HEALTH BEHAVIORS AMONG FAMILIES OF CHILDREN WITH DEVELOPMENTAL DELAY

by

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A DISSERTATION

Presented to the Department of Special Education and Clinical Sciences and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 2021

DISSERTATION APPROVAL PAGE

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Title: Health Behaviors Among Families of Children with Developmental Delay

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Degree awarded June 2021

DISSERTATION ABSTRACT

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Doctor of Philosophy

Department of Special Education and Clinical Sciences

June 2021

Title: Health Behaviors Among Families of Children with Developmental Delay

When compared to typically developing children, children with developmental delays (DD) are at especially high risk for poor health outcomes. Several interpersonal factors, including caregiver behaviors, have been examined in relation to typically developing preschool children's health. Limited research has examined these associations in the DD population. The following preliminary study sought to provide a preliminary evaluation of the associations between caregiver health behaviors and health behaviors of preschool-aged children with DD in a sample of 77 families. Surveys and interviews were completed with caregivers to assess sociodemographic variables, child adaptive behavior and autism symptoms, and family lifestyle and health behaviors. This study included the following research questions: (1) Are family sociodemographic variables (i.e., caregiver education, household income, caregiver race/ethnicity) associated with caregiver health behaviors (i.e., caregiver eating habits and physical activity)? (2) Are caregiver health behaviors (i.e., caregiver eating habits and physical activity) associated with child heath behaviors (i.e., child unhealthy eating, physical activity, and screen time)? (3) Does child developmental functioning (i.e., adaptive behavior and autism symptoms) moderate the association between caregiver health behaviors and child health behaviors?

Study results for the first research question indicated neither caregiver race, caregiver education, nor household income, were meaningfully associated with caregiver health behaviors. The second research question revealed that 1) caregiver health behaviors were negatively associated with child unhealthy eating habits and positively child physical activity, but not meaningfully associated with child screen time. Results for research question three demonstrated that 1) the relation between caregiver health behaviors and child unhealthy eating was moderated by child adaptive behavior and 2) the relation between caregiver health behaviors and child unhealthy eating was moderated by child ASD symptomatology, 3) neither child adaptive behavior functioning nor child ASD symptomatology moderated the association between caregiver health behaviors and child physical activity or caregiver health behaviors and child screen time. The results of this study have implications for the development of interventions for families of children with developmental delays.

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ACKNOWLEDGMENTS

I wish to express sincere gratitude to my entire dissertation committee for their guidance, wisdom, and flexibility during these unprecedented times. Thank you to John Seeley, who took the time to meet with me on multiple occasions to discuss and interpret my statistical analyses. Thank you to Charlotte Winters, who put so much time and effort into coordinating with our California research site and quickly processed my data despite state restrictions related to the ongoing pandemic. I want to express special thanks to Laura Lee—I cannot imagine a better advisor and mentor throughout this entire dissertation process and my graduate school career. Thank you for your time, dedication, and unwavering support over the last four and a half years.

To my mother, Robin, father, David, and sister, Jessica—I would not have completed this process without you. Momma, thank you for your unconditional love and support; and inspiration to tirelessly help others. Dad, thank you for instilling in me an unrelenting desire to pursue higher education and pay my privilege forward. Jess, thank you for serving as an incredibly persistent, resilient, and strong-willed role model, and always being a source of humor and encouragement.

To Tripp — I could never put into words how grateful I am for your selflessness over the last 3 years. Thank you for constantly building me up, always being my captivated audience, and sharing in my struggles and joy.

To AnnaCecilia McWhirter—graduate school would not have been the same without you. Thank you for bringing me into your family, sharing in the highs and lows of graduate school, and always being my confidant.

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I: INTRODUCTION

Children with Developmental Delay and Disabilities

Developmental Delay (DD), a substantial lag in cognitive and/or physical development, greatly impacts functioning in young children. DD is a disability category typically used to provide children ages 3 to 9 with supports and services prior to being diagnosed with a specific disability (Boyle et al., 2011; Morin, 2014). Delays can occur in one or more skill domains, including 1) cognitive abilities, 2) social and emotional functioning, 3) speech and language abilities, 4) fine and gross motor skills, as well as 5) daily living skills. It is well-documented in the literature that those diagnosed with developmental delays often present with deficits in adaptive functioning, which are defined as skills necessary for coping with the natural and social demands of the environment (Liss et al., 2001; Volkmar et al., 1987). Adaptive behavior has been shown to impact engagement in health-related activities. For example, Bremer and Cairney (2020) suggest that level of adaptive behavior significantly moderates the relation between motor competence and health-related fitness in a sample of school-age children. Impairments in the skill domains mentioned above put these individuals at risk for attention issues, learning difficulties, behavior problems, and poor health outcomes (Liss et al., 2001). While not every child with DD will require services later in life, some are diagnosed with a developmental disability in middle or late childhood. Such developmental disabilities include, but are not limited to, Attention Deficit/ Hyperactivity Disorder (ADHD), Cerebral Palsy, Autism Spectrum Disorder (ASD), Intellectual Disability (ID), and Down Syndrome (Morin, 2014).

Although causes can be unclear, some delays begin prenatally. Other factors associated with risk for delay include perinatal complications, infections during or after pregnancy, injury, exposure to environmental toxins, trauma, as well as caregiver health behaviors (Boyle et al., 2011; Center for Disease Control and Prevention [CDC], 2018). Caregiver health behaviors contribute to the overall nature of the household environment and family context, which can have a tremendous impact on children's development and overall functioning. Although a wealth of literature has documented the relation between parent well-being, parenting strategies, and meeting the unique needs of children within this population, limited research has examined the associations between specific family lifestyle factors and child health behaviors (Abbeduto et al., 2004; Paczkowski & Baker, 2010). More research is warranted on the association between caregiver health behaviors and health behaviors among preschool children with DD.

Over the last few decades, the prevalence of DD and related disabilities has increased and currently affects nearly 15% of children ages 3 to 17 years, with males more likely to be impacted in comparison to females (Boyle et al., 2011; CDC, 2018; Zablotsky et al., 2017). This suggests that nearly 1 in 6 families in the United States will require additional health and education services to manage their child's delays (Boyle et al., 2011; CDC, 2018). It is essential to conduct rigorous research in this area to inform early intervention services that promote health and well-being among families of and children with DD. Such evidence-based services can be used to provide preventative and effective health care to this population, which can allow them to lead full lives and stay active within their communities. Providing access to information on healthy decisionmaking may help improve this populations' quality of life and give caregivers direction on how to best support their child's mental and physical health as they grow.

Health Risk Factors

Establishing a healthy lifestyle is essential for maintaining a good quality of life and, ultimately, reducing early mortality. According to the CDC, the leading cause of death in the United States is heart disease, which involves the narrowing or blockage of blood vessels in the body (CDC, 2020; Mayo Clinic, 2018). These blockages often lead to heart attacks, stroke, or angina, and can be caused by diabetes, obesity, unhealthy eating, physical inactivity, and excessive alcohol use (CDC, 2020; Mayo Clinic, 2018). Caregivers, particularly mothers, of children with intellectual and developmental disabilities are at increased risk of poor health outcomes when compared to caregivers of typically developing children (Fairthorne et al., 2015; Lee et al., 2017; Masefield et al., 2020; Miodrag et al., 2015; Miodrag & Hodapp, 2010). Researching methods for improving health among caregivers of this population is essential to promote well-being and reduce the risk of significant health problems throughout life.

Children may be at risk for significant health problems as well. While it greatly depends on the frequency and severity, poor nutrition, physical inactivity, as well as alcohol and tobacco exposure are significant risk factors for chronic disease and premature death (CDC, 2013). Additionally, regardless of body size, the food we eat impacts out health. Despite encouragement from the national government to consume a variety of fruits and vegetables to optimize health outcomes, top calorie sources include sugar sweetened beverages and foods high in simple carbohydrates (U.S. Department of Agriculture, 2010). Furthermore, the leading source of fruit consumption in children's diets takes the form of 100% fruit juice, which lacks the nutrients necessary to promote healthy development (Lorson et al., 2009; Ramsay et al., 2017; U.S. Department of Agriculture, 2010).

Preschool children's diets are dictated by caregivers' food purchases, which are largely influenced by income and education level. Research examining socioeconomic (SES) inequalities in food selection, suggest that families of higher SES spend more money on food when compared to their low socioeconomic counterparts (Pechey & Monsivais, 2016). Considering that foods with little nutritional value are cheaper when compared to fresh produce, children from low income households are more likely to consume fewer fruits and vegetables, and therefore lower quality diets that lack nutritional diversity (Darmon & Drewnowski, 2008; Drewnowski, 2010; Handbury et al., 2015; Jones et al., 2014; Pechey & Monsivais, 2016). Caregiver education level is also associated with overall healthier food purchasing, suggesting that families from lower income and lower caregiver education backgrounds may be especially vulnerable to unhealthy diets.

Furthermore, individuals of color are at a disproportionately higher risk for experiencing poor health outcomes (Li et al., 2017; Mensah et al., 2005). Several social determinants greatly contribute to these disparities in eating habits among racial/ethnic minorities. For example, previous research has found that individuals residing in impoverished and racially diverse neighborhoods are less likely to have access to affordable of food, pharmacies, medications, and have more exposure to advertisements for unhealthy behaviors, including tobacco and alcohol consumption (Cummins, & Macintyre, 2002; Morello-Frosch et al., 2002; Morland et al., 2002; Morrison et al., 2000). It’s likely these social factors contribute to African American adults reportedly consuming fewer micronutrients and having a lower daily caloric intake, when compared to White adults (Li et al., 2017). Similar to discrepancies in caloric intake, it’s reasonable to assume these social determinants impact the existing relation between identifying as White and having an increased awareness of health risks associated with nutrient consumption, when compared to identifying as an individual of color (Wang & Chen, 2011). Provided the intersectionality of SES, caregiver education, and race/ethnicity as well as the disproportionate level of risk associated with identifying as a person of color and/or a member of a low SES family, these factors should be explored when investigating relations between the current study constructs of caregiver and child health behaviors.

Eating Habits and Dietary Concerns among Children with DD

When compared to typically developing children, children with DD are at especially high risk for poor health outcomes (Bandini et al., 2005; De et al., 2008; Emerson, 2009). It is possible that this heightened vulnerability could be due to a predisposition to nutritional deficits, as evidenced by feeding difficulties typically displayed during infancy (Malone et al., 2016). For example, Sanders et al. (1993) found that children with feeding challenges are more likely to engage in food refusal, as well as noncompliant and oppositional behavior during mealtimes. These unique challenges can impact both caregiver and child feeding habits as well as caregiver mental health (Abbeduto et al., 2004; Must et al., 2014).

In addition to this possible predisposition, decades of research have documented eating habits within one development disability, ASD, which is frequently associated with unusual and restrictive eating patterns (Coffey & Crawford, 1971; Jones, 1982; Palmer & Horn, 1987; Perske et al., 1977; Schreck et al., 2004). In particular, children with ASD have significantly more feeding problems and consume a narrower range of food when compared to typically developing children (Schreck et al., 2004). Maintaining overly selective eating habits due to sensory stimuli aversion is common and can lead to malnutrition, high blood pressure, and diabetes among other illnesses (Ahearn et al., 2001; Curtin et al., 2010; Raiten & Massaro, 1986; Schreck et al., 2004; Williams et al., 2000). While these associations have been found within the ASD population, it is plausible that young children with DD display similar restricted eating habits or feeding difficulties, which impacts their overall health.

Despite the nutritional risk and symptoms associated with children with DD and specific diagnoses (e.g., ASD), it is likely that several family factors influence children's health behaviors. Considering that caregivers play a vital role in their child's eating habits and mealtime routines, the family context significantly influences eating patterns, especially in preschool aged children (Birch & Davison, 2001; Must et al., 2014; Ventura & Birch, 2008). For example, results of a 2013 systematic review of this limited literature concluded that higher BMIs in children with developmental disabilities is associated with caregiver body mass index (BMIs), household SES, caregiver perceptions and attitudes toward weight status, as well as caregiver and child activity levels (McGillivray et al., 2013; Must et al., 2014). The present study seeks to extend this research by investigating specific caregiver eating practices as well as physical activity patterns that are associated with children's health behaviors. Considering their nutritional risk and likelihood of displaying problem behaviors during mealtimes, research on factors associated with health behaviors in children within this population is essential for preventing the development of significant health issues later in life.

Physical Activity in Typically Developing Preschool Aged Children

Physical activity refers to any bodily movement produced from muscle contractions resulting in the expenditure of energy (Caspersen et al., 1985). National health organizations posit that higher levels of physical activity can lead to both short- and long-term health benefits across the lifespan (National Institute of Health, 2016; U.S. Department of Health and Human Services, 2008). For preschool-aged children, the most frequently observed active behaviors include crawling, walking, running, jumping, skipping, and climbing (Brown et al., 2009). However, direct observational data across studies suggest that preschool aged children spend 80– 94% of their time engaged in activities such as sitting, squatting, standing, and lying down (Brown et al., 2009; Pate et al., 2008).

According to the CDC's 2018 "Physical Activity Guidelines for Americans", caregivers should encourage preschool aged children to move and play in a variety of physical activities for at least 3 hours per day. However, previous research indicates that the average amount of time typically developing children in this age group spend engaged in physical activity is significantly below this standard (Brown et al., 2009; Pate et al., 2008). Current evidence suggests that the lack of opportunity to engage in activity, lack of variation in the type of play equipment available (i.e., portable versus structure), as well as the education, training and preferences the supervising adult has for physical activity, significantly contributes to this discrepancy (Bower et al., 2008; Brown et al., 2009; Pate et al., 2008).

Several other contextual factors have been examined in relation to preschool children's physical activity (Hinkely et al., 2008). Although findings across studies are mixed when examining demographics variables, there has been a consistent pattern documenting the lack of association between SES and physical activity within the preschool age group (Jackson et al., 2003; Kelly et al., 2006; O'Donoghue et al., 2018; Sallis et al., 1993). However, studies examining the individual components of SES rather than grouping them as one variable have demonstrated significant associations, with income and education positively associated with child physical activity (Ferreria et al., 2006). This not only suggests current practices lack a standard measurement of SES, but also implies that behavioral and cultural variables as well as aspects of the physical environment may influence preschool aged children's physical activity to a larger degree.

Contrary to the lack of association between SES and physical activity, race and ethnicity have consistently been associated with lower levels of activity and higher levels of screen time (Saffer et al., 2015; Sallis et al. 1993). For example, findings from Sallis et al. (1993) suggest that Mexican Americans are less likely to be active and more likely to engage in sedentary activities (i.e., TV watching) when compared to Anglo-Americans. Similarly, Saffer et al. (2015) found that engaging in physical activity for leisure is significantly lower among adults of color. Socioeconomic status and education could account for these differences; however, it is still important to account for race and ethnicity when examining the relations between caregiver and child health given cultural or family practices that may not be accounted for when looking at SES alone.

Research targeting these contextual factors have most commonly occurred in preschool settings or center-based programs (e.g., Head Start, church-affiliated programs), suggesting that childcare centers fostering supportive environments for activity participation leads to increased time spent being active (Bower et al., 2008). Not only has this effect been documented in school and childcare environments, but it is also prevalent in the home. For example, research exploring caregiver influences on preschool children's physical activity, suggest that increased caregiver support for activity leads to children spending more time engaged in physical activity (Zecevic et al., 2010). Similarly, positive associations exist between caregiver enjoyment, encouragement, and involvement in physical activity on their children's active behaviors, which contributes to maintenance of those health habits later in adolescence (Gustafson & Rhodes, 2006; Hinkley et al., 2008; Moore et al., 1991; Trost et al., 2003).

According to Social Learning Theory, new patterns of health behavior can be acquired through observing and imitating the behavior of others (Bandura, 1971). Therefore, caregivers who are active and interested in engaging in physical activity, provide a model and basis for their children to develop thoughts, attitudes, and expectations for appropriate levels of physical activity (Welk et al., 2003). Specifically, Moore et al. (1991) found that children of active mothers were twice as likely to be active when compared to children of inactive mothers. For children with two active caregivers, this number tripled, to six times as likely, when compared to children of two inactive caregivers (Moore et al., 1991). However, even if caregivers are not personally active, being involved (i.e., participating in activities with their child) and acting as facilitators (e.g., providing transportation to parks and stadiums) has been shown to promote physical activity participation in young children as well (Welk et al., 2003).

Due to the adult initiated nature of preschool children's activity engagement, it is important for caregivers to both encourage and organize physical activities for their children. Participating in these activities promotes bone growth, as well as gross and fine motor development, which are necessary for the writing skills required to complete academic work in school, for example (Zecevic et al., 2010; Zeng et al., 2017). Additionally, physical activity supports language learning, academic achievement, working memory, attention, executive functioning, and overall cognitive development (Zeng et al., 2017). Children with DD are at greater risk for experiencing challenges in these areas, which is why conducting research on familial factors that impact physical activity is necessary.

Physical Activity in Preschool Aged Children with DD

Most of the research on physical activity within the preschool population has been conducted with typically developing children. Limited literature has examined determinants and correlates of physical activity within the DD population. The DD literature has primarily focused on the implementation and development of physical education curriculum in schools as it relates to motor skill development, rather than on familial factors related to physical activity patterns (Provost et al., 2007; Valentini & Rudisill, 2004). The dearth of research in this area and limitations of previous studies makes it challenging to draw conclusions about health outcomes within this population. However, within this small sample of literature, several benefits of physical activity have emerged. For example, individuals with DD have displayed decreases in aggressive, stereotypic, off-task, and eloping behaviors, and increases in motor behavior and academic responding following physical activity (Lang et al., 2010; Levinson et al., 1993;

MacDonald et al., 2011). Although these results have been found in school-aged children with developmental disabilities, it is plausible that preschool-aged children would reap similar benefits from engaging in physical activity and being surrounded by environmental factors that promote active lifestyles.

Despite the scarcity of research in this area, it is well documented that individuals with DD are more likely to have deficits in physical and motor functioning, and therefore spend more time engaged in sedentary activities (Memari et al., 2012). This is problematic due to the significant association between lack of activity and weight gain (CDC, 2015). For example, Whitt-Glover et al. (2006) found that individuals with DD are more likely to have higher BMIs and engage in lower levels of physical activity when compared to their typically developing siblings. Previous research attributes this discrepancy to motor impairments and deficits in social communication, which are common symptoms of DD (American Psychiatric Association, 2013; Curtin et al., 2010; Healy et al., 2017; Srinivasan et al., 2014). Despite differences in study designs and procedures, this effect has been replicated across studies and seems to worsen as children age if early interventions are not utilized (Hinckson & Curtis, 2013; MacDonald et al., 2011). Therefore, it is imperative to study factors associated with physical activity in young children with DD prior to the establishment of unhealthy habits and worsening of symptoms.

Prevalence and Impact of Screen Time Behavior

Screen-time has become one of the most ubiquitous sedentary activities for children across settings (Pearson et al., 2018). Sedentary screen-time activities can range from watching TV, playing video games, to using a mobile device, such as a webaccessible tablet or phone. According to a 2017 study, 98% of children ages 0 to 8 years of age live in a home with such devices (Common Sense Media, 2018: Madigan et al., 2019). Contrary to pediatrician's recommendations, most American children spend about 5 to 7 hours per day engaging in these types of activities; compared to the recommended amount of 1 hour per day spent watching high-quality programs (U.S. National Library of Medicine, 2018). In the last four years, the number of homes with tablets nearly doubled, with mobile device use being the second most common screen-time activity to television viewing (Common Sense Media, 2018). Even larger increases have been seen with the amount of time children spend on mobile devices, which has increased ten-fold over the past 8 years (Common Sense Media, 2018).

While evidence exists to support improved learning, cognitive, and social outcomes for preschool children who watch well-designed television programs, a wealth of literature demonstrates the negative health and developmental impacts of heavy media used during the preschool years as well as in adolescence (American Psychiatric Association, 2016). Among adolescents, more screen-time has been associated with consumption of fewer fruits and vegetables, and a higher intake of energy-dense snack foods (Leech et al., 2014; Pearson et al., 2017; Pearson et al., 2018). In preschool, excessive media use has been associated with significant increases in BMI, fewer minutes of sleep, and poorer executive functioning in preschoolers (American Psychiatric Association, 2016; Aishworiya et al., 2018; Cespedes et al., 2014; Cox et al., 2012; Nathansan et al., 2014; Wen et al., 2014). For example, Madigan et al. (2019) found that excessive exposure to screen time at 2 and 3 years of age was significantly associated with poorer performance on developmental screening assessments, when compared to children who spent less time per week on screens. The presence of this effect could be attributed to the limited number of opportunities children have to practice their motor and communication skills while using screen media (Madigan et al., 2019). For instance, it is possible that, if done in excess, the lack of interactivity within screen media could lead to delays in achieving developmental milestones due to the limited number of opportunities to hone adaptive skills. Considering their symptomatology, children with DD are even more susceptible to experience these challenges when compared to children with typical development.

Sociodemographic Variables and Screen Time

When comparing caregiver education level and household income, substantial differences in screen-time use are present. Children from low income families spend nearly an hour and a half more on screen media per day when compared to children from high income families (Common Sense Media, 2018). Similarly, children of lower educated caregivers consume over an hour more of screen time per day when compared to children of higher educated caregivers (Common Sense Media, 2018). Despite this discrepancy, the gap in phone ownership by socioeconomic status is virtually nonexistent because smartphone ownership is so common (Common Sense Media, 2018). Contrary to the significant differences in screen time seen among household income and caregiver education status, research regarding race and ethnicity differences in screen time are mixed. Although some research suggests screen time does not significantly differ among racial groups, others have found greater levels of screen time among Black children ages 4 to 12 years when compared to other racial groups, which could be due in part to cultural differences related to implementing different household rules around the amount of screen-based content children are allowed to consume (Anderson et al., 2008; Common Sense Media, 2018). Findings are far from conclusive and warrant additional investigation, particularly among families with children with delays or disabilities.

Screen Time and Children with DD

Previous research suggests that children with DD spend more time watching television and playing video games when compared to typically developing children (Mazurek & Wenstrup, 2013; Memari et al., 2013; Must et al., 2014; Sandt & Frey, 2005). Of the limited research in this area, studies have most commonly examined children with ASD. According to the *Diagnostic and Statistical Manual of Mental Disorders Fifth Edition* (DSM-5), one of the core features of ASD is engagement in restrictive and repetitive behaviors (American Psychiatric Association, 2013). Some suggest that specific interests in television and video games represent one type of restrictive behavior for this population (Mazurek et al., 2012). Anecdotally, it is noted that children with ASD have circumscribed interests in screen-based media; however, limited research has targeted this topic directly (Mazurek et al., 2012). Of the few published studies, two studies have examined children's screen media habits in relation to caregiver management and perceptions of technology use (Nally et al., 2000; Shane & Albert, 2008). These studies provide preliminary evidence that support anecdotal claims, suggesting that children with ASD are interested in and engage in screen-time activities more often than other sedentary activities (Shane & Albert, 2008).

Although unique manifestations of screen-based media behavior can differ across individuals, they similarly contribute to issues related to social and family functioning (Mazurek et al., 2012; South et al., 2005). For example, caregivers most frequently report using screen-based media (i.e., watching TV and videos) as a distraction and preventive method for maladaptive behavior. Therefore, it's possible that differences in the topography and severity of ASD symptomatology may contribute to differences in children's time spent on screens. For example, if children display higher levels of challenging behavior or more severe symptoms, it is possible caregivers would more frequently use screen-time as an intervention to reduce behavioral outbursts. Furthermore, caregivers of children with ASD report a tremendous amount of stress associated with managing their children's technology use and are concerned about the impact screen-time has on family functioning and relationships (Nally et al., 2000). Therefore, issues surrounding children's screen-time media use are socially valid within the home context, and especially among families of children with developmental disabilities.

Purpose of the Current Study

The aim of the current study is to provide a preliminary evaluation of the associations of caregiver health behaviors and health behaviors of preschool-aged children with DD. Considering that children with DD are more susceptible to nutritional deficits, motor impairments, and delays in adaptive functioning, it is probable that parenting behaviors strongly and positively associated with these children's physical activity patterns and eating habits. This study offers a unique opportunity to examine these factors across a historically underrepresented sample, and will provide information that can be used to inform interventions aimed at promoting overall health and well-being in families of and children with DD.

Research Questions

The present study examined the associations between caregiver health behaviors and children's health behaviors in a diverse sample of preschool-aged children with developmental delay. Given the preliminary nature of the study, no hypotheses are proposed. The specific research questions are:

1. **Are family sociodemographic variables (i.e., caregiver education, household income, caregiver race/ethnicity) associated with caregiver health behaviors (i.e., caregiver eating habits and physical activity)?**
2. **Are caregiver health behaviors (i.e., caregiver eating habits and physical activity) associated with child heath behaviors?**

   2a. Are caregiver health behaviors associated with child eating habits?

   2b. Are caregiver health behaviors associated with child physical activity?

   2c. Are caregiver health behaviors associated with child screen time?
3. **Does child developmental functioning (i.e., adaptive behavior and autism symptoms) moderate the association between caregiver health behaviors and child health behaviors?**

   3a. Does child adaptive behavior moderate the association between caregiver health behaviors and child eating habits?

   3b. Does child adaptive behavior moderate the association between caregiver health behaviors and child physical activity?

   3c. Does child adaptive behavior moderate the association between caregiver health behaviors and child screen time?

   3d. Does the level of child ASD symptoms moderate the association between caregiver health behaviors and child eating habits?

3e. Does the level of child ASD symptoms moderate the association between caregiver health behaviors and child physical activity?

3f. Does the level of child ASD symptoms moderate the association between caregiver health behaviors and child screen time?

As previously stated, we know children with DD are at especially high risk for poor health outcomes (Bandini et al., 2005; De et al., 2008; Emerson, 2009). However, little is known about the extent factors specific to the family context impact health behaviors among preschool- aged children with DD. The present study seeks to address this gap. See Figure 1 for a complete conceptual model with study aims.

II: METHOD

Participants and Setting

A sample of 77 preschool-aged children with DD and their caregivers were recruited from agencies in Southern California and the Pacific Northwest that provide early intervention and childhood special education services to children preschool-aged and younger as part of a larger, randomized controlled trial study (R01HD093661; PIs McIntyre and Neece). Provided the geographical differences in recruitment areas, the sample is culturally, linguistically, and socioeconomically diverse. For the purposes of this study, the term caregiver is used to describe anyone who indicated they were a primary caregiver for the target child including, but not limited to, biological, adoptive, and foster parents, as well as extended family members. Caregivers spoke and read in Spanish and/or English and completed questionnaires.

Caregivers

Table 1 displays caregiver demographic information. Participating caregivers were primarily female (98.7%), on average 38.7 years old (*SD* = 8.76), and living with a partner (89.6%). The sample was predominantly Hispanic/Latinx (70.1%), followed by White/Caucasian (23.4%), Black/African American (6.5%), Asian (2.6%), and multi-ethnic (3.9%). Latinx is used throughout the document as a gender neutral term used to describe people who are of or relate to Latin American origin or descent (Noe-Bustamante et al., 2020). The majority of the sample reported Spanish as the language primarily spoken in the home (53.2%), followed by English (42.9%). Regarding education, 35.1% of caregivers completed less than a high school education, 18.2% graduated from high school or earned a GED, 22.1% attended a few years of college, received specialized training, or earned an Associate's degree, 18.2% graduated from a 4-year college or university, and 6.5% had graduate professional training or earned a graduate degree. The majority of caregivers described themselves as full-time homemakers (55.8%), with fewer reporting full time employment (28.6%), part-time employment (5.2%), self- employment (3.9%), unemployment (2.6%), disabled (2.6%), or retired (1.3%). Household income varied widely, with 6.5% of the sample reporting $10,000 – $14,999, 9.1% reporting $15,000 – $19,999, 10.4% reporting $20,000 – $24,999, 9.1% reporting $25,000 – $29,999, 11.7% reporting $30,000 – $39,999, 5.2% reporting $40,000 – $49,000, 13.0% reporting $50,000 – $59,000, 2.6% reporting $60,000 – $69,999, 7.8% reporting $70,000 – $79,999, 3.9% reporting $80,000 – $89,999, and 20.8% reporting $90,000 or more. The average reported family income in this study was $81,783.33 (*SD* = 124,999.29); however, there was quite a bit of variability.

Children

Table 1 provides demographic characteristics for participating children. Child participants were predominantly male (63.6%) and an average of 3.88 years old (*SD* = 0.81). Most of the children were Latinx (68.8%), followed by White/Caucasian (24.7%), Black/African American (7.8%), Asian (3.9%), multi-ethnic (2.6%), Native American (1.3%), and Pacific Islander (1.3%). Nearly three-quarters of children (72.2%) were reported to receive special education services in school, and 31.2% had existing medical/health problems. Most of the children were bilingual (61%), with more than half indicating English as their primary language (51.9%). Related to primary diagnosis, 44.2% of children were diagnosed with ASD, 23.4% with a speech/language delay, 10.4% with a developmental delay, 1.3% with cerebral palsy, and 19.5% with "other" (e.g., genetic disorder/syndrome, sensory disorder, learning disability, social-emotional delay).

Protocol

The present study analyzed a subset of data collected from the Partnerships in Research for Optimizing Parenting (PRO-Parenting) Project (R01HD093667, PIs McIntyre & Neece). The PRO-Parenting Project is an ongoing, federally funded, multi-site study examining parenting and stress reduction among families with preschool-aged children with DD in Southern California and the Pacific Northwest. Eligible families provided consent for screening and randomization. Prior to the global COVID-19 pandemic, the design involved an initial phone screening for eligibility, home and laboratory baseline assessments, random assignment to one of two treatment groups, in-home posttreatment assessments, in-home 6-month assessments, and in-home 12-month follow-up assessments of child and family functioning. See the "Missing Data" section for pandemic related adjustments to the larger study protocol.

Caregivers were asked to complete several self-report measures (i.e., demographic information, service utilization, caregiver behaviors, and child behavior problems/symptomatology) within a mail-home questionnaire packet. Within this packet, caregivers were asked to complete an additional survey assessing family lifestyle factors, including caregiver health behaviors (i.e., physical activity, eating habits), as well as child screen-time, physical activity, eating habits, and sleep behaviors. As part of the laboratory assessments, caregivers participated in an interview with a research staff member to characterize the child's adaptive behavior.

The Family Lifestyle Survey (see below for a description) was added to the study battery after the larger study was initiated. Thus, data for the present study were collected at the posttreatment assessment phase for cohort 1 (summer 2019), and the baseline assessment phases for cohorts 2 (fall 2019) and 3 (spring 2020). The intervention condition was not controlled for in the present study given that the lion share of the data were collected at baseline (with the exception of cohort 1) and study variables were not targeted in the intervention conditions.

Measures

Demographic Survey

The primary caregiver completed a demographics form, which included caregiver and child characteristics. Caregiver variables included in this study were age, gender, race/ethnicity, education level, employment status, and household income. Child variables included in this study were age, gender, race/ethnicity, bilingualism, primary language, DD status, primary diagnosis, health concerns, and special educational eligibility category for early childhood special education services.

Caregiver and Child Health Behaviors

Family Lifestyle Survey (FLSS). Primary caregivers completed the Family Lifestyle Survey (FLSS) to evaluate the extent to which caregivers of and children with DD engage in health behaviors within their family context (See Figure 2). This 11-item survey includes items related to caregiver and child eating practices (i.e., 6 items measuring child eating; 8 items measure caregiver eating), physical activity (i.e., 7 items measuring child physical activity; 2 items measuring caregiver physical activity), screen time (i.e., 4 items measuring child screen time), sedentary activity (i.e., 1 item measuring sedentary behavior in children) and sleeping habits (i.e., 6 items measuring child sleep habits). Items for this survey were modified from a health questionnaire used in previous prevention trials conducted by Stormshak and McIntyre (U.S. Department of Education grant R324A130002) examining the Family Check-Up (FCU; Dishion & Kavanaugh, 2003) in an early elementary-aged sample. Please see Figure 2 for specific items and response options.

Child Adaptive Behavior

The Vineland Adaptive Behavior Scales, Third Edition (VABS-III; Sparrow et al., 2016). The VABS-III was used to characterize children's level of independence in the everyday environment. This is a norm-referenced assessment that has been established as a reliable and valid measure of adaptive behavioral functioning for the target population (Sparrow et al., 2016). The domain level parent/caregiver form of the VABS-III is a 502-item measure that captures information on five domains: 1) communication, 2) daily living skills, 3) socialization, 4) motor skills, and 5) maladaptive behavior. Each item is scored on a 3-point Likert scale: (2) Usually, (1) Sometimes, (0) Never. Scores are aggregated to form subdomain and domain standard scores, as well as an overall Adaptive Behavior Composite (ABC) standard score. The present study utilized the ABC score as a measure of overall adaptive functioning when conducting statistical analyses. The ABC standard score has a mean of 100 and a standard deviation of 15.

Child Autism Symptomatology

The Social Communication Questionnaire (SCQ; Rutter et al., 2003). The SCQ was used to measure ASD symptomatology, including reciprocal social interaction, language and communication, and repetitive and stereotyped behaviors and interests. The

SCQ is a 40-item questionnaire intended to be completed by the primary caregiver with a child who has the cognitive abilities of, at least, a typically developing 2-year-old. Each item requires a dichotomous response; with the presence of atypical behavior, relative to the child's age, receiving a score of 1, and the presence of typical behavior receiving a score of 0. Scores range from 0 to 39 with higher scores indicating more social communication deficits. The SCQ has been deemed a valid screening tool and reasonable measure of ASD symptom severity (Rutter et al., 2003).

Study Variable Compositions

Continuous. The following were continuous variables: caregiver health behaviors, child unhealthy eating, child physical activity, child screen time, child adaptive behavior scores, and child ASD symptomatology.

Categorical. The following were categorical variables: household income (1 = "$4,999 or less", 2 = "$5,000 to $9,999", 3 = "$10,000 to $14,999", 4 = "$15,000 to $19,999", 5 = "$20,000 to $24,999", 6 = "$25,000 to $29,999", 7 = "$30,000 to $39,999", 8 = "$40,000 to $49,999", 9 = "$50,000 to $59,999", 10 = "$60,000 to $69,999", 11 = "$70,000 to $79,999", 12 = "$80,000 to $89,999", 13 = "$90,000 or more") and caregiver education status (1 = "No formal schooling", 2 = "7th grade or less", 3 = "Junior high completed", 4 = "Partial high school (at least on year)", 5 = "High school graduate/ GED certificate", 6 = "Partial college (at least 1 year)", 7 = "Specialized training", 8 = "Junior college/ Associates degree (2 years)", 9 = "Standard college or university graduation (4 years)", 10 = "Graduate professional training/Graduate degree").

Dichotomous. Identifying as Latinx was a dichotomous variable and dummy coded, such that 0 = "Non-Hispanic/Latinx" (*n* = 23) and 1 = "Hispanic/Latinx" (*n* = 54). Vineland ABC composite scores (1 = "low group of scores $\leq$ 70), 2 = "high group of scores $\geq$ 71") and SCQ scores (1 = "low group of scores $\leq$ 13" and 2 = "high group of scores $\geq$ 14") were also dichotomized based on a median split to interpret moderation analyses.

Data Analysis

Several analyses were used to address the present study research questions. Descriptive statistics are displayed in Table 2. Study variables were analyzed using the Statistical Package for the Social Sciences 25 (SPSS) software package (IBM Corp, 2016). The following analyses were conducted to address each research question.

Preliminary Analyses on Distributions of Key Variables

The shape of the distributions for all continuous study variables, including caregiver health behaviors (*M* = 25.82, *SD* = 7.04, range = 0 – 40), child unhealthy eating (*M* = 4.20, *SD* = 2.87, range = 0 – 28), child physical activity (*M* = 6.51, *SD* = 3.80, range = 0-20), child screen time (*M* = 5.74, *SD* = 3.13, range = 0 – 16), child adaptive behavior scores (*M* = 70.58, *SD* = 10.95, range = 41 - 99), and child ASD symptomatology (*M* = 15.09, *SD* = 7.68, range = 1 - 33) were roughly symmetrical and unimodal, with no severe skew and no outliers. Specifically, the caregiver health behaviors variable had a skewness of -.21 (*SE* = .28), and kurtosis of .22 (*SE* = .55); the child unhealthy eating variable had a skewness of 1.09 (*SE* = .28), and kurtosis of 1.41 (*SE* = .55); the child physical activity variable had a skewness of .37 (*SE* = .27) and kurtosis of -.42 (*SE* = .54); the child screen time variable had a skewness of .40 (*SE* = .27), and kurtosis of -.13 (*SE* = .54); the child adaptive behavior variable had a skewness of -.49 (*SE* = .31), and kurtosis of .90 (*SE* = .61); and the child ASD symptomatology variable had a skewness of .27 (*SE* = .28), and kurtosis of -.82 (*SE* = .55).

Preliminary Reliability Analysis Procedures and Composite Score Development

Preliminary analyses included an examination of the Cronbach's alpha estimate of internal consistency of each a priori scale (Cronbach, 1951). Child health behavior composite scales were comprised of 4 to 5 items and showed Cronbach's alpha values ranging from .61-.73. The caregiver health behavior composite scale was comprised of 10 items and showed a Cronbach's alpha value of .86 (Cronbach, 1951). See below for additional details regarding scale development and internal consistency analyses.

Caregiver Health Behavior Scale Development. Based on face validity, alpha reliability analyses on caregiver healthy eating and physical activity items on the FLSS measure were conducted to determine if the items hung together as a single "caregiver health behaviors" construct. The FLSS originally contained 8 items measuring caregiver eating habits (α = .88) and 2 items measuring caregiver physical activity (α = .68). When a reliability analysis was conducted on the unidimensional "caregiver health behaviors" scale (10 items), Cronbach's alpha showed acceptable reliability (α = .86).

Child Health Behaviors Scale Development. Again, based on face validity, three separate composite scores were developed for child eating behaviors, physical activity, and screen time constructs, respectively using an alpha reliability procedure.

Child Unhealthy Eating Composite. The FLSS contains 4 items measuring child unhealthy eating behaviors. A reliability analysis was conducted using 4 items specifically measuring "child unhealthy eating" (e.g., number of days per week eating at a fast food restaurant, amount of candy consumed per day, and times the child drinks juice or has a sugar sweetened beverage per day). Cronbach's alpha showed moderate reliability (α = .61).

Child Physical Activity Composite. The FLSS contains 5 items measuring child physical activity, including questions such as, "how much time on a typical school day does your child spend: 1) playing sports, 2) playing outside 3) riding a bike, 4) walking, and 5) going to the park." Cronbach's alpha showed the "child physical activity" scale to reach acceptable reliability (α = .73).

Child Screen Time Composite. The FLSS contains 4 items measuring child screen time, including questions such as, "how much time on a typical school day does your child spend: 1) watching TV, 2) playing video games, 3) playing on the computer or tablet, and 4) watching movies." Cronbach's alpha showed the "child screen time" scale to reach moderate reliability (α = .62).

Research Questions and Corresponding Analyses

Research Question #1. Are family sociodemographic variables (i.e., caregiver education, household income, caregiver race/ethnicity) associated with caregiver health behaviors (i.e., caregiver eating habits and physical activity)?

Analysis. Bivariate Pearson correlations were conducted to evaluate the association between family sociodemographic factors (i.e., primary caregiver education, household income, and caregiver race/ethnicity) and caregiver health behaviors.

Research Question #2. Are caregiver health behaviors (i.e., caregiver eating habits and physical activity) associated with child health behaviors?

2a. Are caregiver health behaviors associated with child unhealthy eating habits?

2b. Are caregiver health behaviors associated with physical activity?

2c. Are caregiver health behaviors associated with child screen time?

Analysis. Bivariate correlations were conducted to evaluate the association between caregiver health behaviors and child health behaviors.

Research Question #3. Does child developmental functioning (i.e., adaptive behavior and autism symptoms) moderate the association between caregiver health behaviors and child health outcomes?

3a. Does child adaptive behavior moderate the association between caregiver health behaviors and child unhealthy eating habits?

3b. Does child adaptive behavior moderate the association between caregiver health behaviors and child physical activity?

3c. Does child adaptive behavior moderate the association between caregiver health behaviors and child screen time?

Analysis. To explore the moderation of adaptive skills on the association between caregiver health behaviors on child health behaviors, a hierarchical linear regression was used. Block 1 included caregiver health behaviors and child VABS-III ABC scores as independent predictors of child health behaviors. Block 2 included the interaction of VABS-III ABC scores and caregiver health behaviors (i.e., caregiver health behaviors by VABS-III ABC scores). This procedure was repeated three times with the child outcome variable changing for each analysis (i.e., analysis one included child unhealthy eating habits as the outcome variable, analysis two included child physical activity as the outcome variable, and analysis three included child screen time as the outcome variable).

To make meaningful interpretations of the regression analyses, the child VABS-III ABC scores were dichotomized based on median splits (i.e., categories were labeled “low” and “high”) after conducting a frequency analysis to determine the cutoff score. The lowest scoring 50% of the sample (i.e., obtaining a standard score less than or equal to 70) were conceptualized as the “low” group (i.e., having fewer adaptive skills when compared to the “high” group), while the highest scoring 50% of the sample (i.e., obtaining a standard score equal to or greater than 71) was conceptualized as the “high” group (i.e., having more adaptive skills when compared to the “low” group). Bivariate Pearson correlations were conducted between the caregiver health behavior variable, the dichotomized VABS-III ABC variable, and the child outcome variables only if the previous regression was clinically meaningful.

3d. Does the level of child ASD symptoms moderate the association between caregiver health behaviors and child unhealthy eating habits?

3e. Does the level of child ASD symptoms moderate the association between caregiver health behaviors and child physical activity?

3f. Does the level of child ASD symptoms moderate the association caregiver health behaviors and child screen time?

Analysis. To explore the moderation of ASD symptomatology on the association between caregiver health behaviors on child health behaviors, a hierarchical linear regression was used. Block 1 included caregiver health behaviors and child SCQ scores as independent predictors of child health behaviors. Block 2 included the interaction of

SCQ scores and caregiver health behaviors (i.e., caregiver health behaviors by SCQ scores). This procedure was repeated three times with the child outcome variable changing for each analysis (i.e., analysis one included child unhealthy eating habits as the outcome variable, analysis two included child physical activity as the outcome variable, and analysis three included child screen time as the outcome variable).

To make meaningful interpretations of the regression analyses, the child SCQ scores were dichotomized based on median splits (i.e., categories were labeled “low” and “high”) after conducting a frequency analysis to determine the cutoff score. The lowest scoring 50% of the sample (i.e., obtaining a raw score less than or equal to 13) were conceptualized as the “low” group (i.e., having fewer symptoms of autism when compared to the “high” group), while the highest scoring 50% of the sample (i.e., obtaining a raw score greater than or equal to 14) was conceptualized as the “high” group (i.e., having more symptoms of autism when compared to the “low” group). Bivariate correlations were conducted between the caregiver health behavior variable, the dichotomized SCQ variable, and the child outcome variables only if the previous regression was clinically meaningful.

Posthoc Analyses

Independent samples *t*-tests were conducted to address several post hoc research questions including:

1) Are there clinically meaningful mean differences between child gender and study variables?

a. Are there clinically meaningful mean differences in child health behaviors (i.e., unhealthy eating habits, physical activity, and screen time) by gender?

b. Are there clinically meaningful mean differences in child sleep by gender?

c. Are there clinically meaningful mean differences in child adaptive behavior by gender?

d. Are there clinically meaningful mean differences child SCQ scores by gender?

2) Are there clinically meaningful mean differences between study variables (i.e., child health behaviors, sleep, and adaptive behavior) among children with and without ASD diagnoses?

3) Descriptively, what does sleep look like in this sample?

a. Are there clinically meaningful mean differences between child sleep among children with and without existing medical conditions?

b. Are there clinically meaningful associations between child sleep and child study variables (i.e., child health behaviors, SCQ scores, and adaptive behavior)?

Power Analyses

Power analyses using G*Power 3.1 were conducted to determine what level of power was achieved with two different sample sizes due to missing data (Faul et al., 2009). The overall sample size for this study was 77; however, 60 participants completed the VABS-III (i.e., 17 missing), and 74 participants completed the SCQ (i.e., 3 missing). VABS-III and SCQ data were necessary to complete moderation analyses with three predictors. An exact sample size of 77 with a two-tailed probability for a p value of .05 is needed to reach sufficient power (.80) to detect a medium effect size of $f^2 = 0.15$ for linear regression analyses. Given the large amount of missing data, the study is underpowered. Therefore, results will be reported and discussed using phrases such as, "clinically meaningful" and "meaningfully associated/ moderated" rather than "statistically significant" or "significantly associated/moderated." Reported below are the results of separate power analyses conducted with study sample sizes that correspond to relevant analyses.

Bivariate Correlations

A power analysis was conducted to determine what level of power is achieved with the overall sample size ($N = 77$). Provided the sample size of 77 and a two-tailed probability for a p value of .05, there is a lack of sufficient power (.76) to detect a medium effect size of $r = .30$ for bivariate correlation analyses. Given the underpowered nature of the study, the correlation value of $r \geq .30$ was used to make clinically meaningful interpretations.

Hierarchical Regression Analyses

Based on the smallest sample size ($N = 60$), and a two-tailed probability for a p value of .05, there is a lack of sufficient power (.68) to detect a medium effects size of $f^2 = 0.15$ (incremental $R^2 \geq .06$) for hierarchical regression analyses. Given the underpowered nature of the study, an incremental $R^2 \geq .06$ was used to make clinically meaningful interpretations.

Missing Data

Due to the ongoing global pandemic, there is a substantial amount of missing data for the current study. In-person administrations of assessments were disrupted to due COVID-19. The research team attempted to quickly adjust to two different state's safety precautions by administering assessments over the phone; however, given the rapid progression of the virus and constant regulation changes, data collection could not be completed in all cases. Due to state restrictions, the research teams could not access Oregon or California research spaces, therefore, limiting the teams' access to previously collected data. Furthermore, there were issues with scoring the SCQ in which some of the items were not administered, which contributed to missing data for that measure in three cases.

III: RESULTS

The Presence and Distributions of Caregiver and Child Health Behaviors

As previously stated, due to the underpowered nature of the study. results will be reported using phrases such as, “clinically meaningful” or “meaningfully associated/moderated” rather than “statistically significant” or “significantly associated/moderated.”

Child Eating Habits

Regarding child consumption of energy dense foods, 88.4% of caregivers reported their child eats out at fast food restaurants 0-2 times per week, 94.9% of children consume 0-2 pieces of candy or other sweets daily, 58.5% drink juice 0-1 times per day and 40.3% drink juice 2-3 times per day, and 88.3% of children drink sugar sweetened beverages, such as soda, 0-1 times per day. On average, caregivers rated child unhealthy eating items between a 1 (piece/time per week/time per day) and 2 (piece(s)/time(s) per week/time(s) per day) (M = 1.05, SD = 0.72), indicating that children, on average, are engaging in unhealthy eating habits roughly one time per day/week (i.e., depending on the item) listed above.

Related to consumption of fresh fruits and vegetables, 52% of caregivers reported their children eat 2-3 servings of fruits and vegetables on an average day. Furthermore, 39.0% reported eating a meal together 6-7 nights per week, while 24.7% of caregivers reported 4-5 nights per week most of their family members eat a meal together.

Child Physical Activity

Regarding child activity level, 14.3% of caregivers reported their children normally sit down while playing, coloring, watching TV, or reading, 40.3% of children combine play with activities that involve movement, and 44.2% of children do not stop moving/run from one part of the house to another/go up and down stairs/run and jump. Additionally, 46.8% of children exercise for at least 20 minutes 1-4 days per week, 36.4% exercise for at least 20 minutes for 5-7 days, and 15.6% of children never exercise for 20 minutes per day.

The majority of caregivers reported their children play sports (84.5%), play outside (65%), ride their bike (92.2%), walk (87.1%), and go to the park (74.1%) for under an hour per day. On average, caregivers rated child physical activity items between a 1 (15-30 minutes per day) and 2 (30 minutes to an hour) (M = 1.30, SD = 0.76), indicating that children, on average, are spending more than 30 minutes, but less than 1 hour engaged in the physical activities listed above.

Child Screen Time

Caregivers reported the amount of time their children spend engaging in a variety of screen time activities. The majority of caregivers reported their children watch TV (58.5%), play on the computer/tablet/phone (68.9%), and watch movies (74.1%) for under an hour per day. Additionally, 77.9% of caregivers reported their children do not spend any time playing video games. On average, caregivers rated child screen time items between a 1 (15-30 minutes per day) and 2 (30 minutes to an hour) (M = 1.44, SD = 0.78), indicating that children, on average, are spending more than 30 minutes but less than 1 hour engaged in the screen time activities listed above.

Caregiver Health Behaviors

Caregivers provided self-reports on their own physical activity and eating habits. The majority of caregiver reports fell between a 2 (i.e., sometimes) and 3 (i.e., often) on items measuring eating habits. Furthermore, 66.3% of caregivers reported making low calorie meals for their families between sometimes and often (M = 2.63, SD = 1.06), 71.5% of caregivers reported offering their children a healthy alternative when he/she asks for junk food between sometimes and often (M = 2.76, SD = 0.89), 72.8% reported eating low calorie/fat food themselves between sometimes and often (M = 2.53, SD = 0.97), 52% reported between sometimes and often keeping unhealthy food out of their children's sight (M = 2.84, SD = 1.17), 70.2% reported between sometimes and often choosing healthy options at fast food or other restaurants (M = 2.50, SD = 1.00), 58.5% reported between sometimes and often eating vegetables (M = 2.86, SD = 1.06), 66.3% reported between sometimes and often serving fresh fruits and vegetables in their homes (M = 2.93, SD = 0.88), and 67.6% reported between sometimes and often teaching their children about healthy food choices (M = 2.72, SD = 0.95).

Related to physical activity, 48.1% of caregivers reported almost never to rarely independently participating in physical activity (M = 1.80, SD = 1.31); however, 63.7% reported between sometimes and often participating in physical activities with their child (M = 2.24, SD = 1.03).

The Presence and Distribution of Child Adaptive Skills and ASD Symptomatology

Child Adaptive Behavior

Child adaptive behavior composite (ABC) scores, ranging from 41 to 99 (M = 70.58, SD = 10.95), were primarily used to conduct the analyses for the present study. However, the VABS-III also includes four subscales: Communication, Daily Living Skills, Socialization, and Motor Skills. Communication standard scores ranged from 40 to 101 (M = 68.40, SD = 13.94), Daily Living Skills standard scores ranged from 40 to 112

(M = 73.08, SD = 14.47), Socialization standard scores ranged from 40 to 98 (M = 74.40, SD = 11.34), and Motor Skills standard scores ranged from 37 to 113 (M = 73.82, SD = 12.90). See Table 3 for descriptive statistics for child adaptive behavior.

Child ASD Symptomatology

Child ASD symptomatology scores, as measured by the SCQ, ranged from 1 to 33 (M = 15.09, SD = 7.68). The SCQ was completed by 74 of 77 total participants. The distribution of SCQ scores was unimodal and roughly symmetrical with no severe skew or outliers. See Table 3 for descriptive statistics for child ASD symptomatology.

Research Question 1: Sociodemographic Factors and Caregiver Health Behaviors

To examine the results of the first research question, "are family sociodemographic variables (i.e., caregiver education, household income, caregiver race/ethnicity) associated with caregiver health behaviors (i.e., caregiver eating habits and physical activity)?" bivariate Pearson correlation analyses were conducted (see Table 4). Results indicate neither caregiver race/ethnicity (r = .06, p = .619), caregiver education (r = .01, p = .949), nor household income, (r = -.04 p = .724) were meaningfully associated with caregiver health behaviors. However, there were meaningful negative associations between caregiver race/ethnicity (Latinx) and 1) caregiver education (r = -.58, p < .001), 2) household income (r = -.69, p < .001), and 3) child adaptive behavior (r = -.38, p = .003); indicating that caregiver identification as Latinx was associated with fewer years of education, lower household income, and having children with fewer adaptive skills when compared to other racial/ethnic groups. Caregiver race/ethnicity (Latinx) was also positively associated with higher levels of child unhealthy eating (r = .23, p = .048). Caregiver education was meaningfully correlated with household income ($r = .53$, $p < .001$), child ASD symptomatology ($r = -.30$, $p = .009$), and child adaptive skills ($r = .50$, $p < .001$), such that higher levels of education were associated with higher household incomes, fewer ASD symptoms, and higher adaptive skills. Household income was meaningfully positively associated with child adaptive skills ($r = .47$, $p < .001$), such that higher household incomes were associated with higher levels of child adaptive behavior.

Research Question 2: Caregiver Health Behaviors and Child Health Behaviors

To examine the second research question, "are caregiver health behaviors (i.e., caregiver eating habits and physical activity) associated with child heath behaviors?" bivariate Pearson correlations were conducted (see Table 4). Caregiver health behaviors were meaningfully associated with child unhealthy eating ($r = -.25$, $p = .028$) and child physical activity ($r = .44$, $p < .001$), such that higher levels of caregiver health behaviors were associated with lower levels of child unhealthy eating and higher levels of child physical activity. Caregiver health behaviors were not meaningfully associated with child screen time ($r = -.03$, $p = .801$). Furthermore, child screen time was not meaningfully correlated with any study variables.

Research Question 3: Moderation Analyses

To examine the third research question, "does child developmental functioning (i.e., adaptive behavior and autism symptoms) moderate the association between caregiver health behaviors and child health outcomes?" hierarchical linear regressions were conducted.

Child Adaptive Behavior as a Moderator

To test whether child adaptive behavior moderated the relation between caregiver health behavior and child unhealthy eating, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child Vineland ABC scores. These variables did not account for a meaningful proportion of variance in child unhealthy eating, $R^2 = .08$, $F(2, 57) = 2.44$, $p = .096$. An interaction term between caregiver health behaviors and child adaptive behavior was created. Next, the interaction term between caregiver health behaviors and child adaptive behavior was added to the regression model, which meaningfully accounted for a proportion of the variance in child unhealthy eating, $\Delta R^2 = .06$, $F(1, 56) = 3.90$, $p = .053$, $b = -2.18$, suggesting an association between caregiver health behavior and child unhealthy eating was more pronounced in children with higher adaptive behavior scores ($r = -.35$, $p = .060$) when compared to children with lower adaptive behavior scores ($r = -.23$, $p = .220$) (i.e., see Figure 3). See Table 5 for hierarchical linear regression results related to adaptive functioning, caregiver health behaviors, and child unhealthy eating.

To test whether child adaptive behavior moderated the relation between caregiver health behavior and child physical activity, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child Vineland ABC scores. These variables accounted for a clinically meaningful amount of variance in child physical activity, $R^2 = .11$, $F(2, 57) = 3.66$, $p = .032$. An interaction term between caregiver health behaviors and child adaptive behavior was created. Next, the interaction term between caregiver health behaviors and child adaptive behavior was added to the regression model, which did not account for a meaningful proportion of the variance in child physical activity, $\Delta R^2 = .05$, $F(1, 56) = 3.61$, $p = .062$, *b* = 2.06. See Table 6 for hierarchical linear regression results related to adaptive functioning, caregiver health behaviors, and child physical activity.

To test whether child adaptive behavior moderated the relation between caregiver health behavior and child screen time, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child Vineland ABC scores. These variables did not account for a clinically meaningful amount of variance in child screen time, $R^2 = .02$, $F(2, 57) = 0.44$, $p = .644$. An interaction term between caregiver health behaviors and child adaptive behavior was created. Next, the interaction term between caregiver health behaviors and child adaptive behavior was added to the regression model, which did not account for a meaningful proportion of the variance in child screen time, $\Delta R^2 = .002$, $F(1, 56) = 0.11$, $p = .745$, $b = 0.39$. See Table 7 for hierarchical linear regression results related to adaptive functioning, caregiver health behaviors, and child screen time.

Child ASD Symptomatology as a Moderator

To test whether child ASD symptomatology moderated the relation between caregiver health behavior and child unhealthy eating, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child SCQ scores. These variables accounted for a meaningful amount of variance in child unhealthy eating, $R^2 = .10$, $F(2, 70) = 3.84$, $p = .026$. An interaction term between caregiver health behaviors and child ASD symptomatology was created. Next, the interaction term between caregiver health behaviors and child ASD symptomatology was added to the regression model, which accounted for a meaningful proportion of the variance in child unhealthy eating, $\Delta R^2 = .12$, $F(1, 69) = 10.37$, $p =$

.002, $b = 1.59$, suggesting the association between caregiver health behaviors and child unhealthy eating was more pronounced in children with fewer ASD symptoms ($r = -.55$, $p < .001$) when compared to children with more ASD symptoms ($r = -.02$, $p = .891$) (i.e., see Figure 4). See Table 8 for hierarchical linear regression results related to ASD symptomatology, caregiver health behaviors, and child unhealthy eating.

To test whether child ASD symptomatology moderated the relation between caregiver health behavior and child physical activity, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child SCQ scores. These variables accounted for a clinically meaningful amount of variance in child physical activity, $R^2 = .19$, $F(2, 70) = 8.32$, $p = .001$. An interaction term between caregiver health behaviors and child ASD symptomatology was created. Next, the interaction term between caregiver health behaviors and child ASD symptomatology was added to the regression model, which did not account for a meaningful proportion of the variance in child physical activity, $\Delta R^2 = .001$, $F(1, 69) = 0.09$, $p = .765$, $b = -0.15$. See Table 9 for hierarchical linear regression results related to ASD symptomatology, caregiver health behaviors, and child physical activity.

To test whether child ASD symptomatology moderated the relation between caregiver health behavior and child screen time, a hierarchical linear regression analysis was conducted. In the first step, two variables were included: caregiver health behaviors and child SCQ scores. These variables did not account for a clinically meaningful amount of variance in child screen time, $R^2 = .02$, $F(2, 70) = 0.69$, $p = .505$. An interaction term between caregiver health behaviors and child ASD symptomatology was created. Next, the interaction term between caregiver health behaviors and child ASD symptomatology was added to the regression model, which did not account for a meaningful proportion of the variance in child screen time, $\Delta R^2 = .02$, $F(1, 69) = 1.43$, $p = .237$, $b = 0.65$. See Table 10 for hierarchical linear regression results related to ASD symptomatology, caregiver health behaviors, and child screen time.

Post-hoc Analyses Findings

Gender

Results of independent samples *t*-tests showed that male and female children in the sample were not meaningfully different from each other with regard to child adaptive behavior $t(56) = -0.13$, $p = .901$, child ASD symptomatology $t(70) = 0.52$, $p = .605$, child sleep time $t(73) = -0.37$, $p = .712$, child screen time $t(73) = 0.28$, $p = .780$, child physical activity $t(73) = -0.49$, $p = .629$, or child unhealthy eating $t(72) = -0.12$, $p = .904$.

Child Primary Diagnoses

To determine whether there were clinically meaningful differences in child health behaviors by ASD diagnosis, the child primary diagnosis variable was dichotomized into two categories, 1) ASD, and 2) no ASD. Independent samples *t*-tests showed children with ASD and children without ASD were meaningfully different in their adaptive behavior scores $t(56) = 2.69$, $p = .009$, SCQ scores $t(69) = -4.43$, $p < .001$, as well as their amount of sleep per night $t(72) = 2.84$, $p = .006$, such that children with ASD had lower adaptive scores ($M = 66.71$) when compared to children without ASD ($M = 73.97$), higher SCQ scores ($M = 19.00$) when compared to children without ASD ($M = 11.83$), and slept fewer hours per night ($M = 9.82$) when compared to children without ASD ($M = 10.68$). There were no clinically meaningful mean differences between children with and without ASD for screen time $t(72) = 0.39$, $p = .699$, physical activity $t(72) = 0.30$, $p = .765$, or unhealthy eating $t(71) = 0.22$, $p = .828$.

Child Sleep

On average, children in this sample reportedly slept between 7.5 and 14 hours per night ($M = 10.30$, $SD = 1.36$). Children in this sample reportedly went to sleep between 7:00 pm and 12:00 am (M = 9:00 pm, $SD = 1.23$) and woke up between 5:00 am and 10:00 am (M = 7:30 am, $SD = 1.29$). Regarding sleeping habits, 39.0% of children often had trouble going to bed, 22.1% often had trouble sleeping through the night, and 42.9% sometimes woke up too early. Additionally, 63.6% of caregivers rated their child as rarely being too tired during the day. Child sleep time was meaningfully associated with child physical activity ($r = .26$, $p = .022$), such that children who spent more time sleeping each night were likely to spend more time engaging in physical activity during the day.

Child Medical Problems and Sleep. Results of independent *t*-tests showed that children with and without medical problems did not meaningfully differ in adaptive scores $t(55) = 0.79$, $p = .433$, SCQ scores $t(67) = -1.20$ $p = .234$, sleep time $t(70) = -0.52$, $p = .607$, screen time $t(70) = 0.17$, $p = .863$, physical activity $t(70) = 1.68$, $p = .097$, or unhealthy eating $t(70) = 0.62$, $p = .541$.

IV: DISCUSSION

The present study sought to investigate associations between caregiver health behaviors and child health behavior in a diverse sample of preschool-aged children with DD. As previously stated, due to the underpowered nature of the study. results will be discussed using the phrases "clinically meaningful" or "meaningfully associated/moderated" rather than "statistically significant" or "significantly associated/moderated." Only clinically meaningful associations are discussed below.

Research Question 1: Sociodemographic Variables and Caregiver Health Behaviors

The first research question was "are family sociodemographic variables (i.e., caregiver education, household income, caregiver race/ethnicity) associated with caregiver health behaviors (i.e., caregiver eating habits and physical activity)?" Results indicate neither caregiver race/ethnicity, caregiver education, nor household income, were meaningfully associated with caregiver health behaviors. However, several clinically meaningful findings emerged: 1) caregiver identification as Latinx was negatively associated with caregiver education, household income, and child adaptive scores, and positively associated with child unhealthy eating, 2) caregiver education was positively associated with income and child adaptive scores, and negatively associated with child ASD symptoms, and 3) annual household income was positively associated with higher child adaptive behavior scores. Each of the findings are discussed below:

Caregivers Identifying as Latinx

Household Income, Caregiver Education, and Child Adaptive Functioning. Consistent with previous literature, caregiver identification as Latinx was meaningfully associated with fewer years of caregiver education and lower household income

(Braveman et al., 2010; Morales et al., 2007). According to the U.S. Census Bureau, in the United States the Latinx population has the lowest educational attainment rate relative to any other racial/ethnic group and are second to the Black population for lowest household income (Cuy Castellanos, 2015; US Census Bureau, 2012). Given that many of the participants in the current sample did not speak English, it is possible that these income and education discrepancies within the Latinx population may be attributed to limited employment opportunities due to language barriers. Further, these barriers are exacerbated given decades of systemic racism and marginalization of minority groups within the United States (Alexander, 2010; Kilty & Haymes, 2000) and likely more salient given the politically tumultuous time in which the study took place.

Identifying as Latinx was meaningfully associated with children presenting with fewer adaptive skills when compared to other racial/ethnic groups. Provided the high level of evidence supporting that the Latinx population has more limited access to health care when compared to their non-Latinx counterparts, this population might have fewer resources to access appropriate behavioral health services that could improve their child's adaptive functioning skills (Morales et al., 2007). Lower adaptive functioning skills within this sample could also be due to identification of disabilities later in life when compared to other racial groups (Mandell et al., 2009; Morgan et al., 2017). From an immigration lens, late disability identification could be due to fear associated with real or perceived threat of deportation if families are undocumented. For example, families might be less likely to seek professional behavioral health services or financial support during a time in our country's history where the current administration places stigma on help-seeking behaviors and promotes systemic marginalization of minorities. This interpretation is generalizing and extending beyond the current study's sample provided documentation questions were not part of the larger study's protocol; however, it is important to consider the broader political and cultural context under which these families are making decisions.

Child Unhealthy Eating. Caregiver identification as Latinx was positively associated with child unhealthy eating, such that identifying as Latinx was associated with more unhealthy eating in children. To parse out the intersectionality of sociodemographic variables, including income, education, and race/ethnicity, post hoc analyses were conducted and provided further insight into these associations. After controlling for caregiver education and household income, the association between caregiver identification as Latinx and child unhealthy eating continued to be meaningful ($r = .38$, $p = .048$). Similarly, after controlling for child adaptive behavior scores, the association between caregiver identification as Latinx and child unhealthy eating continued to be clinically meaningful ($r = .31$, $p = .017$).

It is important to recognize that the intersectionality of race/ethnicity, socioeconomic status, and education exists in the United States, and the current results provide evidence to suggest there may be cultural and environmental factors contributing to these associations. For example, it is possible that the association between identifying as Latinx and child unhealthy eating could be due, in part, to acculturation. Acculturation has previously been defined as, "the process by which immigrants adopt the attitudes, values, customs, beliefs, and behaviors of a new culture" (Abraido-Lanza et al., 2004). It is typically a unidirectional process, which often reduces multiculturalism, and manifests in four different ways: 1) "melting pot" – individuals completely forgo their heritage to fully assimilate into mainstream culture; 2) “bicultural” – individuals choose to retain their heritage while also integrating into mainstream culture; 3) “separated”- individuals retain their heritage without attempting to assimilate into mainstream culture; and 4) “marginalized/invisible” – individuals lose their heritage without attempting to integrate into mainstream culture (Cuy Castellanos, 2015). The manifestation of acculturation within individuals is likely impacted by several factors, but most relevant might be timing of residency or immigration to the United States (Morales et al., 2007). For example, individuals whose families have been in the United States for generations, might have similar dietary profiles to those of non-Latinx Americans moreso than members of families who immigrated more recently (Morales et al., 2007).

It is well-documented in the literature that there is a strong association between acculturation and health outcomes (Baquero & Parra-Medina, 2019; Cuy Castellanos, 2015). In particular, results from the Neuhouser et al. (2004) study in Yakima Valley, Washington suggest acculturation is a significant predictor of dietary patterns in the Latinx population. Specifically, after accounting for age, sex, income, and education, Neuhouser et al. (2004) found that highly acculturated Latinx individuals consumed fewer fruits and vegetables and had slightly higher fat intakes when compared to Latinxs who were less acculturated. Furthermore, food selection and consumption are largely influenced by perceptions, attitudes, and beliefs about food within an individual’s cultural lens. When individuals from more traditional societies assimilate to more modern communities with greater food variety and availability, a “nutrition transition” often occurs, which involves the integration of dietary patterns present within the mainstream culture (Lin et al., 2003). Related to the United States, this manifests as consuming fewer complex carbohydrates and more saturated fatty acids (Bermudez et al., 2000; Bermudez et al., 2002; Lin et al., 2003).

Neither citizenship/immigration status, nor residency, or place of birth questions were asked within the larger study. However, provided that 70.1% of our sample identified at Latinx, 58.4% of our sample was monolingual Spanish speaking, and 61% identified their child as bilingual, it is reasonable to surmise that a significant portion of our sample experienced some level of acculturation in a country where the majority speak English. The current study did not include acculturation as a variable; therefore, it is unclear where each individual family is within the acculturation process. However, it is important to consider factors related to minority status within the United States that could potentially account for the continued, clinically meaningful, relation between identifying as Latinx and child unhealthy eating.

Caregiver Income, Education, and Child Symptomatology

Consistent with decades of literature, results suggest higher levels of education were meaningfully associated with higher household incomes (de Wolff & Slijpe, 1973; Muller, 2002). Completing more years of education often leads to individuals gaining more problem-solving skills and specialized training, which can allow individuals to be more qualified for higher paying jobs.

Results also suggest meaningful positive associations between income, education and child adaptive skills, such that children with higher socioeconomic backgrounds have better developed adaptive skills. Additionally, higher education was negatively associated with child ASD symptomatology, such that caregivers who completed more years of school had children with fewer ASD symptoms. These associations may be attributed to increased access to services, provided more affluent families likely have the financial means to access services aimed at improving adaptive skills and symptomatology associated with ASD. It is also possible caregivers who complete more years of school may be more aware of typical child development and/or ASD symptoms, which allows them to seek professional support and participate in intervention earlier than caregivers with fewer years of education.

Research Question 2: Caregiver Health Behaviors and Child Health Behaviors

The second research question was, "are caregiver health behaviors (i.e., caregiver eating habits and physical activity) associated with child heath behaviors?" Results indicate caregiver health behaviors were meaningfully associated with child unhealthy eating and child physical activity, but not child screen time.

Caregiver Health Behaviors and Child Screen Time

Caregiver health behaviors were not meaningfully associated with child screen time. Furthermore, screen time was not associated with any study variables. Previous literature suggests excessive screen time is associated with consumption of fewer fruits and vegetables, and a higher intake of energy-dense snack foods in adolescents (Leech et al., 2014; Pearson et al., 2017; Pearson et al., 2018) as well as significant increases in BMI, fewer minutes of sleep, and poorer executive functioning in preschoolers (Aishworiya et al., 2018; American Psychiatric Association, 2016; Cespedes et al., 2014; Cox et al., 2012; Nathansan et al., 2014; Wen et al., 2014). Within the current sample, neither an excessive amount of screen time nor a high level of screen time variability was reported by caregivers (M = 1.44, SD = 0.78), indicating that children, on average, are spending more than 30 minutes but less than 1 hour engaged in screen time activities.

This lack of amount and variability could be attributed to underreporting screen time provided the stigma associated with exposing young children to high levels of screen time (Hinkley et al., 2014; Twenge & Campbell, 2018). Additionally, caregivers in this sample could also be strictly adhering to the screen time recommendation of approximately 1 hour per day spent watching high-quality programs, for preschool aged children (U.S. National Library of Medicine, 2018).

Caregiver Health is Associated with Child Unhealthy Eating and Child Physical Activity

Unlike child screen time, caregiver health behaviors were negatively associated with child unhealthy eating and positively associated with child physical activity, such that healthier habits among caregivers was associated with healthier eating and more time spent engaging in physical activity in children. These findings are consistent with literature examining typically developing children. Specifically, caregivers who either engage in physical activities themselves, or facilitate their child engaging in physical activities increases child participation in physical activity (Moore et al., 1991; Welk et al., 2003). With regard to eating, children's level of consumption has been found to be positively associated with the degree to which caregivers (specifically mothers) engage in healthy eating, prepare healthy meals, and make healthy foods available (Birch et al., 1999; Johnson et al., 2001; Wardle et al., 2005; Ventura et al., 2008).

Children within the 3 to 5 age range likely do not have a considerable amount of autonomy in making decisions about their health behaviors. Both eating habits and physical activity require caregiver facilitation, which could substantially contribute to the present associations. Furthermore, provided the interconnectedness of caregiver and child health behaviors, it is reasonable to assume caregivers and children are often eating the same foods. When purchasing foods, it is likely caregivers are selecting foods for the entire household rather than shopping separately for their children.

Lastly, these finding support and validate Bandura's (1971) previously referenced Social Learning Theory, stating children acquire new patterns of behavior through observing and imitating the behaviors of others. Provided the young age of the child sample and the current physical distancing regulations due to the pandemic, it is reasonable to assume children are spending a considerable amount of time with their caregivers and attending to their caregiver's behaviors more than they typically would have if the world was functioning normally.

Research Question 3: Vineland and SCQ Scores as Moderators

The third research question was, "does child developmental functioning (i.e., adaptive behavior and autism symptoms) moderate the association between caregiver health behaviors and child health outcomes?" Results indicate: 1) the relation between caregiver health behaviors and child unhealthy eating was meaningfully moderated by child adaptive behavior and 2) the relation between caregiver health behaviors and child unhealthy eating was meaningfully moderated by child ASD symptomatology, 3) neither child adaptive behavior functioning nor child ASD symptomatology moderated the association between caregiver health behaviors and child physical activity or caregiver health behaviors and child screen time.

Caregiver Health Behaviors and Child Unhealthy Eating

Moderation analyses were only clinically meaningful for the relation between caregiver health behaviors and child unhealthy eating. Results are discussed in more detail below.

Child Adaptive Functioning as a Moderator. The relation between caregiver health behaviors and child unhealthy eating was meaningfully moderated by child adaptive behavior, such that children with higher adaptive functioning scores were more likely to engage in healthy eating practices when compared to children with lower adaptive functioning skills.

It is well established that parenting children with DD can be highly stressful and can lead to feelings of frustration, anxiety and depression (MacDonald et al., 2010). Specifically, Feizi and colleagues (2014) found mothers of children with more severe disabilities experience more stress when compared to mothers parenting children with less severe disabilities. The heightened parenting stress associated with parenting children who are lower functioning, could make enforcing strict health habits early more challenging. Colloquially, we might attribute this to caregivers “picking their battles”, such that they might be content if their child is eating something even if it is not necessarily the healthiest option.

Additionally, the association between stress and alteration of eating habits has been well documented in the literature (Yau & Potenza, 2013). According to a study conducted by Torres & Nowson (2007), stress can lead to either over- or undereating, which can be influenced by stress severity. Specifically, chronic life stress has been previously associated with consuming foods with higher sugar and fat content (Oliver et al., 2000; Schiffman et al., 2000), which could lead to an increased chance of energy dense food availability in the home. Furthermore, if caregivers are experiencing a high level of stress and consuming more energy dense foods, they are modeling unhealthy eating habits for their children, which could lead to children observationally acquiring more unhealthy eating habits (Bandura, 1971).

Child ASD Symptomatology as a Moderator. The relation between caregiver health behaviors and child unhealthy eating was meaningfully moderated by child ASD symptomatology, such that children with fewer ASD symptoms were more likely to engage in less unhealthy eating practices when compared to children with more ASD symptoms. This finding is consistent with previous research, which indicates children with ASD consume more snack foods and sugar sweetened beverages, and fewer servings of fruits and vegetables when compared to typically developing children (Evans et al., 2012).

According to the DSM-5, ASD is characterized by social communication deficits as well as restricted and repetitive behaviors (American Psychiatric Association, 2013). Social communication deficits can manifest as difficulty with interacting and communicating with others, including challenges with observing social cues (American Psychiatric Association, 2013). Again, referring to Bandura's (1971) Social Learning Theory, children who present with more deficits in social communication may not readily acquire skills through observing others in their environment. Related to eating, children with more ASD symptoms may require a higher degree of explicit instruction about healthy eating when compared to children with fewer ASD symptoms, who may be able to acquire healthy eating habits through observing their caregivers.

When considering restricted and repetitive behaviors, children with ASD often present with an insistence on sameness, which can manifest as preferences for certain types or brands of food. For example, results from the Bandini et al. (2010) study found children with ASD are more likely than their typically developing counterparts to have a higher intake of single foods and engage in food refusal. These behaviors restrict the type and variety of food children with more symptoms of ASD are willing to consume. Additionally, restricted diets may be associated with sensitivities to the physical characteristics of food. For example, children with ASD often present with rigid eating habits related to dry (crunchy and crisp) and soft (moist or mushy) food textures (Whiteley et al., 2000). Textural sensitivities to food may also be contributing to the differences present between children with more versus few ASD symptoms.

Implications

Although preliminary in nature, the outcomes of this study have a number of meaningful implications for research, intervention, and practice. First, this study adds to the growing body of literature demonstrating links between caregiver health behaviors and child health outcomes in families with young children with DD. Learning about the presence and impact of caregiver health behaviors can inform intervention development and implementation for families. Specifically, the findings from the present study can aid in the development of interventions aimed at promoting the health of Latinx families in the United States. Provided the majority of our sample identified as Latinx, and that the U.S. Latinx population is disproportionately affected by chronic illnesses, relative to other racial/ethnic and socioeconomic groups, it is imperative to develop culturally appropriate intervention programs tailored to the needs of these families (American

Diabetes Association, 2015; Baquero & Parra-Medina, 2019). Furthermore, the study results support existing research regarding the discrepancy between the timing of disability identification in young children from minority backgrounds relative to their White counterparts (Mandell et al., 2009; Morgan et al., 2017). It is essential for clinicians to be aware of this disparity, as implementation of early intervention services should occur as soon as possible.

Second, the study findings may inform 1) feeding interventions that utilize sensorimotor training and nutritional monitoring for children with higher levels of ASD symptomatology and lower adaptive skills, as well as 2) interventions aimed at improving stress associated with parenting children with varying disability severity, which could lead to consumption of healthier food options. Furthermore, the study findings may bring awareness to caregivers looking for information to promote child healthy behavior. Dissemination of these finding will encourage caregivers to personally engage in and facilitate healthy eating and physical activity with their children, which could positively contribute to family well-being and quality of life.

Limitations

While this study yields some interesting findings, there are several important limitations to discuss. First, this study was cross-sectional and did not include longitudinal data. When examining the associations between caregiver health behaviors and child health behaviors (given the age of the children, disability status, and other family factors), it is important to understand that they represent relations that occurred during a single time period. It cannot be determined if these associations will continue to be meaningful over time. Therefore, it is important to highlight that neither predictive nor causal relations can be inferred, provided cross-sectional data yields effects that may be bidirectional. Future longitudinal studies are necessary to determine temporal precedence and the influence of caregiver health behavior on health behaviors of children with DD over time.

There were several pandemic-related adjustments to the larger federally funded research project, which lead to a substantial amount of missing data. Provided the smaller than anticipated sample size, the present study was underpowered. Additionally, direct measures of child factors including ASD symptomatology and intellectual functioning could not be obtained due to physical distancing restrictions. Furthermore, measures of child outcome variables, including motor skills from the VABS-III were not able to be obtained. Prior to the implementation of COVID-19 related restrictions, in-person assessments and interviews were being conducted, which could have aided in the accuracy of data collection, as caregivers' literacy levels and receptive language abilities were unknown.

The study data were primarily based on caregiver reports of their own, as well as their child's behavior via mail-home questionnaire packets. Self-report data does not always yield reliable or representative results of overall behavior (Chan, 2009; Nisbett & Wilson, 1977). It is possible caregiver responses were biased and they completed questionnaires based on what they believed was "correct", or in the case of the larger study, what they thought would place them in their preferred intervention condition. Results of self-report data may also be influenced by caregiver mental health state and social desirability, as well as environmental factors, including what their children are doing the moment they are completing the questionnaires (Couch & Keniston, 1961).

Despite the many limitations mentioned about caregiver self-report, the information gathered through this modality is indicative of what caregivers think about their current situation, which is valuable.

Finally, this study was preliminary in nature and utilized the FLSS measure, which is not norm-referenced and has not undergone rigorous reliability and validity testing. Developing and/or utilizing a stronger assessment tool, with more items measuring each caregiver and child construct, would increase alpha reliability values for composite scales, which may increase the confidence with which researchers can reliably report meaningful results.

Future Directions

There are several important future directions that can be taken to better understand the associations between caregiver health behaviors and child health outcomes. First, future research should utilize a multi-modal and longitudinal approach to data collection with a larger sample size so as to better characterize the severity and persistence of ASD symptoms and adaptive behavior, as well as the frequency and duration of caregiver and child health behaviors over time. For example, future researchers might consider using the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) along with the SCQ to better conceptualize ASD symptoms (Lord et al., 2000). Future research might consider measuring caregiver and child health behaviors through questionnaires as well as pedometers, skin conductance tools, or meal tracking applications to better understand family lifestyles. Conducting this research longitudinally and with a larger sample size, would not only provide information about whether the current study associations persist over the course of a child's life, but allow researchers to examine the predictive relations between caregiver health behaviors and child health behaviors under adequately powered conditions.

Second, research should further investigate the association between identifying as Latinx and child unhealthy eating. Previous research has suggested acculturation as a potential predictive factor (Neuhouser et al, 2004); however, there are different cultural and eating practices within Latinx subgroups (Seiga-Riz et al., 2014). It would be interesting to examine whether the association between identifying as Latinx and unhealthy eating in young children differs depending on Latinx subgroup. Furthermore, it appears as though level of acculturation differentially impacts health behaviors, which could also be fascinating to parse out in the context of the present study questions (Morales et al., 2007).

Pertaining to screen time, there are a few directions future research could explore. The present study did not inquire about caregiver screen time; therefore, it would be interesting to investigate the association between caregiver and child screen time in future studies, particularly in an adolescent population. Relatedly, investigating screen-time as it relates to eating habits and physical activity within an adolescent population presenting with circumscribed interests in video games or online platforms (e.g., YouTube) would meaningfully contribute to the scarce literature in this area. Lastly, provided the pandemic has led to an increase in time spent in the home context, it would be valuable to examine 1) differences in caregiver's perceptions of screen time before and during the pandemic and 2) differences in the amount of caregiver and child screen time before and during the pandemic, and how that varies by season.

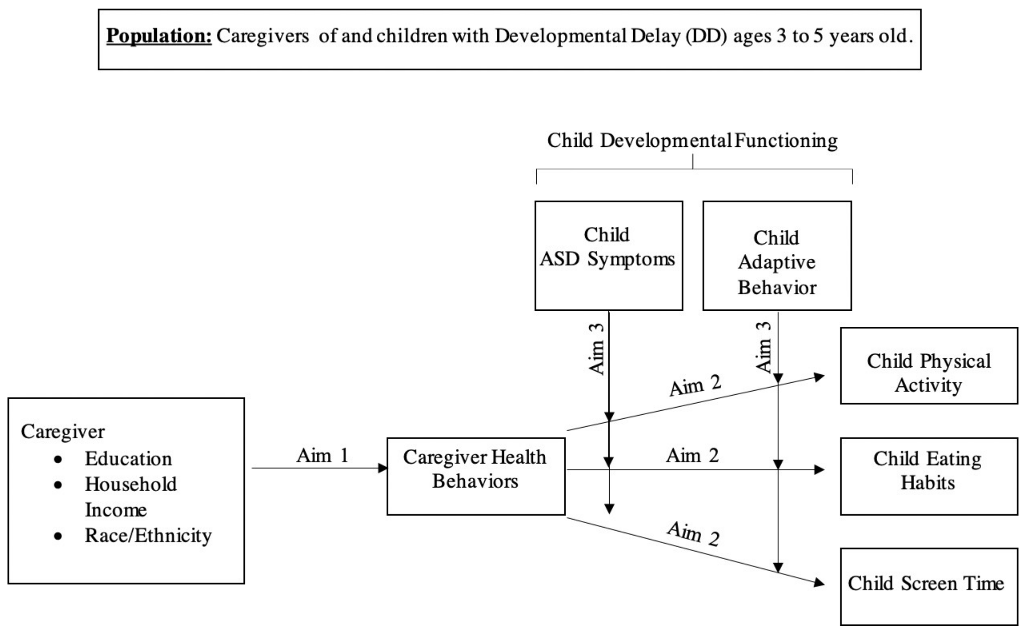
Conclusion

The current study sought to provide a preliminary evaluation of the associations between caregiver health behaviors and health behaviors of preschool-aged children with DD across two west coast states in the United States. Results indicated that 1) caregiver identification as Latinx was negatively associated with caregiver education, household income, and child adaptive scores, and positively associated with child unhealthy eating, 2) caregiver education was positively associated with income and child adaptive scores, and negatively associated with child ASD symptoms, and 3) annual household income was positively associated with higher child adaptive behavior scores. Caregiver health behaviors were meaningfully associated with child unhealthy eating habits and child physical activity, but not child screen time. Moderation analyses indicated, the relation between caregiver health behaviors and child unhealthy eating was moderated by child adaptive behavior and 2) the relation between caregiver health behaviors and child unhealthy eating was moderated by child ASD symptomatology. Neither child adaptive behavior functioning nor child ASD symptomatology meaningfully moderated the association between caregiver health behaviors and child physical activity or caregiver health behaviors and child screen time. In sum, this study added to the literature by providing novel information that is consistent with health literature on typically developing children. The study findings demonstrate important associations between caregiver health behaviors and child health behaviors that will be useful for clinicians and in guiding future research.

APPENDIX: TABLES AND FIGURES

Figure 1

Conceptual Model



Note. Caregiver health behaviors include both caregiver physical activity and eating habits.

Figure 2

Family Lifestyle Survey (FLSS)

1. How much time on a typical school day does your child spend doing the following activities?

	None	**15-30 minutes**	**30 mins - 1 hour**	**1 - 2 hours**	**3 - 4+ hours**
a. Watching TV	○	○	○	○	○
b. Playing video games	○	○	○	○	○
c. Playing on the computer, tablet, phone	○	○	○	○	○
d. Watching movies	○	○	○	○	○
e. Looking at books	○	○	○	○	○
f. Playing sports	○	○	○	○	○
g. Playing outside activities (running, tag, ball games)	○	○	○	○	○
h. Riding a bike	○	○	○	○	○
i. Walking (such as walking a pet, walking with family members	○	○	○	○	○
j. Going to the park	○	○	○	○	○

2. Which best describes your child's activity level at home?
   - ○ Normally sits down while playing, coloring, watching TV, or reading
   - ○ Combines play with activities that involve movement, walking from one end of the house to the other, standing while playing video games.
   - ○ Does not stop moving, runs from one part of the house to another, goes up and down stairs, runs and jumps.

3. How many days a week does your child exercise for at least 20 minutes (examples: biking, running, soccer, etc.)? ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

4. How many days a week does your child eat out at a fast food restaurant? ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

5. How many servings of fruit and vegetables does your child eat on an average day?

   ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 or more

6. How many pieces of candy or other sweets does your child eat daily?

   ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 or more

7. How many times a day does your child drink juice?

   ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 or more

8. How many times a day does your child drink sugar sweetened drinks, such as soda?

   ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 or more

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9. How many nights per week do most of your family members eat a meal together?

○ 0-1 nights ○ 1-2 nights ○ 2-3 nights ○ 4-5 nights ○ 6-7 nights

10. a. What time does your child **go to bed** on a typical week night? ☐☐ ○ AM ○ PM

b. What time does your child **wake up** on a typical week day? ☐☐ ○ AM ○ PM

c. My child has trouble going to bed. ○ Rarely ○ Sometimes ○ Often

d. My child has trouble sleeping through the night. ○ Rarely ○ Sometimes ○ Often

e. My child wakes up too early. ○ Rarely ○ Sometimes ○ Often

f. My child is too tired during the day. ○ Rarely ○ Sometimes ○ Often

11. Please rate how often **you** engage in the following health behaviors.

I...	**Almost never**	**Rarely**	**Sometimes**	**Often**	**Nearly always**
a. Make low calorie, low fat foods when cooking for my family (fruit, vegetables, lean meats like chicken or fish)	○	○	○	○	○
b. Offer my child a healthy alternative when he/she asks for junk food	○	○	○	○	○
c. Eat low calorie, low fat foods	○	○	○	○	○
d. Keep unhealthy food out of sight of my child	○	○	○	○	○
e. Choose healthy options at fast food or other restaurants	○	○	○	○	○
f. Eat vegetables	○	○	○	○	○
g. Workout, exercise, or participate in physical activity	○	○	○	○	○
h. Serve fresh fruits and vegetables	○	○	○	○	○
i. Teach my child about healthy food choices	○	○	○	○	○
j. Participate in physical activities with my child	○	○	○	○	○

Figure 3

Moderation Effects of Dichotomized Vineland Composite Scores on the Association Between Caregiver Health Behaviors and Child Unhealthy Eating Habits

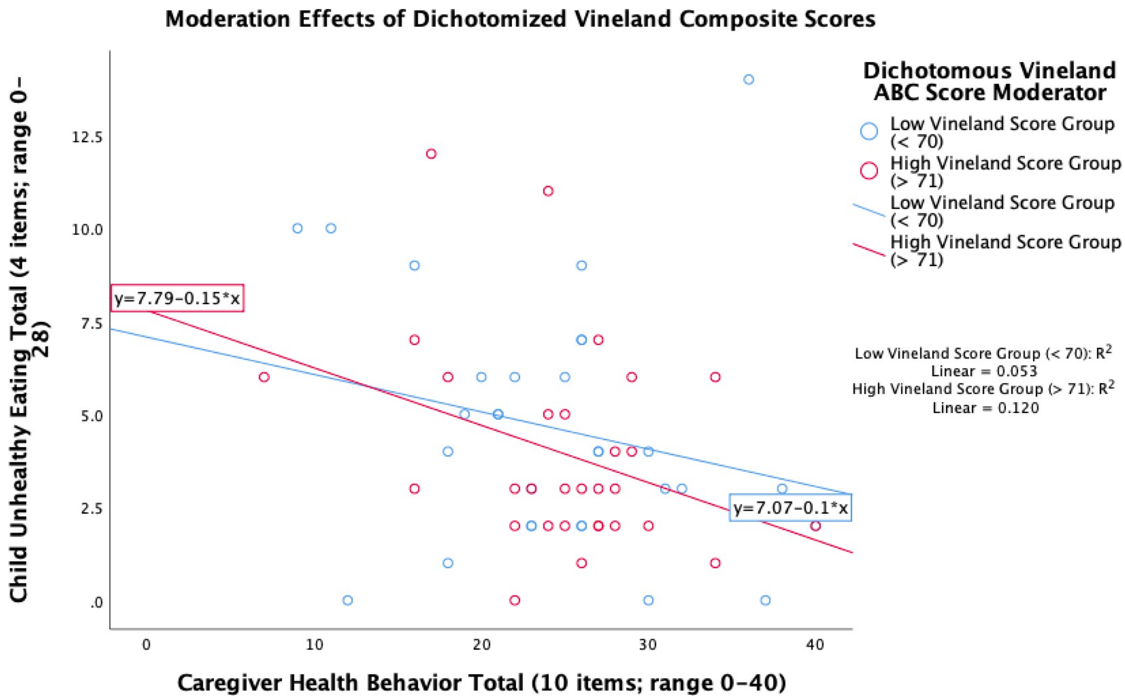

Figure 4

Moderation Effects of Dichotomized SCQ Scores on the Association Between Caregiver Health Behaviors and Child Unhealthy Eating Habits

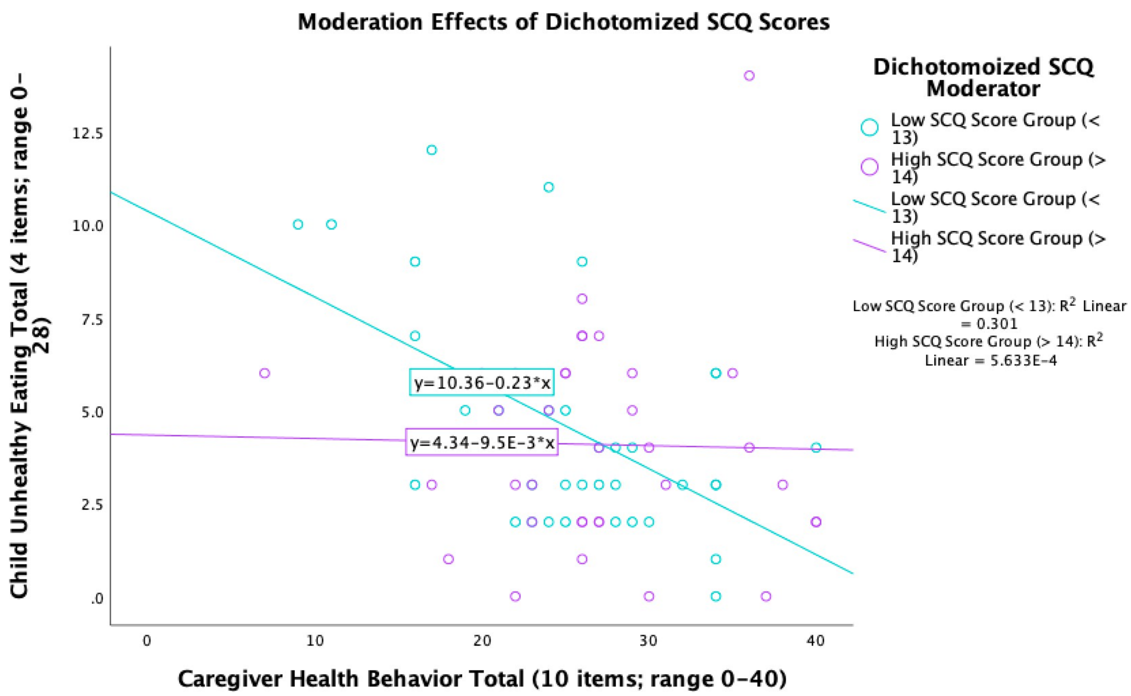

Table 1

Demographic Information for Caregivers and Children (N = 77)

Caregiver		Children	
Characteristic	*M* or % (*SD*)	Characteristic	*M* or % (*SD*)
Age (years)	38.74 (8.67)	Age (years)	3.88 (0.81)
% Female	98.70	% Male	63.60
% White/Non-Latinx	23.40	% White/Non-Latinx	24.70
% Latinx	70.10	% Latinx	68.80
% Monolingual- Spanish	58.40	% SPED[a] eligibility	72.70
% ≥ Partial college	46.80	% Health concerns	31.20
% Employed full-time	28.60	Primary diagnosis	
% Partner in the home	89.60	ASD	44.20
% ≤ 50,000	19.50	Speech lang. delay	23.40
		Other	31.20

Note. "Other" = genetic disorder/syndrome, sensory disorder, learning disability, social-emotional delay, developmental delay, and/or cerebral palsy.

[a]"SPED" = special education.

Table 2

Descriptive Statistics for Caregiver and Child Composite Scores

Variable	*n*	*M*	*SD*
Caregiver health behaviors	76	25.82	7.04
Child unhealthy eating	76	4.20	2.87
Child physical activity	77	6.51	3.80
Child screen time	77	5.74	3.13

Note. The range of possible scores for caregiver health behaviors is 0-40. The range of possible scores for child unhealthy eating is 0-28. The range of possible scores for child physical activity was 0-20. The range for child screen time is 0-16. Ranges were developed by multiplying the number of items comprising each respective composite by the number of response options on the Likert scale.

Table 3

Descriptive Statistics for the Adaptive Behavior Standard Scores (Vineland-3) and Social Communication Questionnaire (SCQ)

Subscales	*n*	*M*	*SD*
Communication	60	68.40	13.94
Daily living skills	60	73.08	14.47
Socialization	60	74.40	11.34
Motor skills	49	73.82	12.90
ABC	60	70.58	10.95
ABC median split			
High ABC Vine	30	$\geq$ 71	
Low ABC Vine	30	$\leq$ 70	
SCQ total score	74	15.09	7.68
SCQ median split			
High total SCQ	37	$\geq$ 14	
Low total SCQ	37	$\leq$ 13	

Note. Distributions are unimodal and approximately symmetrical with no severe skew and no severe outliers.

Table 4

Correlations Between Study Variables and Demographics

Variable	1	2	3	4	5	6	7	8	9
1. Caregiver race – Latinx	—								
2. Caregiver education	-.58***	—							
3. Household income (cat.)[a]	-.69***	.53***	—						
4. Caregiver health behaviors	.06	.01	-.04	—					
5. Child unhealthy eating	.23*	-.13	-.20	-.25*	—				
6. Child physical activity	.04	-.07	-.11	.44***	.04	—			
7. Child screen time	-.06	.09	.00	-.03	.08	.22	—		
8. SCQ	.10	-.30**	-.19	.14	-.13	-.09	-.12	—	
9. Vineland ABC	-.38**	.50***	.47***	.03	.03	-.00	.07	-.52***	—

Note. ****p* < .001, ***p* < .01, **p* < .05

[a] Household income was categorized into 13 groups: 1 = “$4,999 or less”, 2 = “$5,000 to $9,999”, 3 = “$10,000 to $14,999”, 4 = “$15,000 to $19,999”, 5 = “$20,000 to $24,999”, 6 = “$25,000 to $29,999”, 7 = “$30,000 to $39,999”, 8 = “$40,000 to $49,999”, 9 = “$50,000 to $59,999”, 10 = “$60,000 to $69,999”, 11 = “$70,000 to $79,999”, 12 = “$80,000 to $89,999”, 13 = “$90,000 or more.”

Table 5

Regression Results for Child Unhealthy Eating: Vineland Scores[a] and Caregiver Health Behaviors[b] (N = 77)

Parameter	Model 1				Model 2				Model 3			
	b	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	-.25	.05	-2.24	.028	-.28	.06	-2.20	.032	1.56	.42	1.66	.103
Vineland ABC					.04	.04	.31	.760	1.13	.16	2.00	.051
Caregiver health behaviors x Vineland ABC									-2.18	.01	-1.97	.053

Note. Model 1 R^2 = .06, F = 5.01, p = .028. Model 2 ΔR^2 = .08, ΔF = 2.44, p = .096. Model 3 ΔR^2 = .06, ΔF = 3.90, p = .053.

[a] n = 60. [b] n = 77.

Table 6

Regression Results for Child Physical Activity: Vineland Scores[a] *and Caregiver Health Behaviors*[b] *(N = 77)*

	Model 1				Model 2				Model 3			
Parameter	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	.44	.06	4.18	< .001	.34	.06	2.70	.009	-1.41	.44	-1.52	.134
Vineland ABC					-.01	.04	-.09	.926	-1.05	.17	-1.88	.066
Caregiver health behaviors x Vineland ABC									2.06	.01	1.90	.062

Note. Model 1 R^2 = .19, F = 17.44, p < .001. Model 2 ΔR^2 = .11, ΔF = 3.66, p = .032. Model 3 ΔR^2 = .05, ΔF = 3.61, p = .062.

[a] n = 60. [b] n = 77.

Table 7

Regression Results for Child Screen Time: Vineland Scores[a] and Caregiver Health Behaviors[b] (N = 77)

	Model 1				Model 2				Model 3			
Parameter	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	-.03	.05	-.25	.801	-.10	.06	-.75	.455	-.43	.48	-.42	.674
Vineland ABC					.08	.04	.59	.559	-.17	.18	-.19	.849
Caregiver health behaviors x Vineland ABC									.39	.01	.33	.745

Note. Model 1 R^2 = .001, F = .06, p = .801. Model 2 ΔR^2 = .02, ΔF = .44, p = .644. Model 3 ΔR^2 = .002, ΔF = .12, p = .745.

[a] n = 60. [b] n = 77.

Table 8

Regression Results for Child Unhealthy Eating: SCQ Scores[a] and Caregiver Health Behaviors[b] (N = 77)

	Model 1				Model 2				Model 3			
Parameter	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	-.25	.05	-2.24	.028	-.29	.05	-2.54	.013	-.97	.10	-4.10	< .001
Child SCQ scores					-.09	.04	-.74	.461	-1.39	.16	-3.31	.001
Caregiver health behaviors x SCQ									1.59	.01	3.22	.002

Note. Model 1 R^2 = .06, F = 5.01, p = .028. Model 2 ΔR^2 = .10, ΔF = 3.84, p = .026. Model 3 ΔR^2 = .12, ΔF = 10.37, p = .002.

[a] n = 74. [b] n = 77.

Table 9

Regression Results for Child Physical Activity: SCQ Scores[a] and Caregiver Health Behaviors[b] (N = 77)

Parameter	Model 1				Model 2				Model 3			
	b	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	.44	.06	4.18	< .001	.43	.06	4.00	< .001	.50	.13	2.08	.041
Child SCQ scores					-.15	.05	-1.40	.166	-.03	.21	-.07	.947
Caregiver health behaviors x SCQ									-.15	.01	-.30	.765

Note. Model 1 $R^2 = .19$, $F = 17.44$, $p < .001$. Model 2 $\Delta R^2 = .19$, $\Delta F = 8.32$, $p = .001$. Model 3 $\Delta R^2 = .001$, $\Delta F = .09$, $p = .765$.

[a] n = 74. [b] n = 77.

Table 10

Regression Results for Child Screen Time: SCQ Scores[a] and Caregiver Health Behaviors[b] (N = 77)

	Model 1				Model 2				Model 3			
Parameter	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Caregiver health behaviors	-.03	.05	-.25	.801	-.08	.05	-.66	.509	-.36	.12	-1.37	.176
Child SCQ scores					-.10	.05	-.87	.390	-.64	.19	-1.38	.173
Caregiver health behaviors x SCQ									.65	.01	1.19	.237

Note. Model 1 R^2 = .001, F = .06, p = .801. Model 2 ΔR^2 = .02, ΔF = .69, p = .505. Model 3 ΔR^2 = .02, ΔF = 1.43, p = .237.

[a] n = 74. [b] n = 77.

REFERENCES CITED

Abbeduto L., Seltzer M. M., Shattuck P., Krauss M.W., Orsmond G., & Murphy M. M. (2004). Psychological well-being and coping in mothers of youths with autism, Down syndrome, or fragile X syndrome. *American Journal of Mental Retardation, 109*(3), 237-254.

Abraido-Lanza, A. F., White K., Vasques, E. (2004). Immigrant populations and health. In: Anderson N., (Ed). Encyclopedia of health and behavior. Sage Publications.

Ahearn, W. H., Castine, T., Nault, K., & Green, G. (2001). An assessment of food acceptance in children with autism or pervasive developmental disorder-not otherwise specified. *Journal of Autism Developmental Disorders, 31*, 505-511.

Aishworiya, R., Kiing, S. J., Chan H. Y., Tung, S. S., & Law, E. (2018). Screen time exposure and sleep among children with developmental disabilities. *Journal of Pediatrics and Child Health, 54*(8), 889-894.

Alexander, M. (2010). The new jim crow: Mass incarceration in the age of colorblindness. The New Press.

American Diabetes Association. (2020). *What causes diabetes? Find out and take control.*
American Diabetes Association. www.diabetes.org.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Association.

American Psychiatric Association. (2016). Media and young minds. *Pediatrics, 138*(5), http://pediatrics.aappublications.org/content/pediatrics/138/5/e20162591.full.pdf

Anderson, S. E., Economos, C. D., & Must, A. (2008). Active play and screen time in US children aged 4 to 11 years in relation to sociodemographic and weight status characteristics: A nationally representative cross-sectional analysis. *BMC Public Health*, *8*, 366. doi:10.1186/1471-2458-8-366

Bandini, L. G., Anderson, S. E., Curtin, C., Cermak, S., Evans, E. W., Scampini, R., Maslin, M., & Must, A. (2010). Food selectivity in children with autism spectrum disorders and typically developing children. *The Journal of Pediatrics*, *157*(2), 259–264. https://doi.org/10.1016/j.jpeds.2010.02.013

Bandini, L. G., Curtin, C., Hamad, C, Tybor, D. J., & Must, A. (2005). Prevalence of overweight in children with developmental disorders in the continuous national health and nutrition examination survey (NHANES) 1999-2002. *Journal of Pediatrics, 146*(6), 738-743.

Bandura, A. (1971). Social learning theory. General Learning Press.

Baquero, B. & Parra-Medina, M. D. (2019). Chronic disease and the Latinx population: Threats, challenges, and opportunities. In *Martínez, D. A., & Rhodes, D. S. (Eds.), New and Emerging Issues in Latinx Health* pp.19-44. Springer.

Bermudez, O. L., Falcon, L. M., & Tucker, K. L. (2000). Intake and food sources of macronutrients among older Hispanic adults: Association with ethnicity acculturation, and length of residence in the United States. *Journal of the American Dietetic Association*, *100*(6), 665-673.

Bermudez, O. I., Velez-Carrasco, W., Schaefer, E. J., & Tucker, K. L. (2002). Dietary and plasma lipid, lipoprotein, and apolipoprotein profiles among elderly Hispanics and non-Hispanics and their association with diabetes. *The American Journal of Clinical Nutrition*, *76*(6), 1214-1221.

Birch, L. L., & Davison, K. K. (2001). Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatric Clinics of North America, 48*(4), 893-907.

Birch L. L., Fisher J. O., Smiciklas-Wright J. O. (1999). Eat as do not as I say: Parental influences on young girls' calcium intakes. *The FASEB Journal*, *13*, 593.

Boyle, C. A., Boulet, S., Schieve, L., Cohen, R. A., Blumberg, S. J., Yeargin-Allsopp, M., Visser, S., & Kogan, M. D. (2011). Trends in the prevalence of developmental disabilities in US children, 1997–2008. *Pediatrics, 27,* 1034-1042.

Bower, K. J., Hales, P. D., Tate, F. D., Rubin, A. D., Benjamin E. S., & Ward S. D. (2008). The childcare environment and children’s physical activity. *American Journal of Preventative Medicine, 34*(1). doi:10.1016/j.amepre.2007.09.022

Braveman, P. A., Cubbin, C., Egerter, S., Williams, D. R., & Pamuk, E. (2010). Socioeconomic disparities in health in the United States: What the patterns tell us. *American Journal of Public Health*, 186–196. https://doi.org/10.2105/AJPH.2009.166082

Bremer, E., & Cairney, J. (2020). Adaptive behavior moderates health-related pathways in children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, *50*(2), 491–499. https://doi.org/10.1007/s10803-019-04277-6

Brown, W. H., Pfeiffer, K. A., McIver, K. L., Dowda, M., Addy, C. L., & Pate, R. R. (2009). Social and environmental factors associated with preschoolers' nonsedentary physical activity. *Child Development*, *80*(1), 45–58. doi:10.1111/j.1467-8624.2008.01245.x

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports, 100*(2), 126–131.

Center for Disease Control (CDC). (2013). *Preventing Chronic Diseases and Reducing Health Risk Factors*. Center for Disease Control and Prevention. https://www.cdc.gov/nccdphp/dch/programs/healthycommunitiesprogram/overview/diseasesandrisks.html

Center for Disease Control (CDC). (2020). *Heart disease facts.* Center for Disease Control and Prevention. https://www.cdc.gov/heartdisease/facts.html

Center for Disease Control (CDC). (2020). *Leading causes of death.* Center for Disease Control and Prevention. https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

Center for Disease Control (CDC). (2015). *Physical activity for a healthy weight*. Center for Disease Control and Prevention. https://www.cdc.gov/healthyweight/physical_activity/index.html

Center for Disease Control (CDC). (2018). *Physical activity guidelines for Americans-second edition*. Center for Disease Control and Prevention. https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf

Cespedes, E. M., Gillman, M. W., Kleinman, K., Rifas-Shiman, S. L., Redline, S., & Taveras, E. M. (2014). Television viewing, bedroom television, and sleep duration from infancy to mid-childhood. *Pediatrics,133*(5). www.pediatrics.org/cgi/content/full/133/5/e1163pmid:24733878

Chan, D. (2009). So why ask me? Are self-report data really that bad. *Statistical and methodological myths and urban legends: Doctrine, verity and fable in the organizational and social sciences*, 309-336.

Common Sense Media. (2017). The common sense census: Media use by kinds age zero to eight 2017. https://www.commonsensemedia.org/sites/default/files/uploads/research/csm_zerotoeight_fullreport_release_2.pdf

Couch, A., & Keniston, K. (1961). Agreeing response set and social desirability. *The Journal of Abnormal and Social Psychology, 62*(1), 175–179. https://doi.org/10.1037/h0047429

Cox, R., Skouteris, H., Rutherford, L., Fuller-Tyszkiewicz, M., Dell'Aquila, D., & Hardy, L. L. (2012). Television viewing, television content, food intake, physical activity and body mass index: A cross-sectional study of preschool children aged 2-6 years. *Health Promotion Journal of Australia, 23*(1), 58–62.

Cummins, S., & Macintyre, S. (2002). "Food deserts"—evidence and assumption in health policy making. *BMI*, *325*(7361), 436-438.

Cuy Castellanos, D. (2015). Dietary acculturation in Latinos/Hispanics in the United States. *American Journal of Lifestyle Medicine*, *9*(1), 31–36. https://doi.org/10.1177/1559827614552960

Curtin, C., Anderson, S. E., Must, A., & Bandini, L. (2010). The prevalence of obesity in children with autism: A secondary data analysis using nationally representative data from the National Survey of Children's Health. *BMC Pediatrics*, *10*, 0–4. https://doi.org/10.1186/1471-2431-10-11

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334.

Darmon, N., Drewnowski, A. (2008). Does social class predict diet quality? *American Journal of Clinical Nutrition, 87*, 1107–1117.

De, S., Small, J., & Baur, L. A. (2008). Overweight and obesity among children with developmental disabilities. *Journal of Intellectual and Developmental Disability, 33*(1), 43-77. doi: 10.1080/13668250701875137.

de Wolff, P., & Van Slijpe, A. R. D. (1973). The relation between income, intelligence, education and social background. *European Economic Review*, *4*(3), 235-264.

Dishion, T. J., & Kavanagh, K. (2003). *Intervening in adolescent problem behavior: A family-centered approach*. Guilford Press.

Drewnowski, A. (2010). The cost of US foods as related to their nutritive value. *American Journal of Clinical Nutrition, 92*, 1181–1188

Emerson, E. (2009). Overweight and obesity in 3- and 5-year-old children with and without developmental delay. *Public Health, 123*(2). doi: 10.1016/j.puhe.2008.10.020

Evans, E. W., Must, A., Anderson, S. E., Curtin, C., Scampini, R., Maslin, M., & Bandini, L. (2012). Dietary patterns and body mass index in children with autism and typically developing children. *Research in Autism Spectrum Disorders*, *6*(1), 399–405. https://doi.org/10.1016/j.rasd.2011.06.014

Fairthorne, J., de Klerk, N., & Leonard, H. (2015). Health of mothers of children with intellectual disability or autism spectrum disorder: A review of the literature. *Medical Research Archives*, (3).

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160. doi:10.3758/BRM.41.4.1149

Feizi, A., Najmi, B., Salesi, A., Chorami, M., & Hoveidafar, R. (2014). Parenting stress among mothers of children with different physical, mental, and psychological problems. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*, *19*(2), 145–152.

Ferreria, I., van der Horst, K., Wendel-Vos, W., Kremers, S., van Lenthe, F. J., Brug J. (2006). Environmental correlates of physical activity in youth–a review and update. *Obesity Reviews, 8*(2), 129–54.

Gustafson, S. L. & Rhodes, R. E. (2006). Parental correlates of physical activity in children and early adolescents. *Sports Medicine, 36*(1), 79–97.

Handbury, J., Rahkovsky, I. M., & Schnell, M. (2015). What drives nutritional disparities? Retail access and food purchases across the socioeconomic spectrum. *Retail Access and Food Purchases Across the Socioeconomic Spectrum.*

Healy, S., Haegele, J. A., Grenier, M., & Garcia, J. M. (2017). Physical activity, screen-time behavior, and obesity among 13-year olds in Ireland with and without autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(1), 49–57. https://doi.org/10.1007/s10803-016-2920-4

Hinckson, A. E., & Curtis, A. (2013). Measuring physical activity in children and youth living with intellectual disabilities: A systematic review. *Research in Developmental Disabilities, 34*(1), 72-86.

Hinkley, T., Crawford, D., Salmon, J., Okely, A.D., & Hesketh, K. (2008). Preschool children and physical activity: A review of correlates. *American Journal of Preventive Medicine, 34*(5), 435–441.

Hinkley, T., Verbestel, V., Ahrens, W., Lissner, L., Molnar, D., Moreno, L. A., Pigeot, I., Pohlabeln, H, Reisch, L. A., Russo, P., Veidebaum, T., Tornaritis, M., Williams, G., Henauw, S. D., & Bourdeaudhuij, D. I. (2014). Early childhood electronic media use as a predictor of poorer well-being: A prospective cohort study. *JAMA Pediatrics*, *168*(5), 485-492.

IBM Corp. (2016). *IBM SPSS Statistics for Macintosh, Version 25.0*. IBM Corp.

Jackson, M. D., Reilly, J. J., Kelly, A. L., Montgomery, C., Grant, S., & Paton J.Y. (2003). Objectively measured physical activity in a representative sample of 3- to 4-year-old children. *Obesity Research, 11,* 420-425.

Johnson, R. K., Panely C.V., Wang M. Q. (2001). Associations between the milk mothers drink and the milk consumed by their school-aged children. *Family Economics and Nutrition Review, 13,* 27-36.

Jones, T. W. (1982). Treatment of behavior-related eating problems in retarded students: A review of the literature. *In J. H. Hollis & C. E. Myers (Eds.), Life threatening behavior: analysis and intervention (pp. 3–26)*. American Association on Mental Deficiency.

Jones, N. R.V., Conklin, A. I., Suhrcke, M., & Monsivais, P. (2014). The growing price gap between more and less healthy foods: Analysis of a novel longitudinal UK dataset. *PLoS One, 9*.

Kelly, A. L., Reilly, J. J., Fisher, A., Montgomery, C., Williamson, A., McColl, H. J., Paton, Y. J., & Grant, S. (2006). Effect of socioeconomic status on objectively measured physical activity. *Archives of Disease in Childhood, 91*, 35-38.

Kilty, K. M., & Haymes, M. V. D. (2000). Racism, nativism, and exclusion: Public policy, immigration, and the Latino experience in the United States. *Journal of Poverty*, *4*, 1-25.

Lang, R., Koegel, K. L., Ashbaugh, K., Regester, A. Ence, W., & Smith, W. (2010). Physical exercise and individuals with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 4*(4), 565-576.

Lee, M. H., Park, C., Matthews, A. K., & Hsieh, K. (2017). Differences in physical health, and health behaviors between family caregivers of children with and without disabilities. *Disability and Health Journal*, *10*(4), 565-570.

Leech R. M., McNaughton S. A., & Timperio A. (2014). The clustering of diet, physical activity and sedentary behavior in children and adolescents: A review. *International Journal of Behavioral Nutrition and Physical Activity, 11*(4).

Levinson, J. L., & Reid, G. (1993). The effects of exercise intensity on the stereotypic behaviors of individuals with autism. *Adapted Physical Activity Quarterly, 10*(3), 255 268.

Li, W., Youssef, G., Procter-Gray, E., Olendzki, B., Cornish, T., Hayes, R., Churchill, L., Kane, K., Brown, K., & Magee, M. F. (2017). Racial differences in eating patterns and food purchasing behaviors among urban older women. *The Journal of Nutrition, Health & Aging*, *21*(10), 1190–1199. https://doi.org/10.1007/s12603-016-0834-7

Liss, M., Harel, B., Fein, D., Allen, D., Dunn, M., Feinstein, C., Morrie, R., Waterhouse, L., & Rapin, I. (2001). Predictors and correlates of adaptive functioning in children with developmental disorders. *Journal of Autism and Developmental Disorders, 31*, 219–230. https://doi.org/10.1023/A:1010707417274

Lin, H., Bermudez, O. I., & Tucker, K. L. (2003). Dietary patterns of Hispanic elders are associated with acculturation and obesity. *The Journal of Nutrition*, *133*(11), 3651-3657.

Lord, C., Risi, S., Lambrecht, L., Cook, E. H., Leventhal, B. L., DiLavore, P. C., Pickles, A., & Rutter, M. (2000). The Autism Diagnostic Observation Schedule—Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders*, *30*(3), 205-223.

Lorson, B. A., Melgar-Quinonez, H. R., & Taylor, C. A. (2009). Correlates of fruit and vegetable intakes in U.S. children. *Journal of American Dietary Association, 3*, 474–478.

MacDonald, M., Esposito, P., & Ulrich, D. (2011). The physical activity patterns of children with autism. *BMC Research Notes, 4*, 422.

MacDonald, E. E., Hastings, R. P., & Fitzsimons, E. (2010). Psychological acceptance mediates the impact of the behavior problems of children with intellectual disability on fathers' psychological adjustment. *Journal of Applied Research in Intellectual Disabilities*, *23*(1), 27–37. doi:10.1111/j.1468-3148.2009.00546.x

Madigan, S., Browne, D., & Racine, N. (2019). Association between screen time and children's performance on a developmental screening test. *JAMA Pediatrics, 173*(3), 244-250. doi:10.1001/jamapediatrics.2018.5056

Malone, C., Sharif, F., & Glennon – Slattery, C. (2016). Growth and nutritional risk in children with developmental delay. *Irish Journal of Medical Science, 185*(4), 839-846.

Mandell, D. S., Wiggins, L. D., Carpenter, L. A., Daniels, J., DiGuiseppi, C., Durkin, M. S., Giarelli, E., Morrier, M. J., Nicholas, J. S., Pinto-Martin, J. A., Shattuck, P. T., Thomas, K. C., Yeargin-Allsopp, M., & Kirby, R. S. (2009). Racial/ethnic disparities in the identification of children with autism spectrum disorders. *American Journal of Public Health*, *99*(3), 493–498. https://doi.org/10.2105/AJPH.2007.131243

Masefield, S. C., Prady, S. L., Sheldon, T. A., Small, N., Jarvis, S., & Pickett, K. E. (2020). The caregiver health effects of caring for young children with developmental disabilities: A Meta-analysis. *Maternal and Child Health Journal*, *24*(5), 561–574. https://doi.org/10.1007/s10995-020-02896-5

Mayo Clinic. (2018). *Heart disease*. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/heart-disease/symptoms-causes/syc-20353118

Mazurek, M. O., Shattuck, P. T., Wagner, M., & Cooper, B. P. (2012). Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *Journal of Autism Developmental Disorders, 42*(8), 1757-1767. https://doi.org/10.1007/s10803-011-1413-8

Mazurek, M. O., & Wenstrup, C. (2013). Television, video game and social media use among children with ASD and typically developing siblings. *Journal of Autism and Developmental Disorders*, *43*(6), 1258–1271. https://doi.org/10.1007/s10803-012-1659-9

McGillivray, J., McVilly, K., Skouteris, H., & Boganin, C. (2013). Parental factors associated with obesity in children with disability: A systematic review. *Obesity Reviews, 14*(7), 541–54.

Memari, A. H., Ghaheri, B., Ziaee, V., Kordi, R., Hafizi, S. & Moshayedi, P. (2012). Physical activity in children and adolescents with autism assessed by triaxial accelerometry. *Pediatric Obesity, 8*(2), 150-158.

Memari, A. H., Ziaee, V., Shayestehfar, M., Ghanouni, P., Mansournia, M. A., & Moshayedi, P. (2013). Cognitive flexibility impairments in children with autism spectrum disorders: Links to age, gender and child outcomes. *Research in Developmental Disabilities*, *34*(10), 3218–3225. https://doi.org/10.1016/j.ridd.2013.06.033

Mensah, A. G., Mokdad, H. A., Ford, S. E., Greenlund, J. K., & Croft B. J. (2005). State of disparities in cardiovascular health in the United States. *Circulation, 111*(10), 1233-1241.

Miodrag, N., Burke, M., Tanner-Smith, E., & Hodapp, R. M. (2015). Adverse health in parents of children with disabilities and chronic health conditions: A meta-analysis using the Parenting Stress Index's Health sub-domain. *Journal of Intellectual Disability Research*, *59*(3), 257-271.

Miodrag, N., & Hodapp, R. M. (2010). Chronic stress and health among parents of children with intellectual and developmental disabilities. *Current Opinion in Psychiatry*, *23*(5), 407-411.

Moore, L. L., Lombardi, D. A., White, M. J., Campbell, J. L., Oliveria, S. A., & Ellison, R. C. (1991). Influence of parent's physical activity levels on activity levels of young children. *Journal of Pediatrics*, *118*(2), 215–219.

Morello-Frosch, R., Pastor Jr, M., Porras, C., & Sadd, J. (2002). Environmental justice and regional inequality in southern California: implications for future research. *Environmental Health Perspectives*, *110*, 149-154.

Morland, K., Wing, S., Roux, A. D., & Poole, C. (2002). Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine*, *22*(1), 23-29.

Morales, L. S., Lara, M., Kington, R. S., Valdez, R. O., & Escarce, J. J. (2002). Socioeconomic, cultural, and behavioral factors affecting Hispanic health outcomes. *Journal of Health Care for the Poor and Underserved*, *13*(4), 477–503. https://doi.org/10.1177/104920802237532

Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2017). Replicated evidence of racial and ethnic disparities in disability identification in US schools. *Educational Researcher*, *46*(6), 305-322.

Morin, A. (2014). *What you need to know about developmental delays.* Understood. https://www.understood.org/en/learning-attention-issues/treatments-approaches/early-intervention/what-you-need-to-know-about-developmental-delays

Morrison, R. S., Wallenstein, S., Natale, D. K., Senzel, R. S., & Huang, L. L. (2000). "We don't carry that"—failure of pharmacies in predominantly nonwhite neighborhoods to stock opioid analgesics. *New England Journal of Medicine*, *342*(14), 1023-1026.

Muller, A. (2002). Education, income inequality, and mortality: A multiple regression analysis. *British Medical Journal*, *324*(7328), 23.

Must, A., Curtin, C., Hubbard, K., Sikich, L., Bedford, J., & Bandini, L. (2014). Obesity prevention for children with developmental disabilities. *Current Obesity Reports*, *3*(2), 156–170. doi:10.1007/s13679-014-0098-7

Must, A., Phillips, S. M., Curtin, C., Anderson, S. E., Maslin, M., Lividini, K., & Bandini, L. G. (2014). Comparison of sedentary behaviors between children with autism spectrum disorders and typically developing children. *Autism: The International Journal of Research and Practice*, *18*(4), 376–384. https://doi.org/10.1177/1362361313479039

Nally, B., Houlton, B., & Ralph, S. (2000). Researches in brief: The management of television and video by parents of children with autism. *Autism, 4*(3), 331–337.

National Institute of Health. (2016). *Benefits of Physical Activity.* National Institute of Health. https://www.nhlbi.nih.gov/health/health-topics/topics/phys/benefits.

Neuhouser, M. L., Thompson, B., Coronado, G. D., & Solomon, C. C. (2004). Higher fat intake and lower fruit and vegetables intakes are associated with greater acculturation among Mexicans living in Washington State. *Journal of the American Dietetic Association*, *104*(1), 51-57.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*(3), 231–259. https://doi.org/10.1037/0033-295X.84.3.231

Noe-Bustamante, L., Mora, L., & Lopez, M. (2020). *Latinx used by just 3% of U.S. Hispanics: About one-in-four have heard of it.* Pew Research Center. https://www.pewresearch.org/hispanic/2020/08/11/about-one-in-four-u-s-hispanics-have-heard-of-latinx-but-just-3-use-it/

O'Donoghue, G., Kennedy, A., Puggina, A., Aleksovska, K., Buck, C., Burns, C., Cardon, G., Carlin, A., Ciarapica, D., Colotto, M., Condello, G., Coppinger, T., Cortis, C., D'Haese, S., De Craemer, M., Di Blasio, A., Hansen, S., Iacoviello, L., Issartel, J., Izzicupo, P., … Boccia, S. (2018). Socio-economic determinants of physical activity across the life course: A "DEterminants of DIet and Physical ACtivity" (DEDIPAC) umbrella literature review. *PloS One*, *13*(1), https://doi.org/10.1371/journal.pone.0190737

Oliver, G., Wardle, J., & Gibson, E. L. (2000). Stress and food choice: A laboratory study. *Psychosomatic Medicine*, *62*(6), 853-865.

Paczkowski, E., & Baker, B. L. (2008). Parenting children with developmental delays: The role of positive beliefs. *Journal of Mental Health Research in Intellectual Disabilities*, *1*(3), 156. doi:10.1080/19315860801988392

Palmer, S., & Horn, S. (1978). Feeding problems in children. *In S. Palmer & S. Ekvalt (Eds.), Pediatric nutrition in developmental disorders, 13* (pp. 107–129). Charles S. Thomas Publisher.

Pate, R. R., McIver, K., Dowda, M., Brown, W. H., & Addy, C. (2008). Directly observed physical activity levels in preschool children. *Journal of School Health, 78*, 438– 444.

Pearson, N., Biddle, S. J. H., Griffiths, P., Johnston, J. P., & Haycraft, E. (2018). Clustering and correlates of screen-time and eating behaviours among young children. *BMC Public Health*, *18*(1), 1–9. https://doi.org/10.1186/s12889-018-5698-9

Pearson, N., Griffiths, P., Biddle, S. J., Johnston, J. P., McGeorge, S., & Haycraft, E. (2017). Clustering and correlates of screen-time and eating behaviours among young adolescents. *BMC Public Health, 17*, 533.

Pechey, R., & Monsivais, P. (2016). Socioeconomic inequalities in the healthiness of food choices: Exploring the contributions of food expenditures. *Preventive Medicine*, *88*, 203–209. doi:10.1016/j.ypmed.2016.04.012

Perske, R., Clifton, A., McClean, B. M., & Stein, J. I. (Eds.) (1977). *Mealtimes for severely and profoundly mentally-handicapped persons: New concepts and attitudes*. University Park Press.

Provost, B., Lopez, B. R. & Heimerl, S. (2007). A comparison of motor delays in young children: Autism spectrum disorder, developmental delay, and developmental concerns. *Journal of Autism and Developmental Disorders, 37*, 321-328. https://doi.org/10.1007/s10803-006-0170-6

Raiten, D. J., & Massaro, T. (1986). Perspectives on the nutritional ecology of autistic children. *Journal of Autism Developmental Disorders, 16,* 133-143.

Ramsay, S. A., Shriver, L. H., & Taylor, C. A. (2016). Variety of fruit and vegetables is related to preschoolers' overall diet quality. *Preventive Medicine Reports*, *5*, 112-117. doi:10.1016/j.pmedr.2016.12.003

Rutter, M., Bailey A., & Lord, C. (2003). *The Social Communication Questionnaire.* Western Psychological Services.

Saffer, H., Dave, D., Grossman, M., & Leung, L. A. (2011). Racial, ethnic, and gender differences in physical activity. *Journal of Human Capital*, *7*(4), 378–410. doi:10.1086/671200

Sallis, J. F., Nader, P. R., Broyles, S. L., Berry, C. C., Elder, J. P., McKenzie, T. L., & Nelson, J. A. (1993). Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. *Health Psychology, 12*(5), 390-398. http://dx.doi.org/10.1037/0278-6133.12.5.390

Sanders, R. M., Patel, K. R., Le Grice, B., & Shepherd, W. R. (1993). Children with persistent feeding difficulties: An observational analysis of the feeding interactions of problem and non-problem eaters. *Health Psychology, 12*(1), 64-73.

Sandt, D. D. R., & Frey, G. C. (2005). Comparison of physical activity levels between children with and without autistic spectrum disorders. *Adapted Physical Activity Quarterly, 22*, 146–159.

Schiffman, S. S., Graham, B. G., Sattely-Miller, E. A., & Peterson-Dancy, M. (2000). Elevated and sustained desire for sweet taste in African-Americans: A potential factor in the development of obesity. *Nutrition*, *16*(10), 886-893.

Schreck, K. A., Williams, K., & Smith, A. F. (2004). A comparison of eating behaviors between children with and without autism. *Journal of Autism and Developmental Disorders*, *34*(4), 433–438. https://doi.org/10.1023/B:JADD.0000037419.78531.86

Shane, H., & Albert, P. (2008). Electronic screen media for persons with autism spectrum disorders: Results of a survey. *Journal of Autism and Developmental Disorders, 38*(8), 1499–1508.

South, M., Ozonoff, S., & McMahon, W. M. (2005). Repetitive behavior profiles in Asperger syndrome and high-functioning autism. *Journal of Autism and Developmental Disorders, 35*(2), 145–158.

Srinivasan, S. M., Pescatello, L. S., & Bhat, A. N. (2014). Current perspectives on physical activity and exercise recommendations for children and adolescents with autism spectrum disorders. *Physical Therapy*, *94*(6), 875–889. https://doi.org/10.2522/ptj.20130157

Torres, S. J., & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition*, *23*(11), 887-894.

Trost, S. G., Sallis, J. F., Pate, R. R., Freedson, P. S., Taylor, W. C., & Dowda, M. (2003). Evaluating a model of parental influence on youth physical activity. *American Journal of Preventive Medicine, 25*(4), 277–282.

Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, *12*, 271-283. doi:https://doi.org/10.1016/j.pmedr.2018.10.003

U.S. Census Bureau. (2014). *The 2012 statistical abstract*. U.S. Census Bureau. http://www.census.gov/compendia/statab/.

U.S. Department of Agriculture. (2010). *Dietary guidelines for Americans.* U.S. Census Bureau.http://www.cnpp.usda.gov/sites/default/files/dietary_guidelines_for_americans/PolicyDoc.pdf

U.S. Department of Health and Human Services. (2008). *Physical activity guidelines for Americans*. U.S. Department of Health and Human Services. https://health.gov/sites/default/files/2019-09/paguide.pdf

U.S. National Library of Medicine. (2018). *Screen time and children*. National Library of Medicine. https://medlineplus.gov/ency/patientinstructions/000355.htm

Valentini, C. N. & Rudisill, E. M. (2004). Motivational climate, motor-skill development, and perceived competence: Two studies of developmentally delayed kindergarten children. *Journal of Teaching in Physical Education, 23*(3), 216-234

Ventura, A. K., & Birch, L. L. (2008). Does parenting affect children's eating and weight status? *International Journal of Behavioral Nutrition and Physical Activity, 5*, 15.

Volkmar, F., Sparrow, S., Goudreau, D., & Cicchetti, D. (1987). Social deficits in autism: An operational approach using the Vineland Adaptive Behavior Scales. *Journal of the American Academy of Child and Adolescent Psychiatry, 26,* 156-161.

Wang, Y., & Chen, X. (2011). How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among U.S. adults? *Journal of the American Dietetic Association*, *111*(12), 1904–1911. doi:10.1016/j.jada.2011.09.036

Wardle, J., Carnell, S., & Cooke, L. (2005). Parental control over feeding and children's fruit and vegetable intake: How are they related?. *Journal of the American Dietetic Association, 105*, 227-232.

Welk, G. J., Wood, K., & Morss, G. (2003). Parental influences on physical activity in children: An exploration of potential mechanisms. *Pediatric Exercise Science, 15*(1), 19–33.

Wen, L. M., Baur, L. A., Rissel, C., Xu, H., & Simpson, J. M. (2014). Correlates of body mass index and overweight and obesity of children aged 2 years: Findings from the healthy beginnings trial. *Obesity, 22*(7), 1723–1730

Whitt-Glover, M. C., O'Neill, K. L., & Stettler, N. (2006). Physical activity patterns in children with and without down syndrome. *Developmental Neurorehabilitation, 9*(2), 158–164.

Whiteley, P., Rodgers, J., & Shattock, P. (2000). Feeding patterns in autism. *Autism*, *4*(2), 207-211.

Williams, P. G., Dalrymple, N., & Neal, J. (2000). Eating habits of children with autism. *Pediatric Nurse, 26,* 259-264.

Yau, Y. H., & Potenza, M. N. (2013). Stress and eating behaviors. *Minerva Endocrinologica*, *38*(3), 255–267.

Zablotsky, B., Black, L., & Blumberg, S. (2017). *Estimated prevalence of children with diagnosed developmental disabilities in the United States, 2014-2016*. Center for Disease Control and Prevention. https://www.cdc.gov/nchs/products/databriefs/db291.htm

Zecevic, C. A., Tremblay, L., Lovsin, T., & Michel, L. (2010). Parental influence on young children's physical activity. *International Journal of Pediatrics*, 468-526. doi:10.1155/2010/468526

Zeng, N., Ayyub, M., Sun, H., Wen, X., Xiang, P., & Gao, Z. (2017). Effects of physical activity on motor skills and cognitive development in early childhood: A systematic review. *BioMed Research International*. doi:10.1155/2017/2760716