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REVIEW

Neurodiversity in Practice: a Conceptual Model of Autistic Strengths and Potential Mechanisms of Change to Support Positive Mental Health and Wellbeing in Autistic Children and Adolescents

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Abstract

Objectives Neurodiversity affirming frameworks are a paradigm shift from a deficit-focused approach to autism to recognizing autism as a heterogeneous constellation of differences in abilities and strengths. This article completed a literature review and data synthesis to (1) identify autistic strengths used in the design of psychosocial interventions, (2) propose mechanisms of change that explain strength-based psychosocial intervention effects on mental health and wellbeing outcomes, and (3) integrate findings in a conceptual model for testing in future research studies.

Methods A search for articles was completed in June 2023 and resulted in 24 articles that met the inclusion criteria. The Distillation and Matching Model methods were used to code articles and subsequent conceptual groupings generated categorical domains included in the conceptual model.

Results Autistic strengths identified in the design of psychosocial interventions were grouped into four domains: (1) perceptual, (2) reasoning, (3) expertise, and (4) character strengths. Mechanisms of change were grouped into four domains: (1) affective, (2) behavioral, (3) cognitive, and (4) physiological. The resulting conceptual model presents autistic strengths that can be leveraged in psychosocial interventions and potential mechanisms of change that explain intervention effects on mental health and wellbeing.

Conclusions Growing focus on the translation of positive psychology has resulted in strength-based psychosocial intervention programs. However, intervention strategies have not leveraged the diverse array of autistic strengths identified by autistic individuals, their families, and their communities. Furthermore, research is needed to determine mechanistic paths by which strength-based interventions achieve positive effects on mental health outcomes in autistic children and adolescents.

Keywords Autism · Neurodiversity · Strengths · Mental Health · Wellbeing

The DSM-5 diagnostic category, autism spectrum disorders (ASD), refers to a group of neurodevelopmental disorders characterized by differences in communication, socialization, and repetitive or restricted patterns of behaviors, interests, or activities (American Psychiatric Association, 2013; Newschaffer et al., 2007). ASD has a global prevalence rate estimated to be between 0.7 and 1.5%, with the CDC reporting an increase in ASD in the USA of 1 in 54 individuals (Baird et al., 2006; Fombonne, 2009; Knopf, 2020; Lyall et al., 2017; Richler et al., 2006). The name of the DSM-5 category, classifying autism as a disorder, has precipitated alignment with a deficit-focused framework in much research and practice discussions. More recently, scholars have argued that autism should not be conceptualized as a disorder, but rather a difference reflecting natural variation in brains, or, as Johnson (2017) wrote, "an adaptive common variant pathway of human functional brain development" (Johnson, 2017; Lai et al., 2015). How autism is defined has important implications for research and practice. Conceptualized as a disease, autism should be treated and/or cured; conceptualized as a disability, autism needs

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should be accommodated; conceptualized as a neurological difference, autism should be embraced as part of human diversity (Cascio, 2018; Eyal et al., 2014). For these reasons, support has grown to redefine ASD as autism spectrum conditions (ASC) to highlight heterogeneity in presentation that includes both challenges and strengths associated with autism. We will use the term "autism" to refer to ASD or ASC in this review.

Evidence from developmental neuroscience indicates that autistic brains differ from neurotypical brains in the structural and functional patterns of development (Tang et al., 2014). These differences are most often characterized in comparison to typically developing (TD) children to highlight differentiation; however, there is little evidence to support that these differences are necessarily dysfunctional or disordered; rather, these differences are reflective of unique adaptive responses to structural differences in brain development (Johnson, 2017). Common strengths of autistic children cited in literature include excellent memory skills, attention to detail, motivation to recognize patterns, visual learning, analytical proficiency, creative thinking, sensory acuity, and a strong sense of justice/fairness, and hyper-systemizing (Baron-Cohen, 2006; Chamak et al., 2008; Craig & Baron-Cohen, 1999; Dawson & Mottron, 2009; Mottron et al., 2013; Mottron et al., 2014; Russell et al., 2019). In studies examining self-reported strengths by autistic adults, participants identified authenticity, fairness, humor, and open mindedness as top strengths (Kirchner et al., 2016; Samson & Antonelli, 2013). In another study with caregivers and siblings, kindness and humor were identified as strengths (Colavita et al., 2014).

Despite these strengths, autistic children and adolescents are at profound risk for mental health disorders and victimization. Studies estimate risk for attempting and death by suicide is more than three times higher for autistic individuals in comparison to non-autistic individuals and 8.5 times higher for autistic girls; 78% of all autistic people experience at least one occurrence of sexual victimization, the majority of which occur before age 15 (Hodgetts et al., 2015; Kogan et al., 2008; Milton & Sims, 2016; Vohra et al., 2017). Empirical evidence shows that comorbidity with epilepsy, attention problems, anxiety, depression, sensory processing disorder, sleeping disorders, and feeding disorders is common in autistic individuals (Ben-Sasson et al., 2009; Hodgetts et al., 2015; Kogan et al., 2008; Vohra et al., 2017). In one study, 50% of parents described their autistic children as having more than four comorbid problems (Mannion et al., 2013). Anxiety and depression are the most common comorbid mood disorders associated with autism (Lugnegård et al., 2012; Mazzone et al., 2012; White et al., 2009). Depression in autistic early adolescents are estimated to be as high as 54% (Mayes et al., 2011). Autistic females have higher rates of comorbid conditions including anxiety, depression, and eating disorders (Rynkiewicz & Łucka, 2018).

Autistic adults have argued that a driving cause of these tragic statistics is a historical precedence of deficit-focused models and stigma that motivate autistic individuals to mask or pretend to appear neurotypical in an inauthentic way. Masking or camouflaging autistic traits has been associated with diminished self-perception, autonomy, esteem, hope for the future, and extinguishment of specialized skills and passions (Hodgetts et al., 2015; Kogan et al., 2008; Milton & Sims, 2016; Vohra et al., 2017). Strength-based approaches have been shown to promote wellbeing and reduce depression and anxiety in non-autistic populations (Schutte & Malouff, 2019), and evidence suggests that strength-based approaches promote wellbeing, mental health, and quality of life in autistic populations (Courchesne et al., 2015; Dykshoorn & Cormier, 2019; Huntley et al., 2019).

In contrast to deficit-focused treatment approaches, strength-based interventions are strategies that identify and build on strengths and skills of autistic individuals. Strength-based approaches can simultaneously address systemic issues that harm mental health, including reducing negative stereotypes and biases, and shifting attitudes that reduce stigma and promote inclusion. Positive psychology as a field has grown in response to recognition that psychosocial interventions have historically focused on reduction of risk factors for psychopathology, instead of psychosocial interventions to promote protective factors that allow individuals to thrive (Seligman & Csikszentmihalyi, 2000).

Positive psychology also promotes a more holistic view of functioning that highlights how strengths can support functioning and lead to more favorable outcomes in the near term (e.g., self-perception and self-determination) and long term (e.g., educational attainment and employment-related outcomes) (Linley & Joseph, 2011; Lopez et al., 2018; Seligman & Csikszentmihalyi, 2000). Positive psychology has informed the design of psychosocial interventions to reduce mental health disorders, and to promote mental wellbeing. Mental wellbeing extends mental health to include more than the alleviation of emotional suffering, and instead seeks to promote happiness and a life that is enriched with positive emotion, feeling seen and accepted, demonstrating courage, perseverance, creativity, curiosity, and holding a positive outlook for the future (Diener et al., 2002; Lee Duckworth et al., 2005; Seligman et al., 2005).

While historically autism intervention approaches have focused on addressing deficits and inabilities, however, a new movement led by autistic individuals and advocates suggests a neurodiversity framework that shifts conceptualization of autism to being characterized as a heterogenous presentation of differences in abilities and strengths. Instead of seeking to classify autistic traits as either strengths or deficits, researchers have begun to conceptualize a relational

model between perceived strengths and deficits (Baron-Cohen et al., 2011). Application of Bronfenbrenner's (1986) ecological systems theory of child development is useful to consider how different levels of intervention, or lack thereof, may explain patterns of development. The microsystem level includes the interactions the child has with their immediate environment including parents, siblings, teachers, and peers. For example, if autistic children have strong, nurturing relationships with caregivers that recognize and support their needs, changes in parental attachment and family functioning are likely to be associated with improved mental health outcomes. The mesosystem level compasses interactions between a child's microsystems. For example, strong parent-teacher communication and relationships could have positive effects on the child's development, academic achievement, and ability to reach career goals (Stadnick et al., 2015). The ecosystem level incorporates formal and informal social systems that may influence micro- and mesosystems. For example, neighborhood and school climate, social media, and workplace cultures of caregivers are external to the child but may influence mental health (e.g., caregiver work-related stress, exposure to violence, representations of autistic persons in social media). The macrosystem level considers cultural factors that affect child development such as socioeconomic status, religion, and poverty. For example, cultural context can influence autistic individual's beliefs and perceptions about their own life and may shape the ways they are treated by others.

More recently, scholars have argued that a generic approach to delivering treatment to autistic individuals may lead to the elimination of autistic strengths (Baron-Cohen et al., 2011; Happé, 2018). A focus on deficits in function that are ill-timed to patterns of brain development observed in autistic children, could potentially draw developmental resources from the adaptive neurological patterns the autistic brain is seeking to invest resources, without consideration for whether these perceived deficits are adaptive responses of the autistic brain (Dawson et al., 2010; Lyness et al., 2013). This perspective is supported by case analyses that have shown that treatment that was effective in building functional behaviors also resulted in loss of specialized skills and passions such as exceptional drawing skills, or exemplary auditory discrimination (Eigsti & Fein, 2013). Research with autistic adults has emphasized the situational importance of whether traits are advantageous or disadvantageous in different contexts (Russell et al., 2019; Yafai et al., 2014). Autistic abilities and strengths are tied to social ecological contexts so that differences may present as a disability in certain environments but may not be viewed as a disability in others (de Leeuw et al., 2020; Donohue et al., 2019; Mandell & Novak, 2005; Norbury & Sparks, 2013). For example, limited eye contact may be concerning in cultural contexts where eye contact is expected in social interactions, but in other contexts, eye contact may be unexpected or even perceived as disrespectful (Bernier et al., 2010; Bornstein, 2013; Smith et al., 2017; Zhang et al., 2006). A shift towards neurodiversity affirming norms can facilitate new perspectives that recognize and integrate autistic strengths in intervention programming.

To advance strength-based intervention effects, it is critical to understand the mechanistic pathways through which interventions achieve their effects. Mechanisms of change refer to the specific causal mediators or moderators that explain observed effects of the intervention (Lerner et al., 2022). For example, a growing body of work has identified self-determination as a modifiable factor leading to better mental health and wellbeing outcomes among individuals with developmental disabilities (Wehmeyer et al., 2017). Self-determination may be a potent mechanistic path to improved outcomes and has been supported through autonomy supportive intervention approaches to amplify intrinsic motivation (Wehmeyer et al., 2017).

Although nascent, considerably more research has been completed in non-autistic populations to examine specific mechanisms of change from strength-based interventions to mental health outcomes. Evidence is growing that affective, behavioral, cognitive, and physiological mechanisms of change explain intervention effects on mental health outcomes (e.g., internalizing symptoms, externalizing symptoms, resilience, optimism). Evidence suggests affective mechanisms of change (Annan et al., 2017; Cherewick et al., 2023b; Cherewick et al., 2021; Keliat et al., 2019; Kumpfer et al., 2010; Lynch et al., 2021; Pathare et al., 2020; Pine et al., 2001), behavioral mechanisms of change (Annan et al., 2017; Cherewick et al., 2023a; Cherewick et al., 2016; Cherewick et al., 2023b; Cherewick et al., 2021; Cherewick et al., 2022; Keliat et al., 2019; Kumpfer et al., 2010; La Greca & Harrison, 2005; Lynch et al., 2021; Malti & Noam, 2009; Pathare et al., 2020; Patten et al., 2013; Stadnick et al., 2015; Szatmari et al., 2021), cognitive mechanisms of change (Ames et al., 2015; Annan et al., 2017; Cherewick et al., 2021; Cherewick et al., 2022; Keliat et al., 2019; Kumpfer et al., 2010; Lynch et al., 2021; Pathare et al., 2020; Wehmeyer et al., 2017), and physiological mechanisms of change (Cascio et al., 2014; Clements et al., 2022; Fredrickson & Levenson, 1998; Greenough et al., 1987; Kohls et al., 2018; McLaughlin & Gabard-Durnam, 2022; Whelan et al., 2022).

In this article, we propose mechanisms of change of strength-based interventions for autistic individuals for future testing that is needed to advance the field of strength-based intervention programming for autistic children and adolescents. Inclusion of mechanisms of change in conceptual models of strength-based intervention programming is needed to generate innovative and effective psychosocial

interventions (Ehrenreich-May & Chu, 2013). The primary objective of this article was to complete a literature review to identify autistic strengths used in the design of psychosocial interventions. A secondary objective was to identify and propose mechanisms of change that explain strength-based psychosocial intervention effects on mental health and wellbeing outcomes. The final objective was to integrate findings in a conceptual model identifying potential pathways between autistic strengths, mechanisms of change, and mental health and wellbeing outcomes for testing in future research studies.

Methods

Search Strategy The primary search strategy was designed with assistance from a health sciences librarian at University of Colorado Anschutz Strauss Medical Libraries to search the following: (1) Medical Subject Headings (MeSH) terms for autism spectrum disorder, (2) MeSH terms for child OR adolescent, (3) strength-based psychosocial intervention studies. The search was completed on January 5th, 2023. The following search was completed in the database: MEDLINE ALL (Ovid, 1946 to date before search date); Embase (Embase.com 1974 to search date) on July 30th, 2023 (Table 1).

Inclusion and Exclusion Criteria The inclusion criteria included the following: (1) target population was autistic children or adolescents (defined as ages 0–19); (2) strength-based psychosocial intervention; and (3) were published in English up until June 30th, 2023. Strength-based psychosocial interventions were defined as "interpersonal or informational activities, techniques, or strategies that target biological, behavioral, cognitive, emotional, interpersonal, social, or environmental factors" by leveraging positive strengths with the aim of improving mental wellbeing. Studies were excluded if they did not meet the inclusion criteria.

Sources of Evidence After completing the search, 30 citations were retrieved. Duplicates were removed. After screening titles/abstracts, 14 articles were excluded for not meeting the inclusion/exclusion criteria. We identified an additional 13 sources through bibliography scans of included references, resulting in a total sample size of 29 articles included in full-text review coding. A secondary review of commentaries, editorials, and opinion pieces was completed to inform the theoretical development and conceptual groupings of the conceptual model. Last, we searched for systematic reviews identifying protective mechanisms of change from psychosocial interventions to mental health outcomes in children and adolescents (autistic and non-autistic populations) to generate a comprehensive list of empirically supported mechanisms of change (Committee on Developing Evidence-Based Standards for Psychosocial Interventions for Mental et al., 2015).

Data Synthesis A database was created to allow for extraction of data from each research article. We applied the Distillation and Matching Model (DMM) methods to identify autistic strengths integrated in the design of the identified studies, and mechanisms of change (Chorpita et al., 2005; Chorpita & Daleiden, 2009). The DMM uses frequency patterns to guide empirical construction of a distillation tree that organizes empirical findings into categorical domains and was designed to (1) generate a model of intervention approaches with positive outcomes, (2) support learning of relationships between intervention designs, and mediating or modifying variables, and (3) facilitate hypothesis generation for future testing (Chorpita et al., 2005; Chorpita & Daleiden, 2009). First, the authors defined the search strategy of the literature reviewed. Second, they defined autistic strengths as explicit consideration of strengths used

Table 1 Search strategy terms

Category	Search terms	Search fields
Condition	Autis*, Aspberger*, neurodisabilit*	Title or abstract
Age	Adolescen*, teen*, youth*, young people, young adult, early adulthood, schoolchild, child*, kid*, juvenile*, toddler*, minor*, pediatric*, boy*, girl*	Title or abstract
Psychosocial intervention	Mental health services, psychotherapy, community mental health services, psychological techniques, social work, social support, self-help, primary prevention, secondary prevention, tertiary prevention, mental hygiene services, psychosocial support system, psych*, psychosocial, counseling, intervention, therapy, psychoeducation, structured activities	Anywhere in article
Strength-based	Strength-based, positive psychology	Anywhere in article

in intervention design. Third, they defined mechanisms of change as any variable evaluated that was shown to have been associated with a measured mental health and wellbeing outcome. MC completed initial coding using ATLAS.ti to identify in vivo strength-based terms used and mechanisms of change relevant to the study objectives. Next, frequency counts of in vivo codes were summarized in a code book. MC and MM discussed codes and frequencies and grouped codes together that were conceptually similar. The resulting categorical domains were assigned labels (Table 2).

Strengths identified in the design of psychosocial interventions were grouped into four domains: (1) perceptual, (2) reasoning, (3) expertise, and (4) character strengths. Mechanisms of change were conceptually grouped into four domains: (1) affective, (2) behavioral, (3) cognitive, and (4) physiological. Outcomes were grouped conceptually into two domains, mental wellbeing (e.g., hope, self-esteem, happiness) and psychopathology (e.g., internalizing and externalizing symptoms). The resulting conceptual model presents autistic strengths that can be leveraged in psychosocial interventions and potential mechanisms of change empirically supported in autistic and non-autistic populations that explain psychosocial intervention effects on mental health and wellbeing.

Synthesis of Results

The conceptual model (Fig. 1) includes autistic strengths that can be leveraged in the design of psychosocial interventions and potential mechanisms of change that explain intervention effects on mental health (e.g., internalizing and externalizing symptoms) and wellbeing (e.g., happiness, hope, optimism, quality of life). Strength-based interventions may not only produce positive effects on mental health through promotion of positive protective factors (e.g., self-determination, social skills), but also by reducing vulnerabilities (e.g., loneliness, bullying, underemployment). The synthesis presented below is organized by autistic strength domains identified in the review, and we use *italics* for evidence supporting proposed *mechanisms of change* included in our conceptual model.

Perceptual Strengths

Sensory differences are a common trait identified in autistic individuals with 69–95% of all autistic individuals experiencing sensory differences of at least one standard deviation from standardized means of typically developing peers (Hazen et al., 2014). Some sensory symptoms that are common include hypersensitivity where sensory stimuli causes distress, hyposensitivity where response to stimuli is blunted, and sensory seeking in which individuals seek out certain sensory experiences (Hazen et al., 2014; Sivathasan et al., 2023). Variation in sensory preferences and needs is substantial and requires individualized tailoring of sensory programs to meet the needs and preferences of autistic individuals. These programs may include sensory integration therapy, a sensory diet, and environmental modifications (Hazen et al., 2014). Sensory integrated therapy uses enriched sensory opportunities tailored to activities and intrinsic motivations with evidence indicating improvements in *attention*, *cognitive*, and *social skill* measures (Miller et al., 2007). Sensory

Table 2 Overview of categorical domains of autistic strengths aggregated by codes

Domain	Codes
Autistic strengths	
Perceptual	Visual, auditory, tactile acuity/discernment; sensory differences (sensory seeking and sensitivities); memory
Reasoning	Logical reasoning/thinking; analytical reasoning; problem solving; systematizing; hyperlexia; attention to detail; pattern recognition
Expertise	Special interests; preferred interests; in-depth knowledge; deep focus
Character strengths	Humor; nonjudgement; justice; fairness; integrity; honesty; kindness; generosity; creativity; curiosity
Mechanisms of change	
Affective	Sense of belonging/inclusion; self-esteem/perception; confidence; positive affect; family attachment; intrinsic motivation
Behavioral	Self-management; social capital/relationships; family relationships/functioning; inhibitory control; communication skills; social skills/engagement; social support; adaptive behaviors
Cognitive	Self-determination; empowerment; job readiness; cognitive flexibility; coping flexibility; self-efficacy; executive functioning; identity
Physiological	Sleep duration/quality; neuroplasticity; motor skills; physical development; neuroconnectivity; reward processing
Mental health	
Wellbeing	Self-advocacy; employment; enhanced learning; quality of life; daily living skills
Psychopathology	Anxiety; depression; internalizing symptoms; externalizing symptoms

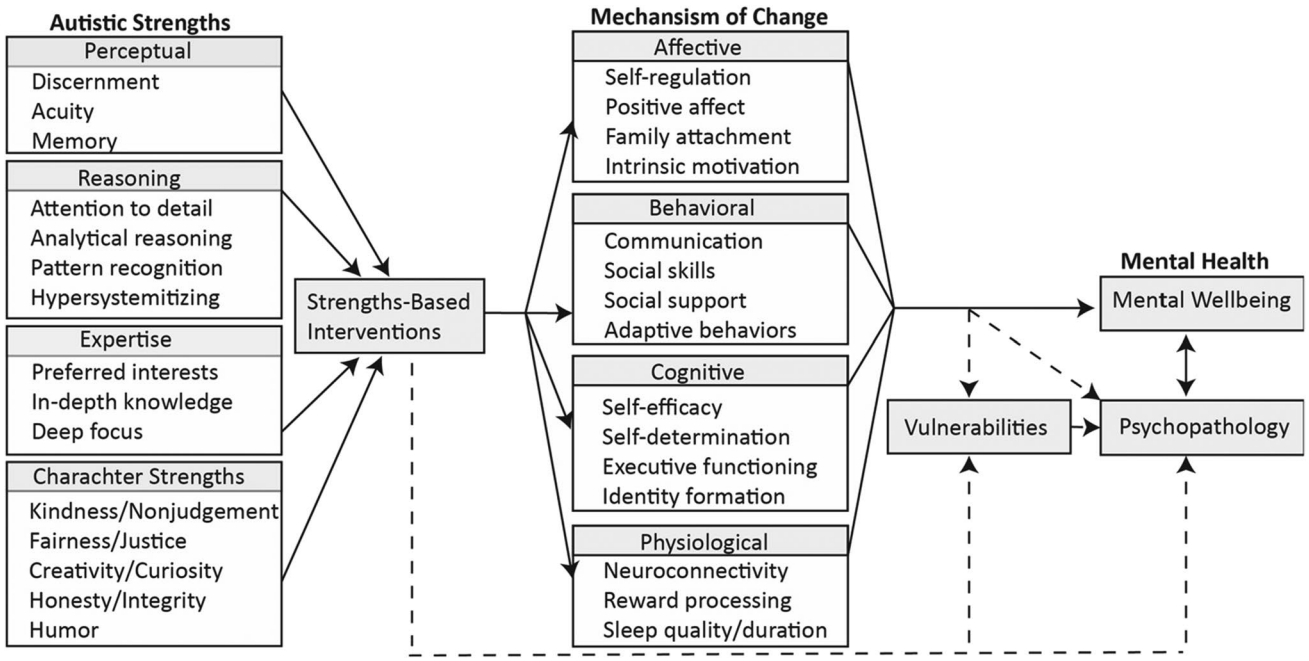

Fig. 1 Conceptual model of mechanistic pathways from strength-based interventions to mental health

differences have often been framed as a disability needing accommodation; however, others have framed sensory acuity and associated over-connectivity of neural networks as a strength because these differences are associated with verbal *communication* and *social skill* mechanisms of change (Rudie & Dapretto, 2013; Thye et al., 2018; Uddin, 2015). Environmental factors in some contexts have been designed to support autistic differences in sensory needs. For example, "autism friendly environments" have become a buzzword with airlines, cruise ships, theaters, and parks designed to provide areas for sensory input or leisure and relaxation (Gaudion & Pellicano, 2016).

Evidence suggests that music perception and abilities are strengths of autistic individuals. Seminal work showed that autistic children taught musical pitches through association with pictures of animals had more accurate pitch memory than typically developing peers. Another study found autistic individuals had enhanced discrimination of changes less than a semitone, the smallest interval between two pitches (Bonnel et al., 2003). Studies also indicate preferred interest in music in comparison with typically developing peers (Blood & Zatorre, 2001). A review of music therapy for autistic individuals completed in nine countries found significant effects on *communication* and *social skills* (Sivathasan et al., 2023). Additionally, a recent study found music therapy resulted in significant effects in *neural connectivity*, suggesting musical engagement may be able to affect change in auditory-motor neural connections, in autistic individuals (Sharda et al., 2018). Other scholars have suggested that future programs could amplify neuroplasticity by stimulating sensorimotor brain networks through music and supporting *reward learning* (Blood & Zatorre, 2001; Sharda et al., 2018).

Reasoning Strengths

Autistic strengths in attention to detail, analytical/logical reasoning, pattern recognition, and hyper-systematizing have generated new intervention approaches that match these strengths with preferred interests such as vocational training in technology that have succeeded in supporting *adaptive behaviors*, *social skills*, *intrinsic motivation*, *executive functioning*, and *identity formation* as well as mental wellbeing and quality of life (Diener et al., 2016; Jones et al., 2018; Lee et al., 2022). Baron-Cohen et al. (2009) proposed a hyper-systematizing theory that argues that autistic individual's excellent attention to detail and reasoning produces talent in system domains such as mathematics, music, and language. A recent article suggests that evidence-based interventions may be made more effective by leveraging systemizing and analytical strengths, autistic strengths (Camilleri et al., 2023).

High performance of autistic individuals has been recorded in technology, mathematics, and engineering fields (de Schipper et al., 2016; Peckett et al., 2016). This strength has been used in designs of interventions that utilize technology as an implementation strategy to deliver interventions or as to support achievement of skills in technology

(Hatfield et al., 2017; Le et al., 2021; Lee et al., 2020; Little et al., 2018). The Autism Academy for Software Quality Assurance (AASQA) technology program tailored activities facilitated by mentors and delivered in a naturalistic and safe social environment to foster peer learning and to leverage strengths in logical thinking, and problem-solving skills (Jones et al., 2018). Qualitative results indicated AASQA was effective in changing *sense of belonging*, *social relationships and interactions*, *confidence*, and *self-esteem* (Lee et al., 2020). Additionally, the AASQA program noted effects on *intrinsic motivation* with high enthusiasm for participation reported by autistic participants and parents (Lee et al., 2020). A systematic review of studies examining information and communication technology among autistic youth identified *social capital* as a mechanistic path for future studies to examine (Hassrick et al., 2021).

While speech/language limitations are often perceived as a common deficit in autistic children, some autistic children develop hyperlexia, or superior skill in word-reading in comparison to typically developing peers (Newman et al., 2007). To date, few interventions have been developed specifically to leverage the strength of hyperlexia in some autistic children (Burd & Kerbeshian, 1985; Goldberg & Rothermel Jr, 1984). However, one study with autistic children with advanced reading ability modified speech therapy approaches to include multiword requests and effectively motivate *communication skills* (Roche et al., 2019). Given current investment in early childhood intervention programming for autistic children, future tailored approaches should consider how to leverage hyperlexia to support positive development.

To connect these strengths in reasoning to positive developmental trajectories, interventions have sought to promote autonomy-enhancing environments and mindfulness interventions to build self-awareness and enhance *self-determination* and career-related interests among autistic youth (Dean et al., 2022; Shogren et al., 2021; Shogren & Singh, 2022). The right to self-determination is supported by the Autistic Self-Advocacy Network (ASAN) to empower autistic individuals to reach their goals (Shogren et al., 2021). Targeting self-determination is a promising approach because interventions to promote self-determination can be personalized to strengths and interests and given tailored support (Larsen & Luna, 2018).

Expertise in Preferred Interests

In recent years, one of the most common autistic strengths that is integrated in strength-based interventions includes approaches that include special interests or preferred interests. Preferred interests are one of the most prevalent traits observed among autistic individuals (Esbensen et al., 2009). Many autistic individuals have the ability to hyper-focus on areas of preferred interest and build expertise and knowledge in specific areas related to those interests (de Schipper et al., 2016; Murray et al., 2005). Common preferred interests identified in autistic individuals include higher preference for sciences, history, culture, animals, information and mechanical systems, machines, and technology (Patten Koenig & Hough Williams, 2017). A survey of autistic adults found the majority of respondents had a positive view of preferred interests and viewed interests as a strategy to mitigate anxiety and focus career aspirations (Patten Koenig & Hough Williams, 2017).

LEGO therapy is a social skills intervention designed to develop children's strengths and interests in naturalistic settings (Lindsay et al., 2017). A scoping review of LEGO play therapy in autistic children reported positive effects on *social skills*, *building friendships*, *family relationships*, *coping strategies*, and *social interactions* (Lindsay et al., 2017). To take advantage of autistic preferred interests with technology, an intervention targeting mid- to late adolescence used an online transition planning program, including interactive modules to help autistic adolescents identify preferred interests and skills to match those interests and skills to employment opportunities and motivate *goal setting*, *identity formation*, *self-efficacy*, and *social support seeking* (Hatfield et al., 2018). Another school-based intervention, the Power Card strategy, was developed to promote *social skills* by focusing on special interests (Campbell & Tincani, 2011; Gagnon et al., 2021). The Power Card strategy uses the child's preferred interest as a motivator to teach *social skills* by incorporating special interest items and activities into interventions (Gagnon et al., 2021). A brief intervention delivered to autistic children at day camps used preferred interests to support engagement and found large intervention effects on *social skills and engagement* (Thompson-Hodgetts et al., 2023).

Character Strengths

Character strengths have been defined as positive capacities for thinking, feeling, and behaving in ways that benefit the individual and others (Niemiec, 2013). Character strengths predict many positive outcomes including academic achievement, social skills, happiness, life-satisfaction, and mental wellbeing (Harzer & Ruch, 2014; Macdonald et al., 2008; Toner et al., 2012; Vertilo & Gibson, 2014). Character strengths commonly reported by caregivers, teachers, and autistic individuals include kindness and nonjudgement of differences, fairness and justice, creativity and curiosity, honesty, integrity, and humor (Kirchner et al., 2016; Mirenda et al., 2022; Nocon et al., 2022; Samson & Antonelli, 2013; Shogren et al., 2017b; Weber et al., 2016). To date, most of these character strengths have not been leveraged in most strength-based programming. This is a missed opportunity. Many of these character traits are sought after by employers; yet, autistic individuals are significantly underemployed

(Cimera & Cowan, 2009; Eaves & Ho, 2008). For example, divergent and creative thinking suggests that autistic individuals perceive problems and challenges in new ways, skills needed in many employment sectors (Best et al., 2015; Hough & Koenig, 2014). Autistic creative proclivities have also been studied in visual and musical arts, and would be of value in many employment sectors (de Schipper et al., 2016). Nonjudgmental attitudes and acceptance for differences, kindness, honesty, integrity, and authenticity are traits most employers admire. Studies show that the simple intervention of identifying one's own strengths has resulted in increased happiness and decreased depression (Gander et al., 2013; Seligman et al., 2005).

Recent research in non-autistic populations has sought to target other strengths in intervention designs delivered in schools or community programs. For example, "counting kindness" (counting acts of kindness each day) or encouraging helping behavior increased happiness in children and adolescents (Gander et al., 2013; Otake et al., 2006). Similarly, other approaches have targeted humor by asking people to report funny things that happened during the day (Gander et al., 2013). Samson and Antonelli (2013) found that in autistic populations, humor was an under-used strength, despite being more commonly endorsed as a strength in autistic populations in comparison to non-autistic populations. Leveraging these strengths in psychosocial interventions for autistic children and adolescents could include new areas for innovation such as how humor and kindness could be used as a strategy to promote *positive affect*, *communication*, and *social skills*.

Discussion

A foundational value of a neurodiversity framework is recognition and support of a balanced perspective that recognizes strengths and unique abilities and differences in abilities or challenges (Wright et al., 2020). The conceptual model presented in this study seeks to inform future research studies designed to examine how integrating strengths and positive psychology into intervention design can effect change mediating variables (mechanisms of change) and lead to positive mental health outcomes. An emerging body of research on broader developmental disabilities has called for a paradigm shift to transform framing disability as a pathology to consider applications of positive psychology. The Oxford Handbook of Positive Psychology examined applications of positive psychology to the disability context in 2013 and that while there were more articles examining strength-based approaches, there were comparatively fewer applications to disability than other chronic diseases (Wehmeyer et al., 2017). Studies that have applied strength-based approaches within disability contexts have found self-determination could be enhanced by leveraging character strengths and practicing mindfulness. A theoretical framework, causal agency theory, explicates that self-determination empowers individuals in the disability community and is associated with a positive quality of life and life satisfaction (K. Shogren et al., 2017a). Applications of strength-based approaches in broader disability research have emphasized the importance of considering outcomes targeted through intervention. For example, several scholars argue that there is an urgent need to include persons with disabilities in the design of research studies and to evaluate positive wellbeing constructs including optimism, hope, and resilience (Wehmeyer, 2021). Importantly, positive psychology approaches such as mindfulness programs have shown positive effects on children with autism as well as their caregivers (Singh et al., 2019; Singh et al., 2020). These multilevel positive effects align with the conceptual model included in this article that suggests that mechanisms of change can be multilevel and include social and family relationships that support positive development.

Recently, activists and scholars have called for a focus on strengths and skills unique to autism (Mottron, 2011; Pellicano & Stears, 2011). A neurodiversity framework combines recognition of differences in functional behaviors and strengths to center intervention focus on inclusion, needed accommodations, and supports tailored to each autistic child. While not all accommodations may be plausible in every setting, having an array of potential supports tailored to each child can be instrumental in promoting positive development. Furthermore, exclusive focus on interventions targeting deficits without equal attention to strengths can perpetuate stigma surrounding autism and lead to more exclusion from social contexts, lower self-perception, and self-esteem (Den Houting et al., 2021; Lawson et al., 2020; Pellicano & Stears, 2011; Urbanowicz et al., 2019; van der Cruijsen & Boyer, 2021). In contrast, strength-based programs help autistic individuals to identify strengths and have confidence in their abilities, important character traits for success in education and future careers. Perceptual strengths, reasoning strengths, and, most of all, preferred interests have been integrated in several innovative strength-based intervention programs. Other strengths, notably character strengths, have not been intentionally leveraged in intervention designs to the same extent. Additionally, strength-based interventions for autism must be flexible and individually tailored because of the heterogeneity in differences in abilities and strengths across the spectrum (Shtayermman et al., 2018).

Research is needed to identify the highest impact mechanistic pathways of change that make strength-based interventions. In addition, implementation strategies including who delivers or mediates the intervention may an important driver of effects. Whether caregivers, peers, siblings, teachers, or community members mediate intervention

delivery could implicate different mechanistic pathways. In high-income countries, investment in early intervention, specialist-delivered therapy, and caregiver-mediated intervention approaches are most common (Brookman-Frazee et al., 2012; Gibson et al., 2021; Kumar et al., 2022; Matson & Konst, 2014; Rojas-Torres et al., 2020; Zhou & Yi, 2014). Evidence shows that caregivers who receive autism diagnosis from providers with higher positivity and confidence have more positive affect about their children, increase caregiver-child relationship quality, and can change the way autistic children view themselves (Brookman-Frazee & Koegel, 2004; Brown et al., 2021; Urbanowicz et al., 2019). Especially for younger children who may not yet have developed communication skills, caregivers are uniquely positioned to identify strengths and challenges and nuanced changes in development over time (Langan, 2011).

In the past two decades, more strength-based interventions have employed peer-mediation implementation designs (Chang & Locke, 2016). This approach is motivated by evidence indicating that autistic children and adolescents experience more loneliness and poorer friendship quality in comparison with typically developing peers (Bauminger & Kasari, 2000; Chang et al., 2019; Lasgaard et al., 2010; Locke et al., 2010). Loneliness is associated with risk for depression, anxiety, and suicidal ideation that can persist into adulthood (Mazurek, 2014). Peer-mediation approaches typically train peers as facilitators of intervention components (Laushey & Heflin, 2000). The most common target of peer-mediation approaches are acquisition of social skills achieved through modeling social behaviors, prompting social interactions, and reinforcing and maintaining social interaction (Chan et al., 2009). Additionally, peer-mediated interventions delivered during early and middle adolescence may be well-matched for accelerating social reward processing and development in autistic adolescents. Peer-mediated interventions may benefit not only autistic children and adolescents, but also the peer-facilitators. Reciprocal benefits associated with implementation strategies should be examined in future studies.

The opportunity to learn and play in different social contexts reinforces the skills that lead to positive developmental trajectories. Multi-level interventions that engage multiple levels within an individual's social ecology have proven to be successful. Engaging families, peers, schools, and the community may be particularly important for autism interventions (Kohrt et al., 2018), the context in which strength-based interventions are important to consider in designing psychosocial interventions. For example, studies that purposefully adapt the environment where interventions are delivered to be autism-friendly, including providing quiet rooms for participants with sensory sensitivity, have been successful (Piller & Pfeiffer, 2016).

To advance strength-based psychosocial interventions for autistic children and adolescents, more research is needed to examine intervention design, implementation strategies, and mechanisms of change that explain intervention effects. Others have advocated for greater precision in psychosocial intervention design including attention to timing, sequence, duration, and targets (Mottron, 2017). Studies that seek to identify strengths from multiple perspectives (autistic individuals, caregivers, teachers) may be the best approach to fully represent potential opportunities to amplify or leverage strengths in intervention programs. Self-identification of strengths may be inaccurate if comorbid conditions common among autistic adolescents prevent identification of positive attributes (Clark & Adams, 2020; Taylor et al., 2022). Future studies should examine whether combination of components, mediated by different people in different contexts, increases impact on outcomes. Furthermore, examination of the mechanistic pathways that explain intervention effects and potential interaction effects by socioecological level is needed.

More research is needed to identify prevalence rates of strengths in autistic individuals to consider opportunities to scale psychosocial interventions that maximize effects in diverse autistic populations. At the same time, researchers have cautioned that perpetuating stereotypes of autistic strengths may harm autistic people who do not conform to generalizations and thus creating unrealistic expectations (Dawson & Fletcher-Watson, 2022). While autistic perspectives grounded and motivated this study, autistic individuals were not involved in the analysis competed in this study. The authors recommend that future research designs consider participatory research methods that include representation from the autistic community.

Author Contributions MC conceptualized the research objectives of this study. MC and MM contributed to the methodology and formal analysis of the study. MC completed the writing of the original draft and MM contributed to the review and editing of the manuscript. MC and MM read and approved the final manuscript.

Declarations

Conflict of Interest The authors declare no competing interests.

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