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CORRECTION

Correction to: A Systematic Review of Mental Health Interventions for ASD: Characterizing Interventions, Intervention Adaptations, and Implementation Outcomes

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Due to the errors occurred in the originally published version, this article is being reprinted in its entirety as Correction. All errors have been corrected. It is the correct version.

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Abstract

Youth with autism spectrum disorder (ASD) have high rates of co-occurring mental health needs that necessitate mental health interventions. Given the unique clinical characteristics of youth with ASD, there have been significant efforts to adapt and test mental health interventions for this population. Yet, characterization of the nature and types of interventions adaptations is limited, especially across the wide range of interventions tested for youth with ASD with a focus on implementation factors. Additionally, understanding how these interventions may be implemented in community services is limited. The aims of this systematic review are to characterize the (1) types of interventions tested for co-occurring mental health conditions for youth with ASD; (2) adaptations to mental health interventions for use with youth with ASD; and (3) implementation strategies, outcomes, and determinants of mental health interventions to inform their translation to community service settings. Eighty-three articles testing interventions targeting mental health symptoms in youth with ASD that included implementation factors in analyses were reviewed. The Stirman et al. (2013; 2019) FRAME adaptation, Powell et al. (2012;2015) implementation strategies, and Proctor et al. (2011) implementation outcomes taxonomies were applied to characterize the nature and types of adaptations for use with youth with ASD and types of implementation strategies, outcomes, and determinants used, when available, respectively. Of the interventions examined, the majority (64.1%) were originally designed to target youth mental health concerns and were then adapted to be used with ASD. The most common adaptations included those to the intervention content, particularly adding elements and tailoring or refining aspects of the intervention while maintaining core functions. Half of the articles described at least one implementation strategy used during intervention testing. Fidelity and acceptability were the most frequently examined implementation outcomes, with some examination of appropriateness and feasibility. Nineteen percent of articles

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described implementation determinants (i.e. barriers/facilitators) of these implementation outcomes. The common adaptations for ASD provide direction for future intervention development and training community therapists. Further examination, specification, and reporting of implementation strategies and outcomes within ongoing efforts to adapt interventions to meet the co-occurring mental health needs of youth ASD are needed to facilitate their translation to community settings. Areas for future research as well as clinical implications are discussed.

Keywords
Autism spectrum disorder
Mental health treatment
Implementation
Adaptations

Mental Health Needs and Mental Health Services for Youth with ASD

Children and adolescents, herein after referred to as youth, with autism spectrum disorder (ASD) have high rates of co-occurring mental health conditions, with estimates as high as 70% compared to 25% for youth without ASD (Costello et al., 2003; Gurney et al., 2006; Lai et al., 2019; Simonoff et al., 2008). The majority of these youth meet criteria for more than one co-occurring mental health condition, most frequently attention-deficit/hyperactivity disorder (ADHD), disruptive behavior disorders, and/or anxiety (Lai et al., 2019). These co-occurring mental health problems confer further functional impairments and detrimental outcomes across the lifespan (Cadman et al., 2012; Factor et al., 2017; Joshi et al., 2013). Given this high prevalence and the associated functional impairments, effective mental health interventions are needed to appropriately address the mental healthcare needs and improve outcomes for this population.

The public mental health service system plays a critical role in providing treatment for youth with ASD and co-occurring mental health conditions, with youth with ASD or suspected ASD reportedly representing 21% of provider caseloads in community-based mental health services (Brookman-Frazee et al., 2009, 2012b). However, data suggest these youth are served within mental health programs designed to address a range of presenting problems versus those specifically focused on ASD, and that providers in these settings have little experience or training in working with youth with ASD (Brookman-Frazee et al., 2012b, 2020c). As such, serving youth with ASD poses challenges for community mental health organizations and providers. These factors highlight the need for targeted efforts to integrate effective interventions that address the complex mental health needs of youth with ASD and co-occurring mental health conditions into community-based mental health services.

Use of EBIs in Community Mental Health Service Settings

Despite significant efforts to develop and test evidence-based interventions (EBIs) for ASD, including those targeting mental health problems, there is limited translation of these practices in routine, community-based care (Hume et al., 2021; Wood et al., 2015). This has spurred increased prioritization and calls to address this significant research-to-practice gap in community settings caring for individuals with ASD (Wood et al., 2015). This may be especially important within the context of community mental health services for youth with ASD. Mental health providers report limited specialized training and low confidence, as well as perceived slower progress and generalization related to serving children and adults with ASD (Brookman-Frazee et al., 2012b; Maddox et al., 2019a, 2019b). Additionally, providers report lower intentions and self-efficacy in terms of using mental health EBIs for this population (Brookman-Frazee et al., 2012b; Maddox et al., 2019a, 2019b). The presence of multiple co-occurring conditions common in ASD may also limit the acceptability, adoption, and use of these interventions for providers. For example, the presence of co-occurring conditions as well as the need to learn more than one EBI to meet the needs of their clients have been identified as significant barriers to community-provider's EBIs use (Chandler et al., 2004; Powell et al., 2013). Further understanding of factors that may facilitate the successful use of these EBIs for youth with ASD is essential to improving the effective translation of these interventions to community settings where the majority of youth with ASD are served.

Mental Health EBIs for Youth with ASD

There has been a prolific growth in efforts to develop and test interventions targeting the range of mental health conditions seen in youth with ASD (see Keefer et al., 2018; Vasa et al., 2018; Vetter, 2018; Weston et al., 2016; White et al., 2018). These interventions generally fall into two broad categories: (1) interventions developed specifically for use with youth with ASD to address symptoms of ASD and co-occurring mental health concerns and (2) adaptations of existing EBIs targeting mental health concerns for use with ASD. Specific development or adaptation of mental health EBIs may be especially important for youth with ASD as the feasibility or appropriateness of existing

mental health interventions may be limited by their fit with the complex clinical needs of this population. For example, mental health EBIs tend to require high levels of language comprehension and focus on complex and/or abstract concepts (e.g. cognitive restructuring). These elements may pose particular problems for ASD given noted challenges with verbal communication and the tendency towards literal or concrete thinking. Further, many EBIs are disorder specific (i.e. they target one type of mental health symptom or condition), which may limit their appropriateness for youth with ASD who typically present for mental health services with an average of two or more co-occurring mental health conditions (Brookman-Frazee et al., 2017). In fact, recent work by Wood et al., (2020) highlights the importance of adapting mental health interventions for ASD, with improved efficacy of cognitive behavioral therapy (CBT) adapted for ASD compared to both standard CBT and treatment as usual. Thus, adaptations aimed at improving EBI fit with child clinical concerns are likely to enhance the effectiveness of mental health treatment for youth ASD and co-occurring with mental health conditions.

Interventions Developed Specifically for Co-Occurring Mental Health Conditions in ASD

There are a growing number of interventions developed to specifically address co-occurring mental health problems in youth with ASD. For example, An Individualized Mental Health Intervention for ASD (AIM HI; Brookman-Frazee et al., 2019) was specifically developed for use in publicly funded mental health settings for children with ASD. Many interventions of this type take a transdiagnostic approach, targeting common problems in ASD such as challenging behaviors, the most common presenting problems for youth with ASD served in these settings (Brookman-Frazee et al., 2012b). These interventions also often include strategies to adapt psychotherapy to meet the unique needs of this population (e.g. incorporation of special interests, caregiver-directed strategies, content focused on social skills).

Adaptations of Non-ASD Mental Health Interventions for ASD

In addition to those developed specifically for ASD, many existing mental health EBIs have been adapted for use with ASD. For example, many groups have adapted CBT to treat anxiety in ASD (e.g. Facing Your Fears; Reaven et al., 2008; Behavioral Interventions for Anxiety in Children with Autism; Wood et al., 2009). Similar to those described above, these approaches often apply specific adaptations pertaining to the content (e.g. incorporation of special interests, incorporating more visual versus verbal materials) or delivery modifications (e.g., inclusion of parents or caregivers in sessions to improve fit with youth with ASD).

Gaps in the Current Literature on Mental Health Interventions for ASD

Several reviews highlight the mounting evidence supporting the efficacy and/or effectiveness of these interventions including those with a specific focus on one EBI (e.g. CBT; Weston et al., 2016; PCIT; Vetter, 2018) or mental health target (e.g. internalizing disorders; Keefer et al., 2018). However, there is scant literature synthesizing the specific types of mental health interventions (i.e. whether they were developed or adapted for ASD) and the specific intervention considerations or adaptations for use with ASD, especially across the broad range of co-occurring mental health conditions seen in ASD. One exception is a review by Moree and Davis (2010) which characterizes adaptations to CBT for anxiety in ASD. Several modification trends were noted, with the primary proposed reason for modifications to make CBT more appropriate or viable for youth with ASD. However, there is a need to extend this work by expanding the focus to include a broader range of mental health interventions tested with youth with ASD and mental health concerns and disorders.

A number of adaptation frameworks and methods have been developed for classifying the types of modifications and adaptations to existing EBIs (Escoffery et al., 2018; Rabin et al., 2018; Stirman et al., 2013b, 2019). One example includes the comprehensive FRAME framework and methods developed by Stirman et al., (2013b; 2019). FRAME specifies several adaptation components, including those pertaining to EBI training and evaluation, context, and content, and identifies specific types of content and context modifications to intervention materials and/or delivery and links these to the reason for such adaptations. FRAME is increasingly used to characterize EBI adaptation use by community providers (Aarons et al., 2012; Dyson et al., 2018; Lau et al., 2017). FRAME is especially appropriate for characterizing adaptations within the context of mental health EBIs for ASD, as it supports the systematic characterization of clinical adaptations and is frequently used to characterize adaptations for other youth mental health services. This can also facilitate contextualization of these adaptations with the broader literature.

Translation of Mental Health EBIs for ASD to Community Services: Impact of Implementation Strategies and Outcomes

There are growing efforts to develop and test strategies to facilitate the implementation of EBIs to routine care settings, including a small number of studies focused on mental health EBIs adapted or developed for ASD in mental health service settings (e.g. Brookman-Frazee & Stahmer, 2018; Dickson et al., 2020a, 2020b; Pellecchia et al., 2016). Across these efforts is an examination of outcomes that extend beyond clinical effectiveness, such as those pertaining to the implementation process and whether an EBI is successfully adopted and sustained in community settings. Proctor et al., (2011) developed a taxonomy of such outcomes, specifying seven distinct implementation outcomes: (1) acceptability (satisfaction with an intervention); (2) adoption (intervention use or intention to try); (3) appropriateness (intervention relevance or usefulness); (4) feasibility (or intervention fit or utility); (5) fidelity (adherence, delivery quality); (6) implementation cost (cost–benefit, cost-effectiveness); (7) penetration (intervention reach or number of clients used with), and (8) sustainability (continued use, maintenance). Implementation outcomes serve a necessary intermediary function in promoting clinical effectiveness outcomes and are important to consider during initial efforts to develop or adapt EBIs to enhance their feasibility and use in community service settings (Proctor et al., 2011). Beyond implementation outcomes, examination of how implementation strategies influence the translation of these adapted mental health EBIs into routine care is also critical. Implementation strategies refer to the methods used to promote adoption and use of an intervention (Eccles et al., 2009; Proctor et al., 2013). In fact, implementation strategies are often referred to as the "how to" component of changing community practice (Proctor et al., 2013). Powell et al., (2012, 2015) specify a compilation of discrete implementation strategies used in implementation research to support rollout of new interventions. This typology specifies and defines 73 implementation strategies based on the prior literature (e.g. developing academic partnerships, making training dynamic, providing ongoing consultation) that can be referenced to identify or specify, assess, and report strategies used to facilitate the intervention implementation process. Several recent implementation efforts have applied these taxonomies to aid strategy and outcome specification prior to, during, and retrospectively following the development and/or delivery or testing of an intervention (Brookman-Frazee & Stahmer, 2018; Rudd et al., 2020).

EBI adaptations are closely intertwined with both implementation strategies and outcomes given their importance for intervention adoption, use, and perceptions regarding feasibility and appropriateness. However, it is not yet known how the broader collection of mental health EBIs and the specific adaptations or included components for ASD can function to inform ongoing efforts to facilitate the translation of these to community settings. There is minimal research characterizing implementation strategies and outcomes within studies testing adapted mental health EBIs for ASD. The exception is recent work by Lake et al. (2020) that conducted a focal examination of implementation strategies and outcomes within the context of effectiveness trials for CBT for ASD. Further efforts examining these key implementation factors across the range of mental health interventions tested for youth with ASD is valuable to informing and responding to increasing prioritization of translating these interventions into routine care settings. This includes an examination of studies with an explicit focus on community implementation (e.g. effectiveness trials) as well as those without (e.g. efficacy trials). Both study types may address implementation considerations, even if indirectly, and thus there is value to be gleaned from both.

Research Questions

This systematic review seeks to consolidate the literature testing mental health interventions for youth with ASD, including efficacy, effectiveness, and implementation intervention studies. It is guided by three primary aims: (1) characterize the types of interventions tested for co-occurring mental health conditions for youth with ASD that also examined implementation outcomes; (2) apply the Stirman et al. (2013b, 2019) FRAME adaptation framework and methods to characterize the adaptations to mental health interventions for use with youth with ASD, including identifying what is adapted, the nature or types of adaptations, and associated reason for the adaptation; and (3) apply the Proctor et al. (2011) and Powell et al. (2012, 2015) taxonomies to characterize types of implementation strategies and outcomes specified, respectively, to accelerate translation of these adapted mental health interventions for ASD to community service settings. A review of the clinical outcomes of interventions tested was not included given the growing number of recent reviews examining the efficacy and/or effectiveness of mental health interventions for ASD (seeKeefer et al., 2018; Vetter, 2018; Weston et al., 2016).

Table 1 Search Strategy

Search String
Autis* OR Asperger*
AND
"Mental health" OR internaliz* OR externaliz* OR "behavior problems" OR "challenging behaviors" OR anxiety OR depression OR psychosis OR ADHD OR "Attention deficit" OR "oppositional defiant disorder" OR Conduct disorder OR "disruptive behavior disorder" OR Trauma OR PTSD OR "Post-traumatic stress"
AND
Intervention OR psychotherap* OR "parent training" OR "Cognitive behavior*" or Mindfulness or "Parent Child Interaction Therapy" OR "Parent–Child Interaction Therapy" OR PCIT or "Positive Parenting Program" OR "Triple P" OR "Stepping Stones" OR "Incredible Years" OR "AIM HI"

Methods

Inclusion and Exclusion Criteria

This systematic review identified empirical research evaluating the efficacy, effectiveness, and implementation of mental health interventions for youth with ASD. To be included, studies had to meet criteria related to study design, intervention targets or focus, and participants. Criteria included: (1) a psychosocial intervention tested via randomized control, quasi-experimental, or pre-post experimental trial; (2) studies with a sample size greater than 10 participants[1]; (3) an intervention with a primary focus on mental health disorders or symptoms (e.g. depression, anxiety, ADHD, challenging behaviors); (4) an intervention delivered to youth with ASD and co-occurring mental health conditions or symptoms and/or their families; (5) youth participants aged birth to 25 years old. Studies were excluded if they included: (1) a non-experimental design; (2) focused on interventions targeting non-mental health symptoms (e.g. social skills, sensory sensitivities, core symptoms of ASD) as the primary intervention target or outcome; and/or (3) did not examine implementation factors such as implementation outcomes.

Search Strategy

Relevant articles were identified by systematically searching the PubMed, PsycINFO, Scopus, CINAHL Plus, and Web of Science electronic databases. The search strategy included a joint function of (1) terms for autism spectrum disorder, (2) terms for mental health conditions or symptoms, and (3) terms for mental health and psychosocial interventions, including specific names of major mental health interventions (see Table 1 for specific search terms used). To increase the comprehensive nature of this review, backward (reference list) and forward (citation) searches were conducted with recent relevant reviews (e.g. Keefer et al., 2018; Weston et al., 2016; White et al., 2018) and seminal articles in this area; relevant articles identified from these searches were included in data collection and extraction. An initial search was completed 19 March 2019 and an additional search to find more recently published articles was completed 30 June 2020.

Data Collection and Extraction

An online systematic review software program (Covidence; covidence.org) facilitated data collection and extraction. Four trained master's or bachelor's level reviewers completed title and abstract screening. Four Ph.D. level and one master's degree level reviewers completed full-text screening. The same inclusion and exclusion criteria were applied at each step. Each article was assessed by two reviewers and a third reviewer (first author) served to resolve disagreements regarding inclusion. Applying a codebook defining every included construct of interest, data extraction consisted of coding of data pertaining to the EBI characteristics, adaptations, and implementation factors and outcomes by the same reviewers from full-text screening. Two trained coders independently reviewed and extracted data from each article. Subsequent consensus meetings were held comparing extraction results and data were combined into a single entry. We systematically and iteratively developed and refined the data extraction codebook. Interventions were coded as ASD-specific or adapted for ASD. Interventions were coded as "adapted for ASD" if the specific model (e.g. Triple P, Incredible Years) or type (e.g. cognitive behavioral therapy) of intervention was originally developed to treat non-ASD mental health conditions. Interventions were coded as "ASD-specific" if the intervention was specifically developed for ASD (e.g. An Individualized Mental Health Intervention for ASD). Coding procedures pertaining to adaptations and implementation factors were informed by relevant frameworks

[1] We included the criterion of a sample size greater than 10 in order to exclude primarily single subject or case study designs.

and taxonomies, including the FRAME adaptations framework (Stirman et al., 2013b, 2019), ERIC compilation of implementation strategies (Powell et al., 2012, 2015), and taxonomy of implementation outcomes (Proctor et al., 2011). We applied the FRAME framework to code what is adapted (e.g. content, context), the nature of the adaptation (e.g. adding, substituting, tweaking elements), and associated reason (e.g. improve organization-innovation fit, improve provider-innovation fit) for each adaptation or modification specified. Two types of adaptations were coded: those pertaining specifically to ASD and more general adaptations pertaining to the end organization, provider, or end-user (excluding those specific to ASD). This was determined based on whether the adaptations were described for the purposes of improving the fit for youth with ASD or not. The Powell et al. (2012, 2015) taxonomy was applied to code implementation strategies and Proctor et al. (2011) taxonomy was applied to code implementation outcomes that were either explicitly or implicitly specified in included articles.

Risk of Rater Bias

Risk of bias for individual studies was assessed using the Cochrane risk of bias tool (Higgins, et al., 2019). Of the recommended domains for assessing bias, domains pertaining to selection, allocation, and performance bias were judged not applicable given the primary aims of the current review. For the remaining applicable domains, two authors (first and fifth) independently assessed the risk of bias and resolved discrepancies by consensus including a third author. As described below, the unit of analysis was set at the intervention level for relevant analyses (e.g. examination of adaptations) to reduce bias. To account for rater bias pertaining to data extraction, extraction guidelines and codebooks with definitions of each included construct were developed and all articles were independently screened and/or coded by two authors and subsequently consensus coded. Any remaining issues and/or disagreements were assessed by a third reviewer (first author).

Data Synthesis

Data were recorded in an extraction database. Per current recommendations, we utilized descriptive statistics to address our primary aims (Popay et al., 2006). Studies with multiple articles evaluating the same EBI were grouped together by intervention and the unit of analysis was set at the intervention level when applicable. Analyses were primarily descriptive, with some mean difference analyses to examine whether there were differences in the nature or number of adaptations or implementation strategies and outcomes examined in articles conducting efficacy and effectiveness studies.

Results

A total of 8,352 articles were identified from electronic databases searches; 58 articles were added that were identified through backward (reference) and forward (citation) searches of relevant articles. An additional 727 articles were identified following our additional search in 2020. Following the removal of 2,585 duplicate articles, a total of 6552 articles were identified as potentially eligible for the current review. Title and abstract screening resulted in the exclusion of 6,183 articles and the remaining 369 articles were then subjected to full-text screening. An additional 286 studies were excluded during full-text screening for various reasons (see Fig. 1). Eighty-three articles were included in data extraction and subjected to coding. Results of our bias assessment indicated that the majority of articles (68%) had no or low risk of bias and no articles demonstrated more than a medium risk of bias, primarily related to the lack of criteria used in reporting acceptability and/or feasibility outcomes. Given that the primary outcome is to *characterize* the nature of implementation outcomes examined versus drawing conclusions from the nature of implementation outcomes reported, we deemed the impact of those articles with higher risk of bias on our results as minimal. Forty-four articles (53.0%) pertained to efficacy studies whereas 31 articles (37.3%) were effectiveness studies.

Objective 1: Characterize ASD Mental Health Interventions Tested for Youth with ASD (Table 2)

A total of 39 interventions were examined across 83 articles, including 25 (64.1%) existing mental health interventions adapted to be used with ASD and 14 (35.9%) interventions developed specifically to treat co-occurring mental health problems in ASD. In terms of intervention type, interventions consisted of CBT or CBT-based (n = 16, 41.0%), parent management or parent training (n = 13, 33.5%), mindfulness-based (n = 3, 7.7%) or other (e.g. social skills, working memory; n = 7; 17.9%). One article (Schohl et al., 2014) focused on a social skills intervention, but was included given its primary mental health target of social anxiety. The primary mental health problems targeted included externalizing symptoms and conditions such as challenging behaviors or oppositional defiant disorder (n = 20, 51.4%), internalizing symptoms and disorders such as anxiety or depression (n = 16, 41.1%), and/or transdiagnostic symptoms such as emotion

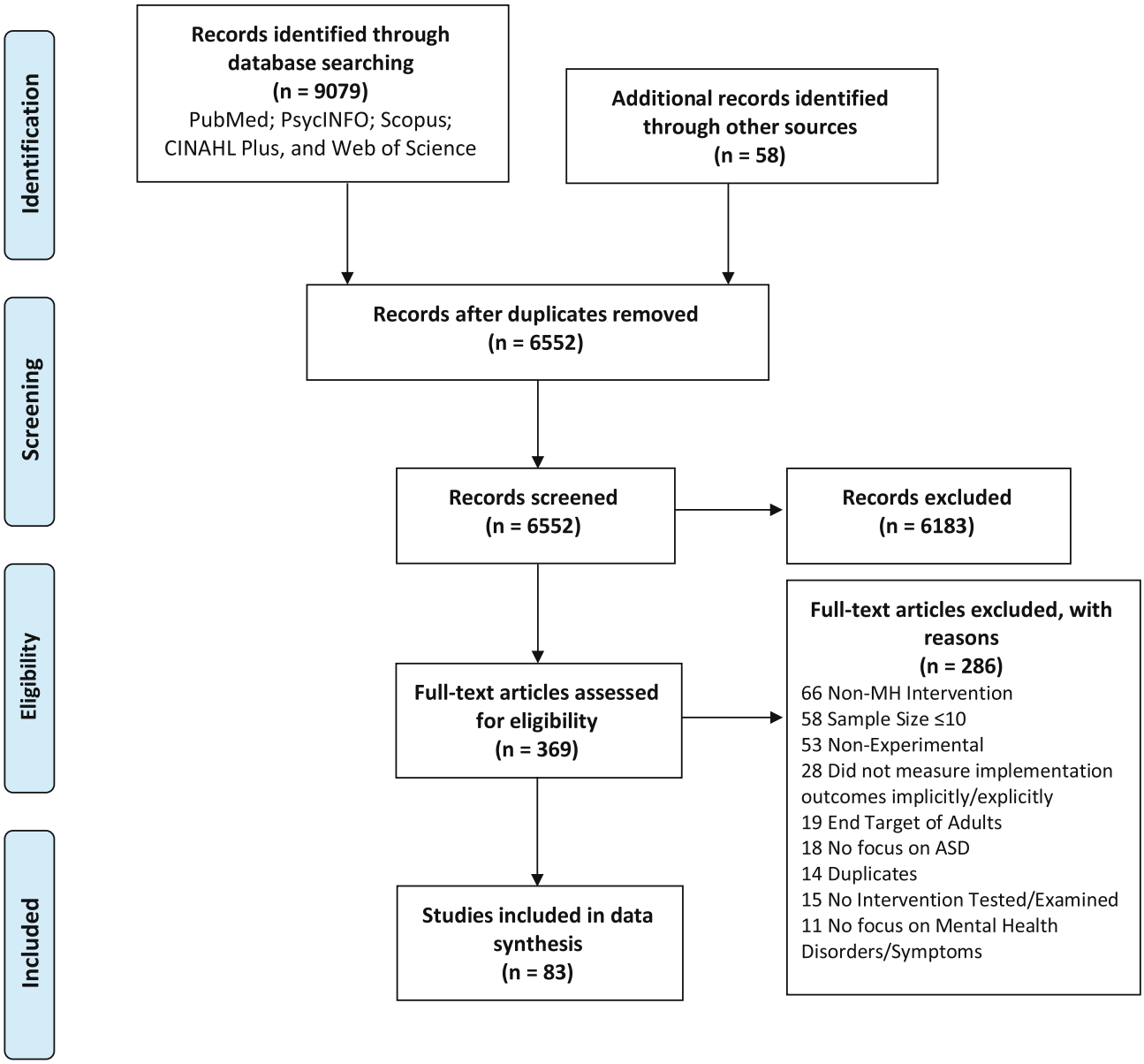

Fig. 1 PRISMA 2009 Flow Diagram

regulation or mindfulness (n = 6, 16.4%); four interventions (10.3%) targeted more than one problem area. Only one article specifically focused on attention-deficit/hyperactivity disorder and no articles specifically examined trauma or depressive disorders. Interventions primarily targeted parents or families (n = 33, 84.6%), children (n = 28, 71.8%), and/or teachers (n = 2, 5.1%). Seventeen (43.6%) and 22 (56.4%) articles targeted one and more than one individual(s), respectively, with a range of 1–3 intervention targets (Mean = 1.7, SD = 0.60). Across included articles, interventions were delivered in the following formats: parent-only individual (n = 30, 36.1%) or group (n = 28, 33.7%), child-only individual (n = 19, 22.9%) or group (n = 20, 24.1%), and parent–child individual (n = 33, 39.8%) or group (n = 18, 21.7%). A range of 1–3 delivery formats (Mean = 1.77, SD = 0.85) were included, with one or more than one format included in 41 (49.4%) and 42 (50.6%) articles, respectively. There was some variation in the delivery of the same intervention across articles; for example, Ros and colleagues (2019) tested the delivery of PCIT in a group-based format versus the individual format utilized in other articles. Most articles (n = 51, 61.4%) described incorporating a structured delivery approach, with specified session focus and order, while some (n = 14, 16.9%) reported the inclusion of a modular or flexible approach. Five articles (6.0%) incorporated a telehealth delivery model. In terms of implementation context, the majority of articles (n = 47, 79.7%)

Table 2 Mental Health Interventions Tested for Youth with ASD

Developed or Adapted for ASD	Specific EBI	Source	MH Target	End Target	Therapy Format	Number of Sessions	Implementation Factors									
							Strategy	Deter-minant	Accept-ability	Adoption	Appro-priateness	Feasi-bility	Fidelity	Implemen-tation Cost	Pene-tration	Sustain-ability
Developed	An Individualized Mental Health Intervention for Children with ASD (AIM HI)	Brookman-Frazee et al. (2012a)	E	C, P	5, 7	13 core	X	X			X		X			
		Brookman-Frazee et al. (2019)	E	C, P	5, 7	13 core	X						X			
		Lind et al. (2020)	E	C, P	5, 7	13 core	X						X			
	Applied Behavior Analysis (ABA)	Sanders et al. (2020)	E	C	1	N/A			X					X		
	ASCEND	Pillay et al. (2011)	E	P	4, 8	11 core			X		X					
	BRAVE online	Conaughton et al. (2017)	I	C, P	1, 3, 8, 9	10 core child online, 6 core parent	X		X							
	Cogmed Working Memory Training	Benyakorn et al. (2018)	T	C	1, 7	25 core		X	X		X	X				
	COMPASS for Hope (C-HOPE)	Kuravackel et al. (2018)	E	P	3, 4, 8	8 core			X				X			
	Cygnet	Stuttard et al. (2016)	E	P	4, 8	6 core			X				X	X		
	EASE	Conner et al. (2019)	T	C, P	5, 7	16 core			X			X	X			
	Family-based Management of Behavioral Excesses of Autism Program (FMBEAP)	Shiri et al. (2020)	E	P	4, 5, 8	11 core, 1 optional, 1 booster		X	X				X			
	PEERS	Schohl et al. (2014)	I	C, P	4, 2, 6, 8	14 core	X					X				
	Project Evo	Yerys et al. (2019)	E	C	1	N/A			X			X				
	Research Units on Pediatric Psychopharmacology (RUPP)	RUPP (2007)	E	C, P	3, 6, 7, 8	11 core, 4 optional			X			X	X			
		Aman et al. (2009)	E	C, P, T	5, 8	11 core, 3 booster, 3 optional							X			
		Arnold et al. (2012)	E	C, P	5, 8	11 core, 3 booster, 2 home visits,3 optional	X				X		X			
		Farmer et al. (2012)	E	C, P	5, 8	11 core, 3 booster, 2 home visits, 3 optional	X						X			

Table 2 continued

Developed or Adapted for ASD	Specific EBI	Source	MH Target	End Target	Therapy Format	Number of Sessions	Implementation Factors									
							Strategy	Determinant	Acceptability	Adoption	Appropriateness	Feasibility	Fidelity	Implementation Cost	Penetration	Sustainability
		Bearss et al. (2013a)	E	C, P	5	11 core, 3 booster, 2 home visits, 3 optional	X	X	X				X			
		Bearss et al. (2013b)	E	C, P	3, 5, 8	11 core, 3 booster, 2 home visits, 3 optional			X				X			
		Bearss et al. (2015)	E	C, P	5, 8	11 core, 3 booster, 2 home visits, 3 optional	X	X	X			X	X			
		Handen et al. (2015)	E	C, P	5, 8	9 core			X				X			
		Bearss et al, (2018)	E	C, P	5	11 core, 3 booster, 2 home visits, 3 optional	X	X	X				X			
		Iadarola et al. (2018)	E	P	5, 8	11 core		X					X			
		Edwards et al. (2019)	E	C, P	6, 8	11 core, 1 booster	X		X				X			
		Burrel et al. (2020)	E	C, P	4, 5, 8	11 core, 1 optional, 1 booster			X			X	X			
	Riding the Rapids	Stuttard et al. (2014)	E	P	4, 8	10 core			X				X	X		
	Unstuck and On Target	Kenworthy et al. (2014)	T	C, P, T	2, 3, 8	28 core	X						X			
Adapted	Behavioral Interventions for Anxiety in Children with Autism (BIACA)	Wood et al. (2009)	I	C, P, T	1, 3, 8	16 core	X	X					X			
		Storch et al. (2013)	I	C, P	1, 3, 5, 7	16 core	X						X			
		Ehrenreich-May et al. (2014)	I	C, P	1, 3, 5, 7	16 core, 14 child modules, 12 parent modules	X						X			
		Storch et al. (2015)	I	C, P	1, 3, 5, 7	16 core	X						X			
		Wood et al. (2020)	I	C, P, T	1, 3, 8	16 core	X						X			
	Child-Centered Play Therapy (CCPT)	Schottelkorb et al. (2020)	E	C, P	1, 3	24 core child, 6 core parent	X		X				X			
	Cognitive Behavioral Therapy (CBT)	Sofronoff et al. (2005)	E, I	C, P	1, 3, 5, 8	6 core	X		X				X			

Table 2 continued

Developed or Adapted for ASD	Specific EBI	Source	MH Target	End Target	Therapy Format	Number of Sessions	Implementation Factors									
							Strategy	Determinant	Acceptability	Adoption	Appropriateness	Feasibility	Fidelity	Implementation Cost	Penetration	Sustainability
		Sofronoff et al. (2007)	E, I	C, P	2, 4, 8	6 core	X		X		X		X			
		Sung et al. (2011)	E, I	C	2, 7, 8	16 core							X			
		Cook et al. (2019)	I	C, P	3, 8	9 core, 1 booster				X						
		Swain et al. (2019)	E, I	C, P	2, 4, 6	9 core	X		X				X			
		McCrae et al. (2020)	O	C, P	5, 8	7 core	X		X			X				
		Cool Kids	Kilburn et al. (2020)	I	C, P	2, 4, 6, 8	10 core	X		X				X		
			Bischouf et al. (2018)	I	P	N/A	N/A			X		X				
	Coping Cat	Keehn et al. (2013)	I	C, P	1, 3, 8	16 core, 14 child modules, 12 parent modules						X	X			
	Discussing + Doing = Daring	Van Steensel et al. (2014)	I	C, P	1, 3, 5	15 core								X		
		Van Steensel et al. (2015)	I	C, P	1, 3, 5	23 core	X						X			
	Exploring Feelings	McConachie et al. (2014)	I	C, P	2, 4	7 core			X				X			
	Facing Your Fears (FYF)	Reaven et al. (2012b)	I	C, P	2, 4, 5	14 core, 1 booster	X	X	X							
		Reaven et al. (2012a)	I	C, P	2, 4, 6, 9	12 core			X				X			
		Reaven et al. (2015)	I	C, P	2, 4, 6, 8	14 core, 1 booster	X		X		X		X			
		Hepburn et al. (2016)	I	C, P	4, 6, 8	10 core	X	X	X		X	X	X			
		Drmic et al. (2017)	I	C, P	2, 4, 6, 8	10 core child online, 3 core parent	X	X	X			X				
		Keefer et al. (2017)	I	C, P	2, 4, 6, 8	15 core							X			

Table 2 continued

Developed or Adapted for ASD	Specific EBI	Source	MH Target	End Target	Therapy Format	Number of Sessions	Implementation Factors									
							Strategy	Determinant	Acceptability	Adoption	Appropriateness	Feasibility	Fidelity	Implementation Cost	Penetration	Sustainability
		Reaven et al. (2018)	I	C, P	2, 4, 6, 10	14 core	X						X			
		Walsh et al (2018)	I	C	2, 4, 6, 11	14 core	X		X							
		Meyer et al. (2020)	I	C, P	2, 4, 6, 8	14 core	X						X			
		Pickard et al. (2020)	I	C, P	2, 6, 8	14 core		X	X		X		X			X
		Solish et al. (2020)	I	C, P	6	14 core			X				X			
		Incredible Years (IY)	Dababnah et al. (2016)	E	P	4, 10	15 core		X	X		X		X		
			Dababnah et al. (2019)	E	P	4, 9	12–16 core		X	X						
			Williams et al. (2020)	E	C, P	3, 4, 8	12 core	X		X			X	X		
	Mindfulness-Based Positive Behavior Support (MBPBS)	Singh et al. (2019)	T	C	4	1 core							X			
		Singh et al. (2020)	T	C	4	3 core							X			
	Multimodal Anxiety and Social Skill Intervention (MASSI)	White et al. (2013)	I	C, P	1, 5, 6, 7	20 core	X		X			X	X			
		Maddox et al. (2017)	I	C, P	3, 5, 6, 7	19–20 core							X			
		Murphy et al. (2017)	I	C, P	2, 4	12 core parent, 1 optional booster parent, 5 core child	X		X				X			
	MYmind: Mindfulness training for Youngsters with ASD; Mindful Parenting	de Bruin et al. (2015)	T	C, P	1, 3, 5, 8	19 core	X		X		X					
		Ridderinkhof et al. (2018)	T	C, P	2, 3, 5, 8	19 core, 1 booster							X			
		Salem-Guirgis et al. (2019)	T	C, P	1, 3, 8	10 core	X		X			X	X			
	Parent Child Interaction Therapy (PCIT)	Ginn et al. (2017)	E	C, P	5, 8	8 core							X			
		Zlomke et al. (2017)	E	C, P	3, 5, 7, 8	11–22 core			X			X	X			

Table 2 continued

Developed or Adapted for ASD	Specific EBI	Source	MH Target	End Target	Therapy Format	Number of Sessions	Implementation Factors									
							Strategy	Determinant	Acceptability	Adoption	Appropriateness	Feasibility	Fidelity	Implementation Cost	Penetration	Sustainability
		Ros et al. (2019)	E	C, P	6, 8	8 core	X		X			X	X			
		Scudder et al. (2019)	E	C, P	5, 8	16 core			X				X			
		Parladé et al. (2020)	E	C, P	3, 5, 8	N/A	X						X			
		Zlomke et al. (2020)	E	C, P	3, 8	1 core	X		X							
	PBS	Durand et al. (2013)	E	P	3, 8	8 core	X		X				X			
	Post-Traumatic Stress Symptoms (PTSS)	Okuno et al. (2011)	E	P	4, 8	6 core	X				X		X			
	Predictive Parenting	Hallett et al. (2020)	E	P	4, 8	12 core			X			X				
	Resourceful Adolescent Program (RAP)	Mackay et al. (2017)	I	C	1, 8	11 core	X		X		X		X			
	Secret Agent Society: Operation Regulation (SAS:OR)	Weiss et al. (2018)	T	C, P	5, 8	10 core	X		X		X		X			
		Tajik-Parvinchi et al. (2020)	T	C, P	5	10 core							X			
	Special FRIENDS	Higgins et al. (2019)	I	C, P	2, 4	12 core, 2 booster		X	X		X					
	Positive Parenting Program (Triple P)	Hinton et al. (2017)	E	P	3, 7, 9	8 core online	X		X		X	X				
		Tellegen et al. (2014)	E	P	3, 9	4 core online			X				X			
		Zand et al. (2018)	E	P	3, 9	4 core online		X	X				X			

Therapy Format: 1 = Child-only individual, 2 = Child-only group, 3 = Parent-only individual, 4 = Parent-only group, 5 = Parent–Child individual, 6 = Parent–Child group, 7 = Modular/Flexible, 8 = Structured, 9 = Telehealth/Online; Mental Health (MH) Target: E = Externalizing, I = Internalizing, M = Mindfulness, T = Transdiagnostic, WM = Working Memory, PS = Parent Skills; End Target: C = Child, P = Parent, T = Teacher

Table 3 Nature, Types, and Level of Adaptations Specified

	All Adaptations n (%)	ASD-Specific Adaptations n (%)	Non-ASD Specific Adaptations n (%)
Interventions Specifying Adaptations	25 (64.1)	20 (51.3)	15 (38.5)
What is Adapted	N = 25	N = 20	N = 15
Content	27	20	7
Context	10	6	4
Training	2	0	2
Adaptation level			
Organization	–	–	12
Provider	–	–	3
Client	–	–	21
Types of Adaptations	N = 118	N = 96	N = 36
Total Adaptations	118 (100.0)	96 (100.0)	36 (100.0)
Tailoring	23 (19.5)	16 (16.7)	9 (25.0)
Adding Elements	52 (44.1)	49 (51.1)	14 (38.9)
Removing Sessions	7 (5.9)	2 (2.1)	5 (13.9)
Shortening Elements	6 (5.1)	2 (2.1)	4 (11.1)
Lengthening	9 (7.6)	9 (9.4)	0 (0.0)
Substituting Elements	0 (0.0)	1 (1.0)	0 (0.0)
Reordering	4 (3.4)	2 (2.1)	2 (5.6)
Integrating Another Approach	11 (9.3)	11 (11.5)	1 (2.8)
Integrating Into Another Approach	1 (0.8)	0 (0.0)	1 (2.8)
Repeating	2 (1.7)	2 (2.1)	0 (0.0)
Loosening	1 (0.8)	1 (1.0)	0 (0.0)
Departing/Drift	0 (0.0)	0 (0.0)	0 (0.0)
Other	2 (1.7)	2 (2.1)	0 (0.0)

These adaptations were examined at the intervention level (N = 39 Interventions) and coded applying the Stirman et al. (2013b, 2019) FRAME adaptations framework

specified context where the intervention was delivered, of which only 27 articles (32.5%) tested interventions in a community-based setting (versus private, research-lab, or other setting). More information regarding interventions can be found in Table 2.

Objective 2: Characterize the Nature and Type of Intervention Adaptations (Table 3)

Of the 39 included interventions, 25 interventions specified the nature of adaptations made (i.e. whether the adaptation was stated as specifically for ASD or not), with more frequent adaptations specifically for ASD (n = 20) than additional non-ASD specific adaptations (n = 15). Seven interventions (22.6%), BIACA (Wood et al., 2009), Facing Your Fears (Reaven et al., 2012a, 2012b), PCIT (Zisser & Eyberg, 2008), a Parent Training program (Barkley, 2013; Iwasaka et al., 2002), Triple P (Sanders, 1999), and two general CBT interventions, specified having made both types of adaptations. There was significant variation in the number and extent of adaptations specified. For example, some interventions specified both those specific for ASD and to improve innovation fit, whereas others reported a smaller number of adaptations only pertaining to ASD. On average, a range of 0–13 (Mean = 2.46, SD = 3.29) and 0–14 (Mean = 1.08; SD = 2.52) of ASD specific and non-ASD specific adaptations were described for each intervention, respectively. No frameworks to inform adaptations or modifications were reported. See Table 3 for full adaptation results.

Adaptations Specifically for ASD

Eleven types of adaptations specific to ASD were specified across 20 interventions specifying adaptations for ASD. All pertained to the intervention content with some also related to the context or how of intervention delivery; none were related to how providers were trained or evaluated. Adding elements and tailoring or refining were most frequent. Elements added included incorporating parent involvement or parent-specific elements, visuals and visual supports, special interests, reinforcers, and session schedules or

agendas. Tailoring or refinement adaptations included making sessions more structured, altering session focus or emphasis to address patterns of strengths and weaknesses associated with ASD, using more concrete or simplified language, and tailoring to the developmental or functioning level of the individual. The integration of other approaches primarily pertained to the addition of social skills modules or social stories. Related to context, the primary adaptation pertained to the delivery format, such as changing from group to individual, and setting, such as delivering in primary care or via telehealth in order to increase engagement and/or access to the intervention. There were no significant differences between the number and nature of ASD-specific adaptations between articles conducting efficacy or effectiveness trials.

Additional Non-ASD Adaptations

Across the 15 interventions specifying general, non-ASD specific modifications, the majority pertained to the content of the intervention, with fewer related to context (how the intervention is delivered) and training (how providers are trained or evaluated). Similar to ASD-specific adaptations, adding elements and tailoring or refining were most frequent. The reason for these adaptations most frequently pertained to improving fit with the end user (child and/or family functioning), such as adding parent engagement or parent-oriented components, or adding topic specific strategies or materials (e.g. psychoeducation, emotion regulation). Those pertaining to fit with the organization included shortening the total number and/or length of sessions or changing the requirements to progress through session content to meet the realities of the agency. Those pertaining to the provider included incorporating variable training formats to aid provider learning. Similar to ASD-specific adaptations, there were no significant differences between the number and nature of non-ASD adaptations between articles conducting efficacy or effectiveness trials.

Objective 3: Describe the Types of Implementation Strategies and Outcomes Described (Tables 4 and 5)

In terms of implementation factors, only three articles (3.6%) specified applying implementation frameworks or theories in any capacity (e.g. to guide study design, outcome specification, or data analysis or interpretation). These studies used the Dynamic Sustainability Framework (Chambers et al., 2013) and Beidas and Kendall's (2010, 2011) models and best practice recommendations surrounding provider training in evidence-based practices. We applied the Powell et al., (2012, 2015) compilation of implementation strategies to examine and code implementation strategies described either explicitly or implicitly. Approximately half of the articles described, either explicitly or implicitly, using a type of

Table 4 Implementation Strategies and Determinants Specified

	n (%)
Implementation Strategies	
Articles Indicated	44 (53.0)
Type	
Clinical Supervision	30 (68.2)
Ongoing Consultation	10 (22.7)
Quality Monitoring	6 (13.6)
Audit and Feedback	3 (6.8)
Change Service Site	2 (4.5)
Develop Educational Materials	2 (4.5)
Promote Adaptability	2 (4.5)
Capture Local Knowledge	1 (2.3)
Obtain Consumer Feedback	1 (2.3)
Implementation Determinants	n (%)
Articles Indicated	16 (19.3)
Determinant Level	
Organization	8 (13.6)
Provider	6 (7.2)
End User	9 (10.1)
Innovation	9 (10.1)
Barrier	
Session Attendance/Scheduling Constraints	6 (37.5)
Parent and/or Child Buy-In	5 (31.3)
Child Exclusion Criteria/Poor Innovation Match	2 (12.5)
Technical Difficulties	4 (25.0)
Provider Training and Knowledge	4 (28.5)
Staffing and Funding Constraints	4 (25.0)
Space Availability	2 (12.5)
Parent Functioning & Competing Demands	2 (12.5)
Resource Incompatibility	3 (18.8)
Facilitator	
Research Team Support	2 (12.5)
EBP Adaptability	3(18.8)
Flexibility of Session Scheduling	2 (12.5)
Stakeholder Support	1 (6.3)
Resource Availability	1 (6.3)
Appropriate Recruitment	1 (6.3)
Provider Training	1 (6.3)
Parental Stress	1 (6.3)

Implementation strategies were coded applying the Powell et al. (2012, 2015) taxonomy of implementation strategies

Table 5 Implementation Outcomes and Associated Methodologies

Implementation Outcomes Types	n (%)	Method			
		Survey/Questionnaire n (%)	Qualitative n (%)	Administrative Data n (%)	Observed/Objective n (%)
Adoption	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Acceptability	55 (66.3)	40 (48.2)	13 (15.7)	0 (0.0)	21 (25.3)
Appropriateness	18 (21.7)	9 (10.8)	8 (9.6)	0 (0.0)	1 (1.2)
Feasibility	12 (14.5)	7 (8.4)	2 (2.4)	0 (0.0)	8 (9.6)
Fidelity	65 (78.3)	21 (25.3)	0 (0.0)	0 (0)	50 (60.2)
Implementation Cost	4 (4.8)	1 (1.2)	0 (0.0)	1 (1.2)	2 (2.4)
Penetration	0 (0.0)	0 (0.0)	0 (0.0)	0 (0)	0 (0.0)
Sustainability	1 (1.2)	1 (1.2)	0 (0.0)	0 (0)	0 (0.0)

Implementation strategies were coded applying the Proctor et al. (2011) taxonomy of implementation outcomes

implementation strategy to aid in training and use of the interventions tested. Articles described a range of 1–7 strategies (Mean = 0.71; SD = 0.97). As can be seen in Table 4, clinical supervision and ongoing expert consultation were described as the most frequently used strategies, although seven additional strategies were judged to be utilized. Implementation determinants (i.e. barriers/facilitators) were described in 16 (19.3%) articles spanning the organizational, provider, end-user or client, and innovation levels. Seven articles (7.9%) described determinants at multiple levels. Across articles discussing determinants, barriers were most frequently specified and primarily pertained to limited participant "buy-in" (e.g. parent or child interest or buy-in), session attendance or scheduling constraints (e.g. schedule conflicts, transportation issues), limited provider training and knowledge (e.g. lack of provider knowledge, varying experience of providers trained), and technical difficulties for telehealth delivered interventions. Facilitators were less frequently specified and included ongoing research team support (e.g. real-time coaching and support, ongoing consultation to discuss barriers), flexibility of session scheduling (e.g. online sessions available anytime), and EBI adaptability (e.g. extending program length based on needs or feedback). There were no significant differences between articles conducting efficacy or effectiveness trials in terms of implementation strategy and determinant specification, number utilized, or type.

Using Proctor et al.'s (2011) implementation outcome taxonomy, we coded and examined implementation outcomes described either explicitly or implicitly. Provider fidelity was the most frequently reported implementation outcome examined using objective or observationally-based (e.g. observationally coded by research staff member) or survey-based (e.g. provider self-report) measurement methods. Acceptability was also reported in more than half of articles, using a satisfaction questionnaire, qualitative interview or open-ended survey questions, and/or observational or objective methods of measurement (e.g. treatment completion, attendance). Appropriateness and feasibility were also frequently examined, primarily using quantitative (e.g. caregiver- or provider-report usefulness survey) and/or objective (e.g. parent homework compliance, session completion) methods to do so. Finally, only one article examined sustainability and three articles examined implementation cost; these articles used questionnaire or survey, objective and/or administrative data methods to do so (e.g. estimated hospital stay or intervention delivery cost). No articles examined adoption or penetration. A range of 1–4 outcomes (Mean = 1.8, SD = 0.8) were examined per article. Finally, our results suggest there were no significant differences between the number of implementation outcomes reported within articles conducting effectiveness studies (Mean = 1.87) versus efficacy (Mean = 1.87) or differences in the types of outcomes reported. See Table 5 for full information on implementation outcomes and measurement methods. The supplemental table includes also information regarding implementation outcomes and types of adaptations.

Discussion

This systematic review examined the existing research testing mental health interventions for youth with ASD that included implementation factors in analyses. An additional aim was to characterize the implementation strategies, outcomes, and determinants reported in interventions studies to inform the translation of these adapted interventions to community service settings. The results highlight variability in the types of interventions examined as well as the nature and types of adaptations, and

implementation strategies and outcomes examined. Overall, these results highlight the importance of examining these key implementation efforts to inform further EBI translation efforts.

Intervention Information

Interventions specifically adapted for use with youth with ASD were more common than those developed to specifically to treat co-occurring mental health problems in ASD. Consistent with prior reviews examining mental health interventions for ASD (e.g. Keefer et al., 2018; Lake et al., 2020), the primary mental health problems or conditions targeted were internalizing problems (primarily anxiety) and challenging behaviors. Interventions *developed specifically for ASD* more frequently targeted externalizing or transdiagnostic problems, such as challenging behaviors, compared to those *adapted for ASD*, where anxiety was more frequently targeted. A large focus on including both parents and children was included in both types of interventions. This predominant focus on disruptive and anxiety disorders is understandable given the high rates of these problems among youth with ASD, especially among those presenting for community mental health services (Brookman-Frazee et al., 2012b, 2017; Jang et al., 2010; Lai et al., 2019). It also represents an important step towards better meeting the significant mental health needs of youth with ASD. However, the majority of these youth experience multiple mental health problems and meet criteria for more than one co-occurring mental health condition, including many other mental health conditions, such as ADHD, depression, and trauma-related disorders (Brookman-Frazee et al., 2017; Joshi et al., 2010). As the results of the current review suggest, there is a lack of interventions specifically targeting the range of mental health problems seen among this population, including problems with attention, mood or depression, and trauma. Fortunately, and as we observed, there are a growing number of interventions focusing on key transdiagnostic problems or factors, such as increasing mindfulness and improving executive functioning. This move towards transdiagnostic interventions may be especially helpful in addressing mental health conditions in youth with ASD.

Intervention Adaptations

Many interventions reviewed reported adapting existing mental health EBIs for use with ASD. CBT, CBT-based, and behavioral parent training interventions were the most frequently adapted EBIs, which is similarly reflected by these approaches' large representation within the broader children's mental health services literature, including those specifically pertaining to ASD (Keefer et al., 2018; Lake et al., 2020). ASD-specific adaptations were more common than general adaptations, with the most common goal or intent of adaptations to tailor for ASD characteristics. The two most common types of adaptations were augmenting or adding elements and tailoring or refining elements. Elements added included parent involvement and ASD-specific strategies to increase engagement (e.g. adding visuals, incorporating special interests). Tailoring elements centered around altering session focus or structure to align with functioning level or particular characteristics of the individual. These findings are consistent with the broader research applying the FRAME framework to examine community therapists' adaptations to EBIs delivered in mental health services (Aarons et al., 2012; Dyson et al., 2018; Lau et al., 2017; Stirman, et al., 2013a). Specifically, therapists report frequent adaptations of mental health interventions developed for children with ASD to better meet child and caregiver functioning or presentation during the course of community implementation (Dyson et al., 2018). Planned adaptations, such as those examined in the current review, are most frequently aimed to address unique patient characteristics and improve the impact on such patients (Stirman et al., 2017). The emphasis on adding and tailoring elements is consistent with recent reviews noting modification trends to mental health interventions for increasing applicability for youth with ASD (Moree & Davis, 2010; White et al., 2018). In addition to the presence of ASD-specific symptoms, unique and complex presentations of mental health symptoms are common, which can present challenges necessitating components or strategies aimed at improving client engagement, progress, and outcomes.

The current findings characterizing intervention adaptations across both efficacy and effectiveness trials add to the existing literature examining how community therapists adapt existing interventions during delivery in community care. Specifically, the frequent shortening and removing of elements, and integration with other components are similar to type of adaptations to mental health EBIs observed in community settings (Lau et al., 2017; Stirman et al., 2017). The rationale for these adaptations may be based on the service context features of community mental health. For example, service caps restricting the number of sessions available for youth are common in community-based service settings, likely requiring more frequent shortening or condensing of sessions and content. We did not observe significant differences in the number or nature of adaptations between efficacy and effectiveness studies. This lack of differences between the two contexts suggest that common adaptations are more focused on improving fit with the heterogeneous and/or complex needs of youth with ASD versus tailoring to the service setting. Taken together, our results highlight the importance of continued

examination and characterization of adaptations to mental health interventions for ASD, especially within the context of effectiveness and community implementation trials, where adaptations are central to maximizing EBI fit to meet child, family, and community needs.

Implementation Determinants, Strategies, and Outcomes

A strength of the current study is its examination of implementation factors in both community implementation and non-implementation studies, such as efficacy studies, where implementation factors are not necessarily explicitly examined or reported. Characterization across both types of studies has the potential to accelerate our current understanding of how to best translate EBIs to community care. A number of implementation factors (implementation strategies, outcomes, and/or determinants) were described across efficacy and effectiveness studies. Several implementation determinants were specified, including those pertaining to the intervention itself (e.g. EBI flexibility or adaptability), the end user or target characteristics, organizational factors (e.g. stakeholder and/or leader buy-in, funding constraints and resources), as well as characteristics of the team (e.g. research team support), that are consistent with larger literature examining implementation influences, including those within community implementation trials (Brookman-Frazee et al., 2020a, 2020c; Cochrane et al., 2007).

Applying the Powell et al., (2012, 2015) compilation, we observed more frequent specification of implementation strategies primarily pertaining to ongoing consultation and clinical supervision. The larger focus on consultation and supervision is not surprising given the specific focus on studies testing interventions. It is also consistent with a recent review noting the frequency and importance of comprehensive and ongoing trainings in supporting mental health EBI implementation (Powell et al., 2014). Although we observed a limited specification of frameworks and strategies, it is possible that both were used more frequently or thoroughly but simply not specified or reported. Additionally, the predominance of efficacy study designs may have precluded their use and/or specification. Fortunately, recently developed guidelines and pragmatic methods will aid the reporting of implementation strategy use in both efficacy and effectiveness trials in future intervention and implementation efforts (Rudd et al., 2020).

Using the Proctor et al. taxonomy (2011), the reviewed studies described a range of implementation outcomes. There was a primary focus on provider fidelity, which is consistent with the large representation of efficacy studies included in the current review. Acceptability, appropriateness, and feasibility were also frequently examined, with only limited examination of implementation cost and sustainability. None of the studies considered adoption, or penetration, consistent with a recent review of CBT trials for youth with ASD (Lake et al., 2020). While the range of outcomes examined is promising, enhanced attention to and consideration of the range of implementation outcomes is warranted, especially for supporting the translation of these interventions to routine care. For example, sustainability or ongoing use of an EBI in routine practice is the ultimate goal of intervention research and necessary to assure continued provision of quality care. However, there is often limited attention to or measurement of these outcomes in the literature (Stirman et al., 2012). Further, implementation cost and cost effectiveness are key considerations for community-based service settings who often face limited resources. It is also an important consideration in terms of further EBI refinement or adaptation given the potential of adaptations targeting increased cost effectiveness to community exploration and adoption. Again, considerations of these outcomes may be especially important for ASD given the potential to address the significant care service needs and associated costs among youth with ASD (Bui et al., 2016; Leigh & Du, 2015). The general lack of differences in implementation outcomes between efficacy and effectiveness trials is promising given the importance of considering such factors across throughout the translation pipeline, from early development and testing of interventions to the examination in community settings. Finally, the nature of adaptations within the context of specific adaptations reported indicate no clear link between the variety of adaptations reported and outcomes specified. For example, in articles examining acceptability, most studies reported high acceptability, despite the varying range of adaptations specified (see Supplemental Table). This highlights the need for future work directly testing the impact of adaptations on implementation outcomes.

Our results suggest that use of frameworks to guide adaptation and testing of mental health interventions for ASD is limited, which is also likely related to the greater number of efficacy versus effectiveness trials included in the current review. Interestingly, this limited use is consistent with broader literature citing a need for increased comprehensive framework application and implementation strategy reporting, inclusive of community effectiveness and implementation trials (Moullin et al., 2019; Proctor et al., 2013). In addition to their critical role in the development, conduction, and evaluation of research, frameworks provide a shared language and underlying theory that greatly facilitates the translation and generalization of research findings, including translation into practice as well as across interventions, health foci and fields. Relatedly,

implementation strategies are the necessary "how to" component enabling the successful translation of research findings (Proctor et al., 2013). Comprehensive integration of frameworks and strategy specification may be especially critical for the development, testing, and translation of mental health interventions for ASD in community service settings. Fortunately, there has been a recent increase in the availability of practical tools for aiding in this specification of implementation strategies (Moullin et al., 2020; Proctor et al., 2013) as well as relevant projects utilizing and testing these methods (e.g. Brookman-Frazee & Stahmer, 2018; Pellecchia et al., 2016) that will be critical to informing future work aiming to do so.

Clinical and Community Implementation Implications

Findings from the current review have several implications for the treatment of youth with ASD, especially within the context of community mental health services. First, the consistency observed regarding the type and nature of adaptations across the two types of adaptions examined in the current review, as well as the broader literature, has immense implications for services for youth with ASD in settings where they represent clinically challenging populations, such as mental health services. It also has implications for the treatment of co-occurring conditions in the absence of established interventions designed or tested for ASD, such as those targeting depression or trauma. In terms of intervention content, our adaptation results indicated high frequency of adding or incorporating components targeting parent involvement and ASD-specific characteristics suggesting these as important factors in mental health services for youth with ASD, although this was not directly examined in the current review. The importance of parent involvement is supported by the wealth of literature identifying parent engagement as a key quality indicator directly tied to improved outcomes of children's mental health services (Becker et al., 2018; Gopalan et al., 2010; Haine-Schlagel & Walsh, 2015), including those for ASD (Brookman-Frazee et al., 2020b, 2020c; Dickson et al., 2020a, 2020b). At the provider level, this could include incorporation of supports or guidance for adapting interventions for ASD in a way that is consistent with the function and/or goals of the interventions.

This study represents one of the first efforts to apply existing theories and frameworks characterizing implementation factors and adaptations to the growing literature testing mental health interventions for youth with ASD. This is a critical step given widespread calls for prioritization and increased efforts to address the co-occurring mental health needs in youth with ASD and implementation of these interventions in community settings. An examination of the efficacy and/or effectiveness of mental health interventions for youth with ASD was not a focus of the current work given the growing number of recent reviews on this topic (see Keefer et al., 2018; Weston et al., 2016; White et al., 2018). Given the specific focus on mental health interventions and corresponding search terms to achieve this aim, it is possible that some work testing empirically-supported interventions (e.g. applied behavior analysis) effective in addressing relevant behaviors (e.g. challenging behaviors) but do not include these as an explicit primary target or focus are largely used in other service setting contexts are not represented. Further work examining differences in outcomes based on different types of adaptations and implementation studies is needed to add to our knowledge regarding the importance of EBI adaptations in optimizing outcomes, especially within the context of community implementation. The current study is also limited by focus on articles including an analysis of implementation factors and adaptations as they were reported or determined. Thus, it is possible further implementation factors and adaptations were considered but not clearly specified. Furthermore, many of these studies represent earlier phases of the research to community practice translation pipeline, and thus exclude these considerations. However, they point to a number of key multilevel determinants and strategies that may be critical to the uptake and ongoing use of EBIs in community service settings, including those pertaining to the flexibility or adaptability of EBIs, infrastructure, and resources and support surrounding training and ongoing consultation. They also highlight the need for further evaluation of a range of implementation outcomes across the translation pipeline. Given the growing use and evidence supporting hybrid effectiveness-implementation designs, which include both effectiveness and implementation components, consideration of these factors is critical to efficiently increasing access to EBIs in the community. Additionally, further specification regarding adaptations, strategies, and implementation outcomes will inform our field and aid efforts to translation and scale-up of mental health interventions for this high priority population of youth with ASD.

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