., 2019) and how to provide the individualized supports that individuals feel are necessary to navigate adulthood (Anderson et al., 2018). Both of these components can contribute to transition interventions that are tailored to better support these populations. To achieve these goals, researchers must collect and report the demographic characteristics (i.e., race and ethnicity) of participants and actively recruit non-white participants. Over half of the studies included in the current meta-analysis did not report this information, which can help researchers determine whether specific transition interventions are effective for racial and ethnic minority groups.

Conclusion

Within this meta-analysis, the impact of all interventions for transition-age adolescents diagnosed with autism, ID, and extensive support needs were investigated. Five categories of interventions were generated inductively. These included: behavioral, social cognitive, interactional, OT/PT, and person-centered planning interventions. Effect sizes were synthesized for OT/PT interventions that measured physical characteristics and gross motor outcomes. OT/PT interventions that measured gross motor outcomes were significant. In addition, the

effect sizes from social cognitive interventions that measured social behavior were also synthesized, but were insignificant. All additional interventions and outcomes could not be synthesized due to the limited number of studies that met the inclusion criteria. Lastly, moderator analyses were conducted to determine if IQ, proximity, or boundedness of the outcomes measured impacted the effect sizes; however, these too were insignificant.

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* Published peer-reviewed articles included in the meta-analysis
** Dissertations included in the meta-analysis
*** Published peer-reviewed articles related to the datasets collected from the grey literature search. These articles did not include statistical values necessary to calculate the effect size.

Figure Captions

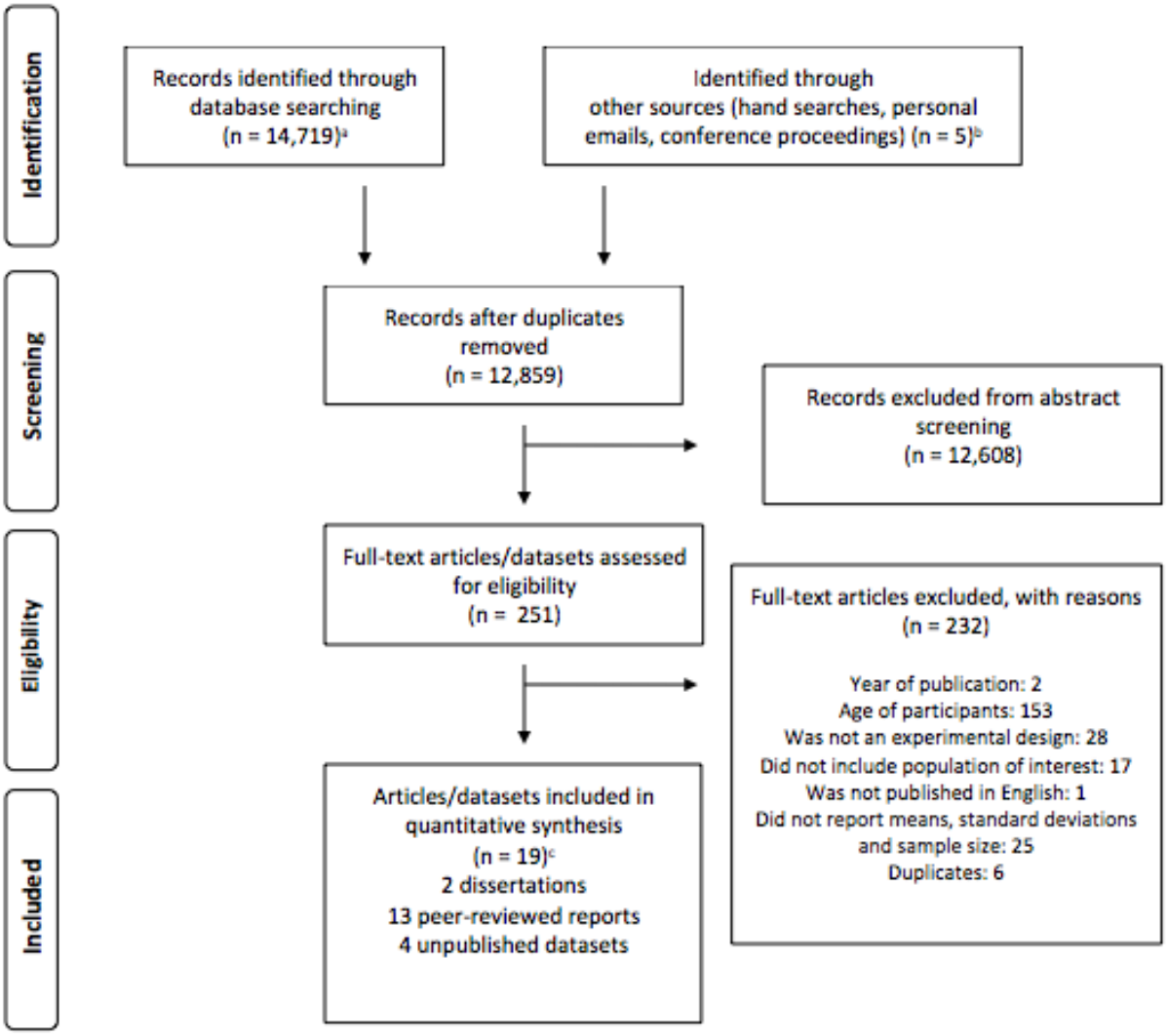
Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram representing the search procedure

a. Peer-reviewed articles (n = 6,341), dissertations (n = 8,378)
b. Of these, authors who published after 2015 were contacted via email, and 3 authors provided the requested data.
c. 215 Effect sizes included. (Peer-reviewed journal article: 132; Dissertation: 20; Grey literature: 63

Figure 2. Forest plot of Hedge's g effect sizes across intervention types and outcomes that had enough studies to be interpretable. n indicates the number of effect sizes and k indicates number of studies. * indicates that results should be interpreted with caution because they are comprised of less than 5 studies.

Figure 3. 'Risk of bias' quality indicators across all included outcomes
Note: Random sequence generation and allocation concealment were rated low, unclear, or high. All remaining indicators were rated on scale from low to high

[Figure 1 Top]



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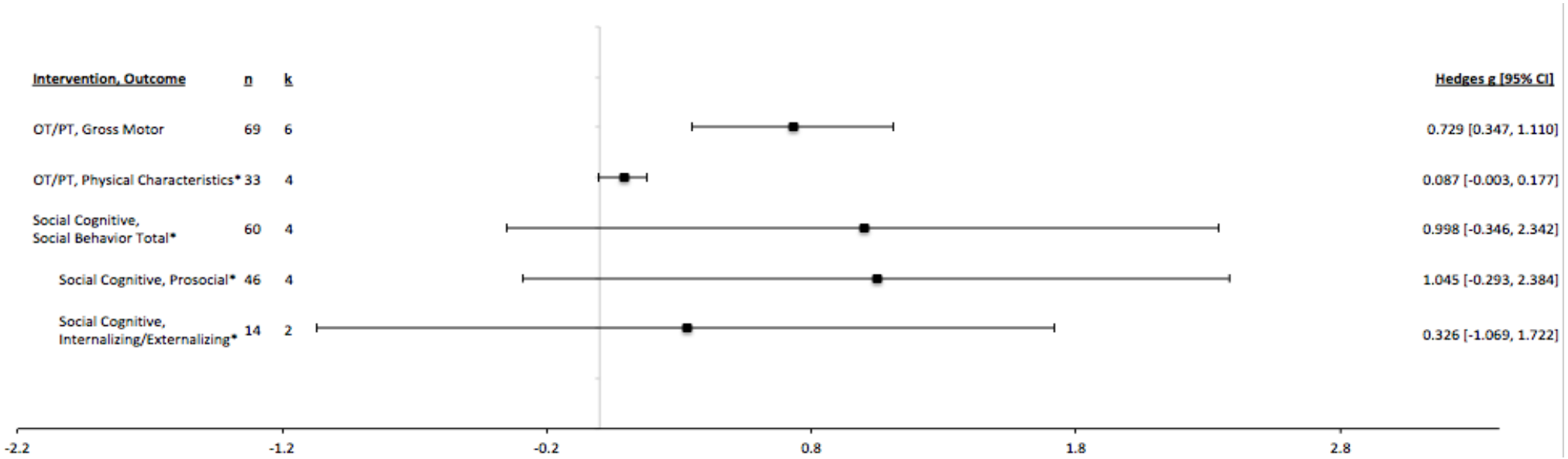
[Figure 2 Top]



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[Figure 3 Top]

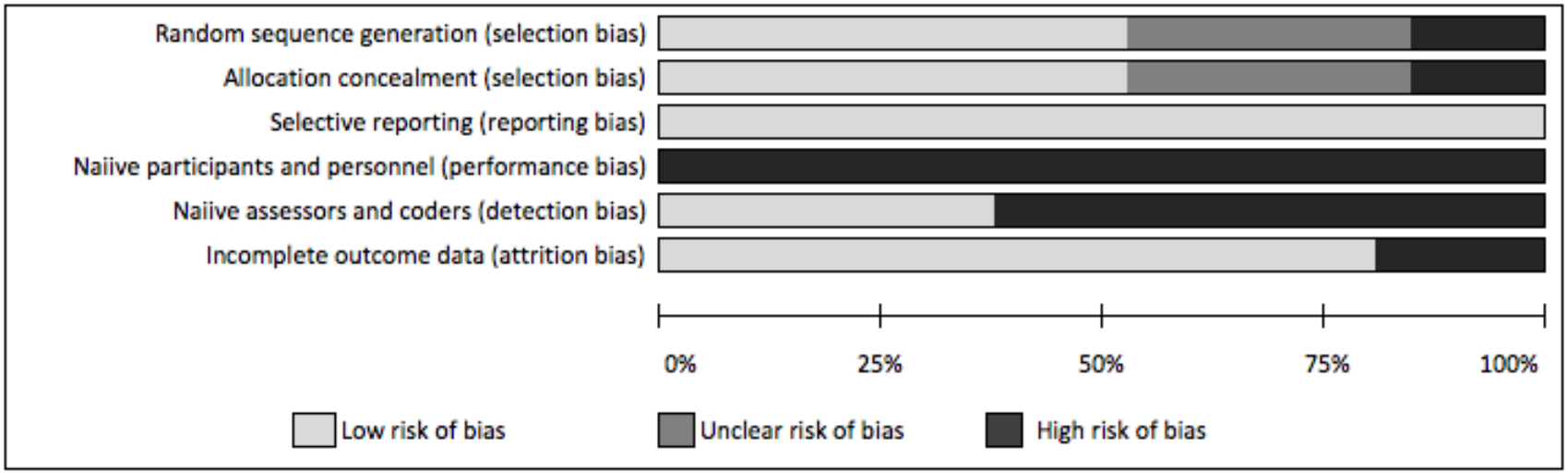

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Table 1.
Participant Characteristics for Included Studies and Datasets

			Participant Characteristics						
	# of ESs	Source	Diagnosis	n	% male	CA	MA	IQ	Race (% Caucasian)
Asmus et al. [2017]	1	J	ESN	95	66.3				69.5
Cartwright [1971]	3	J	ID	36		208	148	71.7	
Wehman et al. [2014]	2	J	ASD	40	72.5	235.5			53.7
Wehman et al. [2017]	9	J	ASD	49	71.4	238.8			51.0
Wehman et al. [2019]	7	J	ASD	121	74.5	235.2			58.8
Boer et al. [2014]	8	J	ID	31	64.5	212.7	125.9	59.2	
Boer et al. [2014]	8	J	ID	29	65.5	204.5	118.9	58.2	
Elmahgoub et al. [2011]	26	J	ID	30					
Lee et al. [2016]	10	J	ID	31	54.8	200.1			
Mikolajczk & Jankowicz-Szmanska [2015][a]	30	J	ID	34	82.4	180.7	81.6	45.2	
Mikolajczk & Jankowicz-Szmanska [2015][b]	10	J	ID	34	82.4	180.7	81.6	45.2	
Ringenbach et al. [2016]	18	U*	ID	28	56.8	221.8	66.8	30.1	
Shields et al. [2013]	10	J	ID	68	55.9	214.8			
Hagner et al. [2012]	4	U*	ASD	38	95.8				
Ruble et al. [2018]	1	U*	ASD	20		218.4	165.3	75.7	70.0

Adibsereshki et al. [2016]	6	J	ID	32	0	191.5			
DaWalt et al. [2018]	2	J	ASD	41	78	185.3	185.5	100.1	95.1
Kajganich [2013]	3	D	ASD	30		193.3			
Kuehnel [2013]	17	D	ASD	42	92.0				78.0
Matthews et al. [2018]	20	U*	ASD	24	83.3	183.5	187.4	102.1	79.2
Matthews et al. [2018]	20	U*	ASD	21	81.8	183.3	182	99.3	86.4
Total	215			874	[0 – 95.8]	[180.7 – 238.8]	[66.8 – 187.4]	30.1 - 102.1]	[51.0 – 95.1]

Note: ASD = Autism Spectrum Disorder, CA=Chronological Age (in months), D=Dissertation or thesis, ESN = Extensive Support Needs, ESs = Effect Sizes, ID = Intellectual Disability, J = peer-reviewed journal, MA=Mental Age, U* = Unpublished dataset

Table 2. *Intervention Characteristics for Included Studies and Datasets*

	Intervention Characteristics				
	Intervention Type	Interventionist Type	Setting	Outcome	Duration of Intervention (total hrs.)
Asmus et al. [2017]	Interactional	Peer	School	SB - Prosocial	Average length of a single meeting = 56.1 minutes
Cartwright [1971]	Behavioral	Teacher	School	Academic	NR
Wehman et al. [2014]	Behavioral	Employer or Job Coach	Workplace	Employment	900
Wehman et al. [2017]	Behavioral	Employer or Job Coach	Workplace	Employment	900
Wehman et al. [2019]	Behavioral	Employer or Job Coach	Workplace	Employment	9 mo. intervention with 35 hrs./wk. of CBET and 206 total hrs. direct instruction
Boer et al. [2014]	OT/PT	Clinician	School	Physical Characteristics, Motor	20
Boer et al. [2014]	OT/PT	Clinician	School	Physical Characteristics, Gross Motor	20
Elmahgoub et al. [2011]	OT/PT	Clinician	School	Physical Characteristics, Gross Motor	25
Lee et al. [2016]	OT/PT	Teacher	School	Gross Motor	11
Mikolajczk & Jankowicz-Szmanska [2015][a]	OT/PT	Clinician	School	Physical Characteristics, Gross Motor	27
Mikolajczk & Jankowicz-Szmanska [2015][b]	OT/PT	Clinician	School	Physical Characteristics, Gross Motor	27
Ringenbach et al. [2016]	OT/PT	Other	Clinic	EF	14
Shields et al. [2013]	OT/PT	Peer	Other	Gross Motor	10 wk. intervention with 45-60 min. sessions 2x/wk.

Hagner et al. [2012]	PCP	Clinician	Home	Job Expectations, Self-Determination	NR
Ruble et al. [2018]	PCP	Clinician		Self-Determination	3 hr. consultation and 4, 1-1.5 hr. coaching sessions
Adibsereshki et al. [2016]	Social Cognitive	Clinician	School	SB - Prosocial, Daily Living Skills, Communication	16.5
DaWalt et al. [2018]	Social Cognitive	Clinician	Clinic	Autism Symptomology, SB - Prosocial	14
Kajganich [2013]	Social Cognitive	Computer Instruction	School	Empathy	1.25
Kuehnel [2013]	Social Cognitive	Computer Instruction	School	SB - Prosocial, SB – Internalizing & Externalizing	6 wk. intervention with sessions lasting 15-30 mins
Matthews et al. [2018]	Social Cognitive	Peer	Clinic	SB – Prosocial, SB – Internalizing & Externalizing	21
Matthews et al. [2018]	Social Cognitive	Clinician	Clinic	SB – Prosocial, SB – Internalizing & Externalizing	21

Note: D=Dissertation or thesis, EF = Executive Functioning, ESs = Effect Sizes, J = peer-reviewed journal, NR = Not Reported, OT/PT = Occupational Therapy/Physical Therapy, PCP = Person Centered Planning, SB = Social behavior, U* = Unpublished dataset

Table 3. *Results From Simple Robust Variance Estimation Analysis*

Intervention	Outcome Type	Coefficient	SE	dfs	p-value	95% CI
OT/PT	Gross Motor*	0.7287	0.1479	4.9425	0.0045	[0.3471, 1.1103]
OT/PT	Physical Characteristics[a]	0.0871	0.0281	2.9827	0.0535	[-0.0025, 0.1767]
Social Cognitive	SB Total[a]	0.9983	0.4835	3.9882	0.1081	[-0.3457, 2.3424]
	SB – Prosocial[a]	1.0451	0.4815	3.9879	0.0960	[-0.2934, 2.3836]
	SB – Internalizing/Externalizing[a]	0.3263	0.1098	1.0000	0.2067	[-1.0694, 1.7221]

Note: OT/PT = Occupational Therapy/Physical Therapy, SB – Social Behavior, SE = Standard Error

[a] There were enough effect sizes to generate a synthesized effect, but too few studies included in the analysis to be confident of the p-values. These effects must be interpreted with caution.

Table 4. *Results From Robust Variance Estimation Meta-Regression Analyses*

	Coefficient	SE	dfs	p-value	95% CI
Source (Grey=1)	-0.0550	0.3038	9.4785	0.8601	[-0.7370, 0.6270]
Proximity (Distal=1)	-0.4496	0.3075	17.4600	0.1615	[-1.0971, 0.1979]
Boundedness (Generalized=1)	-0.2372	0.1514	6.8120	0.1623	[-0.5972, 0.1228]
IQ*	0.0057	0.0064	3.3070	0.4295	[-0.0135, 0.0250]

Note: * the variable was log transformed, CI = Confidence Interval, SE = Standard Error