THESIS

EXPLORATORY EFFECTS OF A MINDFULNESS+LIFESTYLE PROGRAM FOR TYPE 2

DIABETES PREVENTION ON PARENTAL PSYCHOSOCIAL ADJUSTMENT IN

FAMILIES OF LATINO ADOLESCENTS

Submitted by

Raquel Daniels

Department of Human Development and Family Studies

In partial fulfillment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Fall 2020

Master's Committee:

Advisor: Lauren Shomaker

Laura Bellows
Lilyana Ortega

ABSTRACT

EXPLORATORY EFFECTS OF A MINDFULNESS+LIFESTYLE PROGRAM FOR TYPE 2

DIABETES PREVENTION ON PARENTAL PSYCHOSOCIAL ADJUSTMENT IN

FAMILIES OF LATINO ADOLESCENTS

Latino adolescents have a particularly high risk of developing youth-onset type 2 diabetes (T2D) compared to other racial/ethnic groups. Latino families frequently experience high levels of stress due to a variety of social/environmental factors including stigma, discrimination, immigration, and acculturation. Culturally adapted, family-based intervention programs designed specifically for Latino adolescents to increase healthy eating and physical activity show strong potential to reduce adolescents' risk of T2D. Yet, existing programs rarely address the heightened psychological stress faced by Latino families, which is likely to interfere with making lifestyle changes. It is possible that the integration of mindfulness-based training into a culturally-adapted, family-based lifestyle program will result in more favorable family functioning and parental psychosocial adjustment than a lifestyle program alone. The current thesis project was a secondary data analysis of a randomized controlled trial designed to pilot a 6-week/12-session culturally-adapted, family-based lifestyle intervention, with and without a mindfulness-based training component, in $N = 18$ Latino families with adolescents at risk for T2D. The aims were to explore the comparative effectiveness of the mindfulness+lifestyle intervention, versus lifestyle only, on parent psychosocial adjustment and to characterize to what extent changes in parent psychosocial adjustment corresponded to changes in adolescents' own psychosocial adjustment and degree of risk for T2D. At baseline, immediate post-intervention,

and six-months follow-up, parents completed validated survey measures of parent perceived stress and parent depression symptoms. Family functioning also was assessed at baseline. At all intervals, adolescents self-reported their levels of perceived stress and depression symptoms, and adolescent risk for T2D was determined from body mass index (BMI) metrics, insulin resistance, and fasting glucose. The analytic plan included analyses of covariance (ANCOVA) as well as a reliable change index. Correlations were used to describe simple correspondence between parent and adolescent characteristics. ANCOVA results indicated that changes in parent depression/stress at post-intervention and six-month follow-up not differ by intervention. Reliable change analyses revealed that one parent from each condition experienced a reliable change decrease in perceived stress and one parent from the lifestyle only condition experienced a reliable change decrease in depressive symptoms. In correlation analyses, greater decreases in parent depression symptoms were correlated with greater decreases in adolescent perceived stress at post-intervention, and this association was apparent in the mindfulness+lifestyle condition as opposed to lifestyle only. Also in mindfulness+lifestyle only, higher baseline family chaos and baseline parental depressive symptoms were correlated with greater decreases in adolescents' insulin resistance. These highly exploratory findings require follow-up in a larger, adequately powered trial, but suggest the possibility that family and parental psychosocial characteristics relate to health outcomes in adolescents at-risk for T2D among Latino families taking part in mindfulness+lifestyle programming. Consistent with a selective or indicated prevention framework, families with more psychosocial difficulties may stand to benefit the most from integrative health interventions.

TABLE OF CONTENTS

LIST OF TABLES

Health Disparities in Obesity/Diabetes among Latino Adolescents

Rates of obesity (body mass index [BMI] kg/m^2 $\geq$95th percentile for age and sex) in adolescents (ages 12-19 years) are a national public health crisis (Ogden, Carroll, Kit & Flegal, 2014). While some data suggest that rates of pediatric obesity are stabilizing, severe obesity (BMI at or above 120% at the 95th percentile) in adolescents is unfortunately on the rise in the United States (Hales, Carroll, Fryar & Ogden, 2017; Ogden et al., 2014). The prevalence of adolescents with obesity and severe obesity disproportionately affects minority groups including Latino adolescents (Hales et al., 2017; Ogden et al., 2014). For instance, in 2015-2016, the prevalence of obesity in Latino adolescents (25.8%) was markedly higher as compared to non-Hispanic White adolescents (14.1%) (Hales et al., 2017).

Importantly, higher rates of obesity in Latino adolescents place these youth at a greater risk of developing preventable, serious chronic diseases associated with obesity. In particular, excess weight in adolescence contributes to the development of adverse metabolic health outcomes such as insulin resistance, prediabetes, and type 2 diabetes (T2D; Davis et al., 2009; 2011; Falbe, Cadiz, Tantoco, Thompson & Madsen, 2015). The Latino population is the fastest growing minority group in the United States. Yet, they continue to face many barriers to accessing prevention and treatment programs for obesity and obesity-related cardiometabolic disease, in part due to health disparities in affordable healthcare access/utilization and socio-cultural challenges of acculturation, language, and immigration (Falbe et al., 2015). As such, the development of culturally tailored intervention programs for the prevention of cardiometabolic

disease in Latino adolescents has become crucial to address this growing public health crisis. In particular, prevention of T2D is an essential public health priority.

T2D is a serious, preventable chronic disease that can lead to a host of major health complications including cardiovascular disease, blindness, kidney failure, amputations, and earlier mortality (Viner, White & Christie, 2017). T2D occurs when the body does not produce sufficient insulin, a hormone produced by the pancreas to regulate blood sugar (glucose) throughout the body, and experiences insulin resistance, referring to ineffectiveness of insulin to regulate blood sugar (Kelsey & Zeitler, 2016). In response to insulin resistance, the pancreas compensates by creating increasingly more insulin in an effort to regulate glucose, but, in individuals susceptible to T2D, over time the pancreas cannot continue its levels of production of insulin to effectively maintain blood glucose at normal levels (Kelsey & Zeitler, 2016). Thus, insulin secretion becomes insufficient and higher levels of glucose increase in the blood, ultimately resulting in insufficient insulin secretion and T2D (Kelsey & Zeitler, 2016). T2D was previously considered a disease limited to older adulthood, but unfortunately, youth-onset of T2D is on the rise, especially in adolescents from racial/ethnic minority groups (Mayer-Davis et al., 2017). A natural increase in insulin resistance occurs in the transition from prepuberty to puberty, which is thought to trigger a cascade of multiple metabolic changes, increasing susceptibility to T2D in vulnerable youth (Kelsey & Zeitler, 2016). Pubertal youth with and without T2D have higher insulin resistance than prepubertal youth, regardless of BMI (Kelsey & Zeitler, 2016). While we do not yet understand how to predict the onset and timing of T2D, traditional risk factors known to increase T2D development include having obesity and having a family history of T2D, consumption of a diet high in fat and carbohydrate, and physical

inactivity (Arauz Boudreau, Kurowski, Gonzalez, Dimond & Oreskovic, 2013; Patrick et al., 2013).

Traditional Lifestyle Interventions for Prevention of T2D in Adolescents

A small body of randomized controlled trials have been conducted to evaluate the prevention of T2D in the Latino adolescent population. A systematic review conducted in 2017 reported 11 randomized controlled trials, with the majority being pilot studies with sample sizes ranging from 22 (Shaibi et al., 2006) to 4,603 (Foster et al., 2010) adolescents (McCurley, Crawford & Gallo, 2017). These studies all evaluated the traditional lifestyle-based approach to T2D prevention, which refers to a relatively lengthy, structured lifestyle intervention incorporating physical activity, nutrition, and health education. Only four of the 11 studies found significant reductions in fasting insulin and fasting glucose, outcomes that are positively related to insulin resistance (McCurley, Crawford, & Gallo, 2017). Specifically, Davis et al. (2009) found significant reductions in fasting glucose following a 16-week standard lifestyle intervention, as compared to a control group that received no intervention. Treviño et al. (2004) reported significant reductions in fasting glucose at immediate post-intervention follow-up to a seven-month culturally adapted lifestyle-based intervention. Additionally, Davis et al. (2011) found greater reductions in fasting insulin at 16-week immediate post-treatment follow-up, and Foster et al. (2010) found greater reductions in fasting insulin, relative to an assessment only control group, two years following a standard lifestyle intervention. Thus, although existing studies have predominately sampled White youth (Caprio et al., 2008), there is a small body of literature supporting the potential for lifestyle-based interventions for T2D prevention in Latino adolescents; yet, more research is needed (McCurley, Crawford & Gallo, 2017).

Benefits of Cultural Tailoring of Lifestyle Programs for T2D Prevention for Latino Adolescents

Most existing studies have tested standard lifestyle interventions for T2D prevention in Latino adolescents (Davis et al., 2009, 2011; Shaibi 2006; Patrick et al., 2013; Rosenbaum et al., 2007; Weigensberg et al., 2014), and only a handful have tested lifestyle interventions culturally-adapted for Latino families (Falbe et al., 2015; Shaibi et al., 2012; Soltero et al., 2018; Treviño et al., 2004). Culture encompasses knowledge, beliefs, values, attitudes, and understanding for how people interact with their environment, and culture shapes individuals' behavior (Caprio et al., 2008). Cultural adaptations to core components of lifestyle interventions, both nutrition and physical activity components, may be important for a number of reasons. While standard lifestyle programs for T2D prevention promote healthy foods, they often do *not* incorporate culturally traditional foods with healthy modifications, which may diminish acceptability for families (Shaibi et al., 2012). With respect to physical activity, physical activities conducted in fully-equipped exercise gyms alone often are not readily accessible or cost affordable to participants after programs terminate (Davis et al., 2011). Furthermore, traditional lifestyle programs are lengthy and intensive, occurring over a typical period of 16 weeks (McCurley, Crawford, & Gallo, 2017). For many families, attending a program for four months, often with two weekly sessions, is an extended time commitment that is difficult to maintain. Indeed, minority adolescents show poorer adherence to lifestyle programs than White adolescents (Goran, Bergman, Cruz & Watanabe, 2002), and high attrition rates have been observed in many T2D preventative interventions delivered exclusively to Latino adolescents (McCurley, Crawford, & Gallo, 2017).

Additionally, many existing programs solely enroll adolescents, with minimal or even no involvement from parents or siblings, potentially missing an opportunity for facilitating social support, behavior change in youth *and* adults, and improving the whole health of the family (Shaibi et al., 2010; Shaibi et al., 2012). Moreover, programs that encourage the entire family to attend are consistent with the Latino cultural value of familism (Soltero et al., 2018; Williams et al., 2017). Familism is described as a strong attachment to family values, support, and reciprocated loyalty (Cupito et al., 2015). Parents are arguably the largest influencing contributor to adolescents' health well-being and are particularly important in Latino culture (Gruber & Haldeman, 2009). Thus, lifestyle programs incorporating family support through participation for parents and siblings could serve to reinforce lifestyle changes for the adolescent (Caprio et al., 2008). In theory, integrating parent involvement in lifestyle interventions may benefit family functioning through parental role modeling, such that parental role modeling can encourage sustainable healthy lifestyle adaptations (Caprio et al., 2008). One example of a culturally-tailored randomized controlled trial with Latino parent-child dyads examined an intervention to address BMI and cardiovascular risk in Latino youth (Falbe et al., 2015). Youth in the intervention group experienced significant reductions in BMI when compared to the control group at immediate post-intervention (Falbe et al., 2015). Class content included food consumption, cultural perceptions and practices, and stress management (Falbe et al., 2015).

Similarly, from a community-based participatory research framework, cultural adaptations for the Latino population that draw inherent knowledge and wisdom from the community and culture are anticipated to offer more benefit than a standardized lifestyle program alone (Shaibi et al., 2012). A community-based participatory research approach posits that community-academic partnerships engage the community to be active in designing and

implementing a program that is a culturally appropriate intervention that appeals to them (Vivian, 2010). Partnership with the community that incorporates values and beliefs of an ethnic group into the intervention generally receive more acceptance and adherence to messages about health from participants (Vivian, 2010). In culturally-tailored programs, bilingual and bicultural health educators and/or promotoras (community workers) integrate relevant themes in cultural perceptions and beliefs about health behaviors as part of the curriculum (Shaibi et al., 2012). Further, the incorporation of parental involvement, Latino food recommendations, and community members in the intervention development process have been called for to improve participant engagement (McCurley, Crawford & Gallo, 2017).

Integration of Mindfulness-Based Training for Coping with Stress

Despite the high psychosocial needs of Latino adolescents and their parents (Lorenzo-Blanco et al., 2016), no existing programs for T2D prevention Latino youth have directly addressed the psychosocial needs of adolescents or families as part of the intervention. The inclusion of behavioral health, particularly for stress management, within T2D lifestyle prevention programs could potentially broaden health benefits beyond behavior changes and may address underlying factors (e.g., stress, depression) that can interfere with sustained lifestyle change (Moores et al., 2018).

Adolescents with obesity experience greater psychological difficulties than adolescents who do not have obesity (Walders-Abramson et al., 2013), and Latino adolescents and adults are more likely to face major stressful life circumstances than individuals who are White (Caprio et al., 2008). Chronic exposure to social and environmental stressors is common in adolescents presenting for T2D treatment and their families (Nadeau et al., 2016). Thus, a culturally-tailored

lifestyle intervention that includes stress-reduction training theoretically is anticipated to be more effective than lifestyle alone.

Mindfulness-based training may offer distinctive benefits for Latino adolescents at-risk for T2D and their families. Mindfulness is a technique that has been useful in targeting stress (Brown, Ryan & Creswell, 2007). Mindfulness can be defined as being attuned and aware of one's thoughts, feelings, body, and environmental experiences in the present moment with an attitude of non-judgment (Brown, Ryan & Creswell, 2007). Bringing non-judgmental attention to thoughts, emotions, and sensations in the moment can help foster self-regulation and more effective cognitive, emotional, and behavioral control (Brown, Ryan & Creswell, 2007). In adolescents at-risk for T2D, general, dispositional mindfulness has been inversely related to eating in the absence of hunger and binge-eating, such that youth with lower mindfulness eat more in the absence of hunger and are more likely to experience binge-eating episodes (Annameier et al., 2018; Pivarunas et al., 2015). In a pilot trial of a mindfulness program, 120 teen girls participated in a six-week curriculum called Learning to BREATHE and reported lower levels of negative affect and increases in awareness and emotion regulation compared to a control group (Broderick & Metz, 2011).

Mindfulness-based training has been utilized in adults with T2D and type 1 diabetes (T1D) in a series of randomized controlled trials and shows consistent, moderate effects for decreasing depression and anxiety/stress. For instance, in one trial, participants with T2D/T1D were randomized to a mindfulness-based cognitive therapy group or treatment-as-usual condition and assessed at baseline, post-intervention, and six-months follow-up (van Son et al., 2013). For adults in the mindfulness-based intervention, participant psychosocial adjustment resulted in a decrease in depressive symptoms which remained consistent at six-month follow-up (Van Son et

al., 2013). Similarly, Hartmann et al. (2012) found that adults with T2D randomized to a

mindfulness-based group experienced lower levels of depression, compared to a control group,

up to one-year later (Hartmann et al., 2012). Other randomized controlled trial studies show that

mindfulness-based training in adults with T2D and T1D improves glycemic control relative to

waitlist, education, or control conditions, up to 3-months later (Friis et al., 2016; Gregg et al.,

2007).

　　　　While most research has been conducted in adults who already have developed T2D,

mindfulness-based interventions also may offer potential for T2D prevention. In adolescents at-

risk for T2D, Shomaker et al. (2017) found that a relatively brief mindfulness-based intervention

group decreased depressive symptoms and insulin resistance at post-treatment and one-year later

when compared to a cognitive-behavioral therapy group (Shomaker et al., 2017; Shomaker et al.,

2019). While mindfulness-based training alone in adults with T2D/T1D and in adolescents at-

risk for T2D shows promise, the integration of mindfulness-based training into a lifestyle

intervention program for T2D prevention has not been evaluated. Exploring the

feasibility/acceptability and potential benefits of mindfulness+lifestyle programming for Latino

families of adolescents at-risk for T2D should be undertaken.

Addressing Family Functioning and Parent Psychosocial Adjustment

　　　　While most T2D lifestyle prevention programs have focused exclusively on adolescent

outcomes, understanding the effects of interventions on Latino *parental* psychosocial health is

also very important. Bronfenbrenner's well-recognized social ecological theory underscores the

complex relationships among an individual, their family system, their social system, and their

community (Cupito et al., 2016; Soltero et al., 2017). Interfamilial factors such as family

conflict and family environment routine, and community-level factors such as neighborhood

safety and socioeconomic status, all interact in complex ways to influence the health behaviors of a Latino adolescent embedded within their family system (Soltero et al., 2017). Youth who come from disadvantaged socioeconomic contexts are less likely to have access to opportunities for healthy eating and opportunities for physical activity (Kristen et al., 2016). Moreover, Latino families face discrimination and acculturation stress among other environmental and cultural stressors that can lead to increased parental stress (Lorenzo-Blanco et al., 2016). While continuous exposure to adverse experiences generates potential health vulnerabilities, understanding how the family system can be a catalyst for motivation and support is also warranted.

Familism is an important cultural value for many Latino families (Cupito et al., 2015). In a sample of 150 Latino adolescent-parent dyads, familism was inversely associated with depression symptomology in Mexican-American parents as well as lower negative mental health outcomes for all family members (Ayón, Marsiglia, & Bermudez-Parsai 2010). Similarly, Keeler, Siegel, and Alvaro (2014) found that familism was positively associated with perceptions of help-seeking from family when a family member displayed depressive symptomology (Keeler, Siegel & Alvaro, 2014). Environmental stressors that affect parent functioning, in turn, are highly likely to affect adolescent functioning. An existing body of literature supports the concept that Latino parent psychosocial adjustment relates to adolescent psychosocial adjustment.

Effects of Parental Psychosocial Adjustment on Adolescent Psychosocial Adjustment and T2D Potential Health Outcomes

Regarding parental/family adjustment and adolescent psychosocial adjustment, Lorenzo-Blanco et al. (2017) conducted a six-wave longitudinal study with recent Latino immigrant

families and examined how parental acculturation stress influenced youth mental health. In this study, parental cultural stress predicted poorer family functioning over time and parental cultural stress was associated with greater depressive symptoms in adolescents over time (Lorenzo-Blanco et al., 2017). Higher conflict family environments are cross-sectionally associated with greater depressive symptoms in adolescents, whereas higher levels of familism are related to lower depressive symptoms (Young, 2016). Increased stress and associated symptoms of depression experienced by adolescents have the potential to heighten risk for T2D (Shomaker et al., 2011; Suglia, Demmer, Wahi, Keyes, & Koenen, 2016). Conversely, positive family functioning provides family connectedness and support to cope with stressors and, thereby, relates to less depressive symptoms (Stein et al., 2015). Consistent with this framework, familism has been associated with lower adolescent depressive symptoms (Cupito et al., 2016).

The influence of the family system extends beyond psychosocial adjustment such that family functioning also may relate to T2D health outcomes, including in the areas of treatment adherence, BMI, and health behaviors. For example, Berge et al. (2013) found a cross-sectional association of positive family functioning with frequency of family mealtime, a link that was strongest for racial/ethnic minority adolescents as compared to White adolescents. Likewise, positive family functioning was associated with lower BMI (Berge et al., 2013). In Mexican-origin adolescents, higher family cohesion was associated with steeper declines in BMI standard scores over a two-year period (Heredia et al., 2019). In a review of cross-sectional and longitudinal studies evaluating the association of family functioning and youth BMI, poor family functioning was associated with an increased risk of developing obesity (Halliday et al., 2014). These data underscore the likelihood that family functioning is important for the health outcomes for adolescents at-risk for T2D.

For adolescents who have developed T2D, family support and family functioning are critical. Goals for T2D treatment focus primarily around maintaining proper metabolic control through daily tasks such as monitoring glucose levels, adhering to a healthier diet, taking medication, and weight management (Miller & Dimatteo, 2013). In a longitudinal study that examined barriers and strategies for medication adherence in adolescents with T2D at six, 12, and 24 months, forgetting or missing a medication dose was a persistent barrier to maintaining treatment consistency (Venditti et al., 2018). However, the most common strategy that more than half of the study participants at each time point found valuable was utilizing the assistance of family members to assist in remembering to take medications (Venditti et al., 2018). Similarly, in a meta-analytic review, adults and adolescents who received social support for treatment adherence benefited from changes in self-efficacy, motivation, and reduced stress (Dimatteo, 2004). Additionally, family cohesiveness, which includes components of warmth and closeness, has been positively correlated with treatment adherence in youth with T2D and T1D (Miller & Dimatteo, 2013).

In sum, despite the importance of family functioning and parental psychosocial adjustment to adolescent psychosocial health and adolescent physical health, and the particular importance of familism in Latino culture, existing programs for T2D prevention typically do not address psychosocial needs of parents nor adolescents. Therefore, T2D preventative interventions that center on a culturally-sensitive lifestyle approach *and* include mindfulness-based stress training, are anticipated to strengthen the psychological wellbeing of parents, and consequently, adolescents.

Current Study

In the current master's thesis, I conducted secondary data analyses of a small, pilot randomized controlled comparative effectiveness trial. Latino adolescents at-risk for T2D were randomized to one of two intervention conditions, (i) a culturally-tailored, family-based lifestyle intervention for Latino families (lifestyle alone) or (ii) a culturally-tailored, family-based lifestyle intervention that was further adapted to include mindfulness-based training to cope with stress (mindfulness+lifestyle). The primary aim of the trial, reported elsewhere (Sanchez et al., in preparation), was to pilot the feasibility and acceptability of a mindfulness+lifestyle program to decrease depression/stress and lessen T2D risk in Latino adolescents at-risk for T2D. The program grew out of a community-academic partnership between a federally-qualified health center serving Latino families, including a large percentage of mono-lingual Spanish-speaking parents, and the academic research team. Formative work included a Boot Camp Translation, creation of an Advisory Board, and focus groups conducted with Latino adolescents and their parents/guardians to gather feedback on the creation and implementation of a culturally-appropriate T2D intervention. Although the trial collected information about family and parent psychosocial health, these data have not yet been examined. The current master's thesis had the following specific aims and hypotheses: (i) To explore whether mindfulness+lifestyle, relative to lifestyle alone, differentially affected parent psychosocial adjustment. I hypothesized that parents who participated in the mindfulness+lifestyle intervention would show patterns of less parental depression and less parental stress at the end of the intervention and at six-months follow-up, when compared to those who participated in lifestyle alone; (ii) To explore whether baseline family functioning and baseline/change in parental psychosocial adjustment related to adolescent psychosocial outcomes. I hypothesized that, regardless of condition, greater baseline

12

family chaos, parental depression, and parental stress would show a pattern of correspondence to less decreases in adolescents' depression and stress over the intervention period and six-month follow-up. Also, I hypothesized that decreases in parental depression and parental stress from baseline to post-treatment and baseline to six-months follow-up would show a pattern of correspondence with decreases in adolescents' depression and stress during these intervals, regardless of intervention assignment; (iii) To explore how baseline family functioning and baseline/change in parental psychosocial adjustment related to changes in adolescents' risk for T2D. I hypothesized that, regardless of condition, greater baseline family chaos, parental depression, and parental stress would show a pattern of correspondence with less decreases in adolescents' BMI, insulin resistance and fasting glucose over the intervention period and six-month follow-up. I hypothesized that, regardless of condition, decreases in parental depression and parental stress would show a pattern of correspondence with decreases in adolescents' BMI, insulin resistance and fasting glucose over the six-week treatment period and six-months follow-up.

METHODS

Participants

Eighteen adolescent boys and girls identifying as Hispanic or Latino were recruited from the Northern Colorado community through referrals from primary healthcare providers, school district family liaisons, and family health centers serving Latino families. Eligible adolescents were between the ages of 12 and 15 years with the average age being 13 years. To participate, adolescents were required to be patients of a local, federally-qualified health center; families who were interested in participating but not current patients, could register as a new patient to complete the study. Adolescents were included if they were at-risk for T2D by virtue of having a BMI percentile ≥85th for age and sex and having at least one family member with prediabetes, T2D, or gestational diabetes. Because adolescent-focused portions of the intervention were conducted in English, adolescents had to be orally proficient in English. Parents could be mono-lingual Spanish-speaking, English-speaking, or Spanish/English bilingual.

Procedures

All procedures were approved by the Institutional Review Board of Colorado State University. Written consent and assent forms were signed by parents and adolescents, respectively, after having a research team member knowledgeable about the study describe the study in detail. The consent process and through the study, it was emphasized that participation in the study was voluntary and participants could discontinue at any time.

Interventions

Upon completion of baseline assessments to determine eligibility and to collect baseline measures, participants were randomly assigned to one of two family-based, community-delivered

interventions, lifestyle alone (La Vida Saludable/The Healthy Living Program) or

mindfulness+lifestyle (Salud Sin Barreras/Health without Barriers). Both conditions met twice a

week for six weeks (e.g., Tuesdays/Thursdays) in the evenings at a community center for a total

of 12 sessions. Research assistants partnered with community members to facilitate the

intervention sessions; research assistants were responsible for scheduling and making reminder

calls to families. Condition program materials are outlined in **Table 1**.

Table 1. Intervention content outline by condition

Randomization to Intervention or Control 6-weeks (90 minutes 2x/week)	
Mindfulness+Lifestyle	**Lifestyle Only**
6 sessions *CookingMatters* as a family (1/week)	6 sessions *CookingMatters* as a family (1/week)
6 Multidisciplinary sessions (1/week) that included:	6 Multidisciplinary sessions (1/week) that included:
Parent health education and mindfulness-training	Parent health education
Teen physical activity	Teen physical activity
Teen mindfulness-training (Learning 2 BREATHe (L2B)	Teen health education
Family meal	Family meal

Note: Parents and adolescents completed multidisciplinary sessions separately and came
together at the end to share a meal as a family.

Lifestyle only. La Vida Saludable/The Healthy Living Program is a relatively brief

lifestyle intervention developed with Colorado, Latino community input to be culturally-tailored

in terms of delivery of nutrition/physical activity/health knowledge, acceptability, and feasibility.

Participants and their families in La Vida Saludable program received six weekly two-hour

sessions of a nutrition education curriculum called *CookingMatters* that included cooking

demonstrations and recipe handouts using traditional Latino recipes. *CookingMatters* was

delivered by a certified *CookingMatters* instructor who was bilingual and employed at a local

community agency serving Latino families. A research assistant who also was bilingual was available to assist the lead instructor in delivery of *CookingMaters* sessions. Families also attended six weekly two-hour multidisciplinary sessions where parents received education on nutrition, parenting strategies, goal setting, and fitness information, and youth separately completed physical activities/exercise and received health education knowledge. Parent education was delivered by a promotora and a bilingual research assistant who had both obtained training in La Vida Saludable from the developers, including observation of family sessions. Fitness exercises were facilitated by a certified fitness instructor who identified as a member of the Hispanic/Latino community, and were conducted in accessible community health centers and included activities that adolescents could easily implement at home or in their neighborhood. Health knowledge sessions with adolescents were facilitated by two research team members, one of whom identified as Latino and was bilingual. Multidisciplinary sessions concluded with parents and youth sharing a meal as a family to promote family cohesion. All facilitators participated in the family meal.

     Mindfulness+Lifestyle. Salud Sin Barreras/Health without Barriers participants received identical intervention elements as La Vida Saludable/The Healthy Living Program except for the modification of two elements on the multidisciplinary session evenings. Instead of health education, youth received Learning 2 BREATHE (L2B), a mindfulness-based program for adolescents adapted from mindfulness-based stress reduction (Broderick, 2013). L2B was facilitated by the same research staff who delivered the health education program; both facilitators had received training in L2B, including delivery of and feedback on practice sessions, with an expert trainer. They also received weekly clinical supervision throughout the program from a licensed psychologist with L2B expertise. Each letter of the acronym BREATHE was the

focus of each week's lesson: Body, Reflections, Emotions, Attention, Tenderness, and Habits,

with the overall goal of Empowerment (**Table 2**).

Table 2. Primary topics from mindfulness-based group weekly sessions

Week	Mindfulness-Based Group	Health Education Group
1	**Body**: Introduction to mindfulness; mindful listening; mindful eating activities; body scan	Education on family health behaviors and setting goals
2	**Reflections**: Mindfulness of thoughts and connection to emotions	Education on food labels, nutrition and food planning.
3	**Emotions**: Surf the wave of emotions, gratitude practice	Education on parenting skills and effective direction
4	**Attention**: Attention to body, thoughts and feelings	Education on healthy body image and discipline
5	**Tenderness**: Learn to be kind to self, loving kindness meditation	Education on support seeking
6	**Habits for a healthy mind**: Practice healthy mind habits, review **Empowerment**	Education on planning and problem solving

Note: Learning 2 BREATHE (L2B) is a mindfulness-based program for adolescents adapted from Mindfulness-Based Stress Reduction (MBSR) developed by Jon Kabat-Zinn (Broderick, 2011).

L2B activities included sitting meditation, walking meditation, and body scanning. Participants were encouraged to practice brief mindfulness skills on their own between the sessions. Youth engaged in physical activity, parallel with the Lifestyle only group. During the multidisciplinary sessions, parents in Salud Sin Barreras/Health without Barriers also learned similar themes as the youth to better support their adolescents in stress management and mindfulness practices. The presentation to parents was abbreviated (10-15 minutes per session) so that there would still be time to present the other educational content. The parent modules were manualized and developed in collaboration with the lead parent facilitator (promotora), the research staff parent facilitator, and an L2B program expert. As in La Vida Saludable/The

Healthy Living program, parents and adolescents came together at the end of the night to share a family meal.

Outcome Measures

All outcome measures were collected at baseline and repeated at a post-treatment and six-months follow-up, unless otherwise noted. Parents and adolescents completed surveys. Adolescents also completed body measurements and had a fasting blood draw. Assessments were conducted in the outpatient setting of a federally qualified center in Northern Colorado serving Latino families and partnering with the academic team. Surveys were administered in person in English or Spanish language, as indicated.

Family functioning. The Household Chaos questionnaire is a 24-item self-report questionnaire completed by parents at baseline only to measure the perceived level of organization, confusion, and order in the home environment and adapted from the Confusion, Hubbub and Order Scale (CHAOS; Matheny, Wachs, Ludwig, & Phillips, 1995). Sample items include, "Our house feels like a zoo" and "No matter how hard we try, we always seem to be running late." Participants responded True or False in relation to how they normally perceive the environment of their home. A total score was calculated by summing how many responses were endorsed, with more responses indicating higher levels of chaos in the home. The CHAOS scale has demonstrated good internal reliability in a large sample of Spanish-speaking Hispanic/Latino parents (Haack, Gerdes, Schneider & Hurtado, 2013).

Parental and adolescent psychosocial adjustment. Both parents and adolescents completed the Center for Epidemiological Studies – Depression Scale, a widely-used 20-item self-report scale that measures symptoms of depression experienced during the last week (Radloff, 1977). Sample items include, "I had trouble keeping my mind on what I was doing"

18

and "I thought my life had been a failure" (Radloff, 1977). Participants respond on a four-point Likert scale: 0 = rarely or none of the time, 1 = some or a little of the time, 2 = occasionally or a moderate amount of time, or 3 = most or all of the time (Radloff, 1977). The total score is calculated from the sum of all items, ranging from 0-60, where higher scores indicate greater depression symptoms. In a very large cohort of Hispanic/Latino adults from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), internal and test-retest reliability were adequate (González et al., 2017). There is also evidence for the measure's adequate psychometric qualities in Hispanic/Latino adolescents (Stockings et al., 2015).

Parents and adolescents also completed the 14-item Perceived Stress Scale, a self-report scale for measuring the degree to which a person deems situations as stressful in one's life (Cohen, Kamarck & Mermelstein, 1983). Sample items include, "In the last month, how often have you felt you were unable to control the important things in your life" and "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them" (Cohen et al., 1983). Response choices are rated on a four-point Likert-scale of 0 = never or almost never, 1 = sometimes, 2 = fairly often, or 3 = very often (Cohen et al., 1983). The total score is calculated from the sum of all items, ranging from 0-42, with higher values reflecting greater perceived stress. The psychometric properties of the Perceived Stress Scale have been examined in Hispanic/Latino adults with both English and Spanish Language preferences (Baik et al., 2019). The scale has demonstrated good internal consistency and adequate convergent validity in Hispanic/Latino adults (Baik et al., 2019). The Perceived Stress Scale also shows adequate evidence of psychometric qualities in adolescents (Cohen et al., 1983).

Adolescent T2D risk. BMI indices were derived from measurements of adolescents' height and fasting weight to compute BMI (kg/m^2), BMI standard score (z) for age and sex, and

BMI percentile for age and sex. Fasting blood samples were collected by a healthcare provider

to derive fasting insulin and fasting glucose. Insulin resistance was estimated from fasting

insulin and fasting glucose using the homeostasis model assessment of insulin resistance

(HOMA-IR) (Katsuki, Sumida, Gabazza, Murashima, Furuta, Araki-Saski et al., 2001). HOMA-

IR is calculated using a formula of: fasting serum insulin (μU/ml) × fasting plasma glucose

(mmol/l)/22.5 (Katsuki et al., 2001).

Analytic Plan

Overview. Pilot and feasibility studies by design are not anticipated to have adequate

power. A sample of $N = 10$-15 participants per treatment arm, $N = 20$-30 for the total sample of

a two-arm trial, is recommended for pilot and feasibility studies that are expected to have

medium to large effects on outcomes (Whitehead, Julious, Cooper & Campbell, 2016). While

statistical significance is reported as $p < .05$ and trends as $p < .10$, I also describe strength/size of

correlations as $r \geq .40$ as large.

Aim 1. The hypothesis that parents who participated in mindfulness+lifestyle would

demonstrate less parental depression and less parental stress at the end of the intervention and at

six-months follow-up, when compared to those who participated in lifestyle alone, was evaluated

using analysis of covariance (ANCOVA) models with change in the outcome of interest from

baseline to post-treatment follow-up or baseline to six-months follow-up as the dependent

variable, covarying for the baseline level of the outcome. The main effect of group assignment

(mindfulness+lifestyle versus lifestyle alone) for each of the parental outcome measures was

tested. As this is a pilot study, both between and within-condition change is described.

Aim 2. The hypothesis that regardless of condition, greater baseline family chaos and

greater baseline/increases in parental depression, and parental stress would show a pattern of

correspondence with less decreases in adolescents' depression and stress over the intervention period and six-month follow-up was evaluated using a series of correlations. Correlations were examined in the total sample and stratified by condition. Reliable change is the difference between a participant's pretest score and posttest score with the change between scores not likely due to chance alone but that the change in scores is likely actual change in the participant (Jacobson & Truax, 1991). Reliable change was evaluated for parents' and adolescents' depression over the duration intervention.

Aim 3. Last, correlations were also used to explore the hypothesis that, regardless of condition, greater baseline family chaos and greater baseline/increases in parental depression and parental stress would show a pattern of correspondence with greater decreases in adolescents' BMI, insulin resistance, and fasting glucose over the intervention period and six-month follow-up. Correlations were examined in the total sample and separately, stratified by condition. As reliable change is primarily used in psychotherapy research, it was not applied to T2D risk indicators.

Preliminary Analyses/Descriptive Information
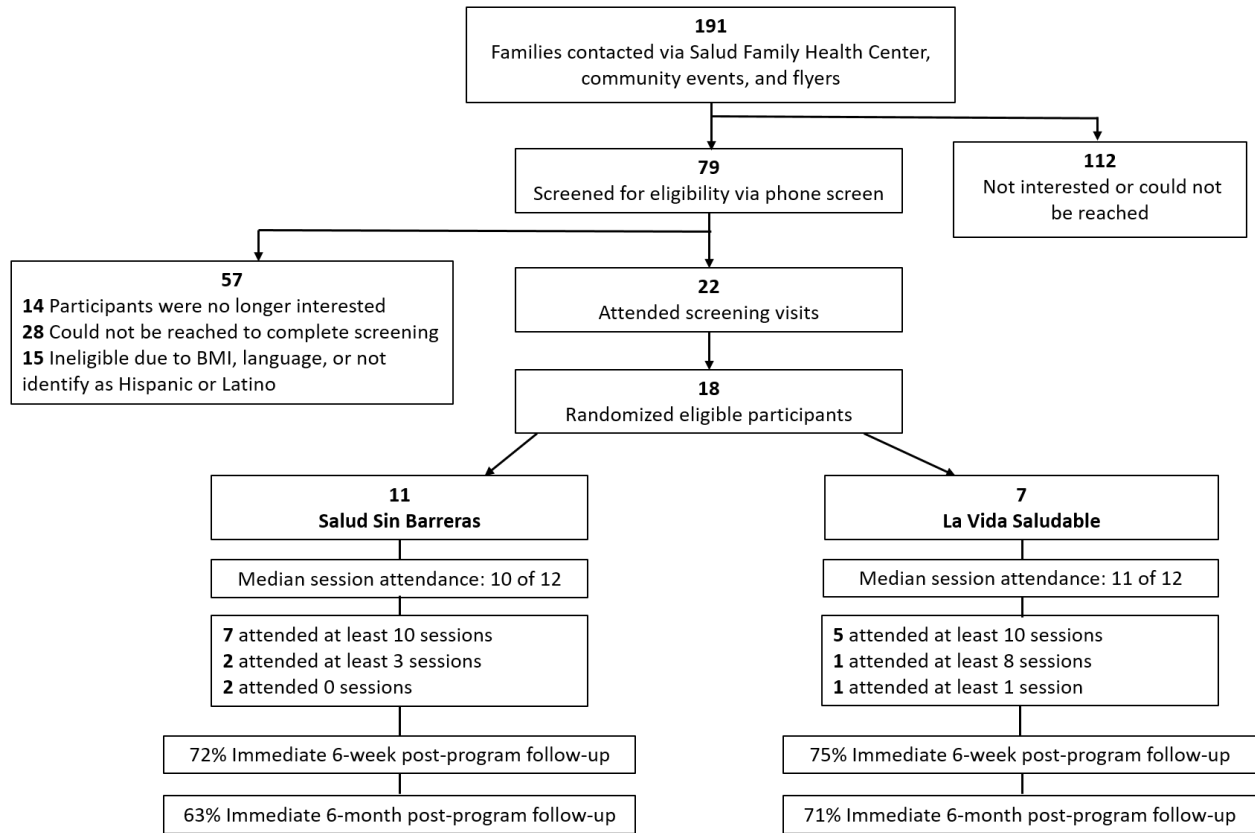
Fig. 1 study flow

Of 191 families contacted, 79 were screened over the phone for eligibility and 22 families (61%) attended screening visits. Of the 57 who did not attend screening visits, 14 were no longer interested, 28 could not be reached, and 15 were ineligible due to BMI, language, or not identifying as Hispanic or Latino. Of the 22 (61%) who attended screening visits, 18 (82%) participants were eligible and were randomized to the mindfulness+lifestyle intervention ($n = 11$) or lifestyle only control ($n = 7$).

Table 3 displays descriptive characteristics by condition. Mother figures completed

parent surveys. Two fathers participated in the intervention, but in these families, mothers were

designated by participating families to complete parent surveys.

Table 3. Baseline characteristics of Hispanic/Latino adolescents randomized to
Mindfulness+Lifestyle (*n*=11) versus Lifestyle Only (*n*=7) and their parents

	Lifestyle+ Mindfulness	Lifestyle Only	
Adolescent characteristic	**M ± SD or % (*n*)**	**M ± SD or % (*n*)**	***p***
Age, years	13.59 ± 1.04	13.68 ± 1.21	.88
Female	54.4% (6)	71.4% (5)	.47
BMI, kg/m^2	32.66 ± 6.23	31.32 ± 3.63	.62
BMI, z-score	2.27 ± 0.54	2.10 ± 0.33	.50
BMI, %ile	97.65 ± 2.32	97.79 ± 1.31	.89
Obesity, BMI ≥95th %ile	81.8% (9)	100.0% (7)	.23
Fasting insulin, mIU/L	25.45 ± 13.25	22.47 ± 10.47	.62
Fasting glucose, mg/dL	90.55 ± 6.22	89.71 ± 7.76	.81
Insulin resistance, HOMA-IR	5.51 ± 2.74	4.90 ± 2.09	.63
Hba1c, %	5.08 ± 0.18	5.09 ± 0.18	.97
Depression symptoms	11.55 ± 5.43	10.86 ± 4.98	.79
Elevated depression symptoms, CES-D ≥16	36.4% (4)	42.9% (3)	.78
Perceived stress	28.27 ± 4.78	25.43 ± 8.75	.38
Elevated global perceived stress, PSS ≥14	100% (11)	85.7% (6)	.43
# 1st/2nd degree family member(s) with diabetes	3.00 ± 1.48	3.43 ± 1.72	.58
% with 1st degree family member(s) with diabetes	45.5% (5)	42.9% (3)	.91
Family/parent characteristic	**M ± SD or % (*n*)**	**M ± SD or % (*n*)**	***p***
Female	100% (9)	100% (7)	1.00
Family chaos	11.67 ± 5.57	6.86 ± 3.53	.06
Depression symptoms	13.83 ± 6.64	11.83 ± 6.49	.61
Elevated depression symptoms, CES-D ≥16	55% (5)	42% (3)	.56
Perceived stress	19.83 ± 7.57	20.33 ± 3.07	.88
Elevated global perceived stress, PSS ≥14	66% (6)	85% (6)	.05

Note: Body mass index (BMI); Center for Epidemiologic Studies Depression Scale (CES-D) 20-item survey: Range 0-60; Perceived Stress Scale (PSS) 10-item survey: Range 0-42.

Adolescents did not significantly differ (*p* < .05) in any baseline characteristic by

condition. On average, adolescents were age 13.59 years (SD = 1.04 years) in the

mindfulness+lifestyle intervention and 13.68 years (SD = 1.21 years) in the lifestyle only

condition. The majority of adolescents in both conditions were obesity (lifestyle alone control: 100% vs. mindfulness+lifestyle intervention: 82%). Insulin resistance was elevated in both conditions (mindfulness+lifestyle: 5.51 (2.74) vs. lifestyle: 4.90 (2.09)), with values exceeding 3.16 often considered indicative of clinically elevated (Kostovski et a., 2018). Over one-third of adolescents in both the mindfulness+lifestyle and lifestyle conditions endorsed elevated depression symptoms (36% vs. 43%, $p = .78$) and the vast majority reported elevated perceived stress (100% vs. 86%, $p = .43$).

With respect to parent characteristics, there were no differences between conditions in perceived stress. However, there were trend-level differences in baseline family chaos and global perceived stress. Mothers in the mindfulness+lifestyle condition tended to report higher (11.67 (5.57)) family chaos than mothers in the lifestyle only condition (6.86 (3.53), $p = .06$). Conversely, there tended to be a higher proportion of mothers in the lifestyle condition who reported elevated global perceived stress than mothers in the mindfulness+lifestyle condition (66% vs. 85%, $p = .05$).

Median attendance in both the mindfulness+lifestyle intervention and lifestyle only condition was 10 sessions. Immediate post-program follow-up was 75% in mindfulness+lifestyle condition and 72% in the lifestyle only condition. Six-month follow-up was 71% in the lifestyle only condition and 63% in the mindfulness+lifestyle condition.

Exploration of Intervention Effects on Parent Depression and Stress (Aim 1)

As displayed in **Fig. 2a**, there was no between-condition effect of condition on change in mothers' depression symptoms from baseline to six-weeks (95% CI -11.14, 6.73, $p = .59$) or from baseline to six-months (95% CI -18.67, 8.52, $p = .42$), accounting for baseline depression symptoms. There was no significant within-condition change in depression symptoms from

baseline to post-treatment within either mindfulness+lifestyle (95% CI -7.88, 3.55) or lifestyle only (95% CI -11.15, 2.41). Likewise, there was no significant within-condition change in mothers' depression symptoms from baseline to six-month follow-up within either mindfulness+lifestyle (95% CI -6.17, 11.23) or lifestyle (95% CI -12.87, 7.77).

As depicted in **Fig. 2b**, condition was not a predictor of change in mothers' global perceived stress from baseline to six-weeks (95% CI -11.26, 10.56, $p = .94$) nor baseline to six-month follow-up (95% CI -9.56, 9.29, $p = .98$), accounting for baseline perceived stress. Similarly, there were no within-condition differences in change in mothers' global perceived stress within mindfulness+lifestyle or lifestyle only at six-weeks (95% CI -9.62, 4.08 versus -11.29, 5.05) or six-months (95% CI -6.20, 5.64 versus -7.47, 6.65).

Panel A
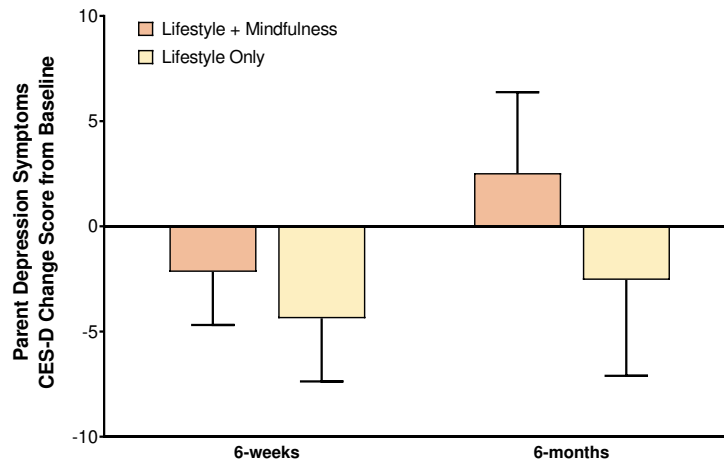
Panel B
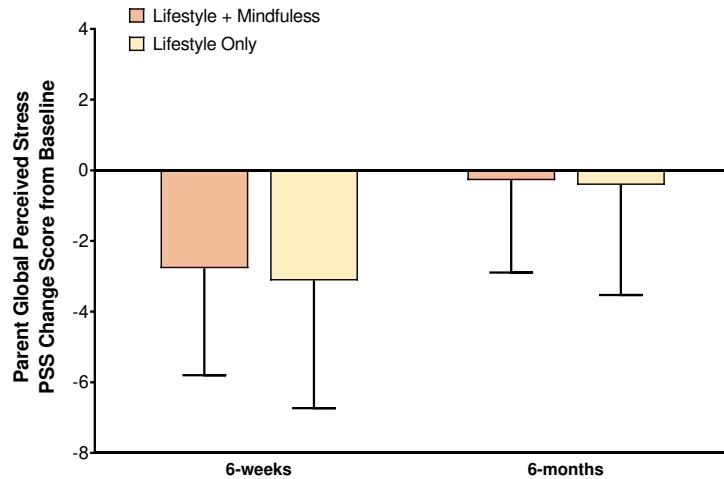
Fig. 2 Non-significant between-condition and within-condition changes in parental depression (panel a) and parental perceived stress (panel b)

Changes in maternal depression were explored using reliable change from baseline to post-treatment. Reliable change index is found by dividing the difference between the pretreatment and posttreatment scores by the standard error of the difference between the two scores (Jacobson & Truax, 1991). With the reliable change index calculation, there is a clear cutoff point for improvement set at 1.96 with scores larger than that threshold reflecting real change. In **Fig. 3**, the solid line represents the line of "no change" with points higher than the

line indicating an increase in depression scores and points below the line indicating decreases in depression scores. The dotted lines on either side of the line of no change represent the reliable change index band set at 1.96 (p < .05) standard error of measure.
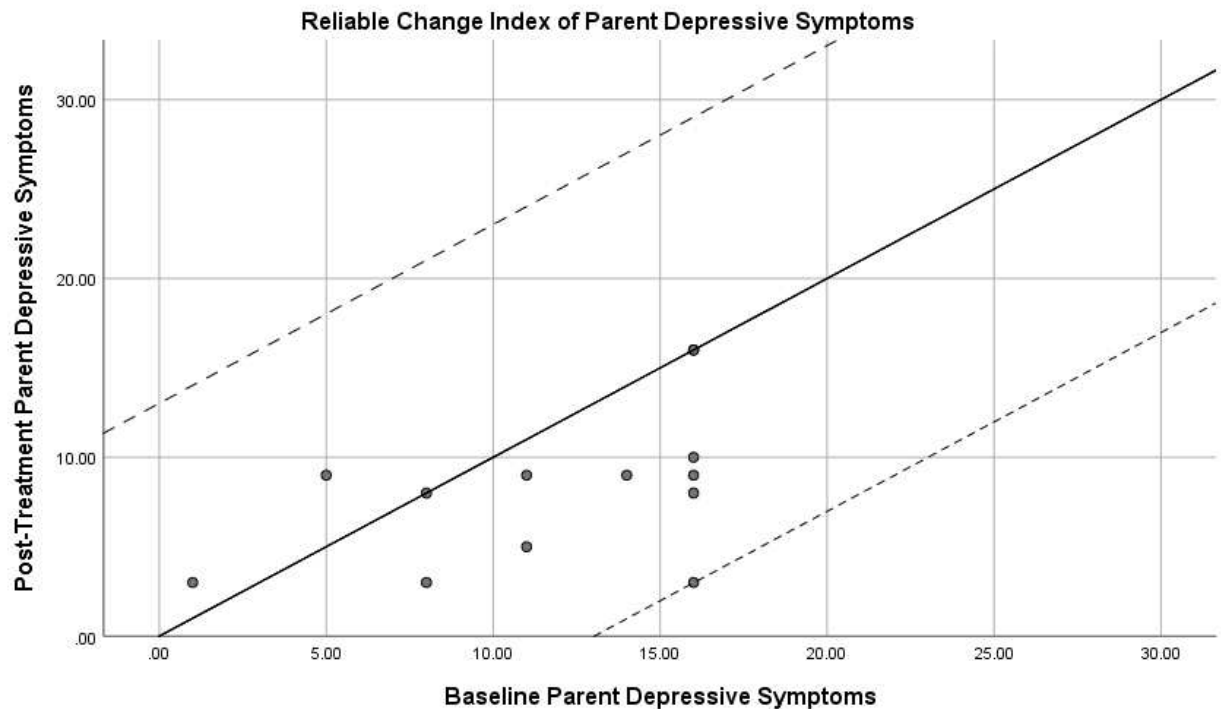
Fig. 3 Reliable change index for parent depression

Note: Change in depressive symptoms for parents with a band of reliable change (*SEMEAS* = 13.02).

Individual scores within the band included seven participants who experienced decreases in depressive symptoms; although these mothers experienced decreases in symptoms, these scores do not show reliable change. Only one parent participant outside of the band experienced a reliable change in decreased depressive symptoms; this parent was in the lifestyle only condition.

Parental perceived stress was also explored using reliable change as displayed in **Fig. 4**.
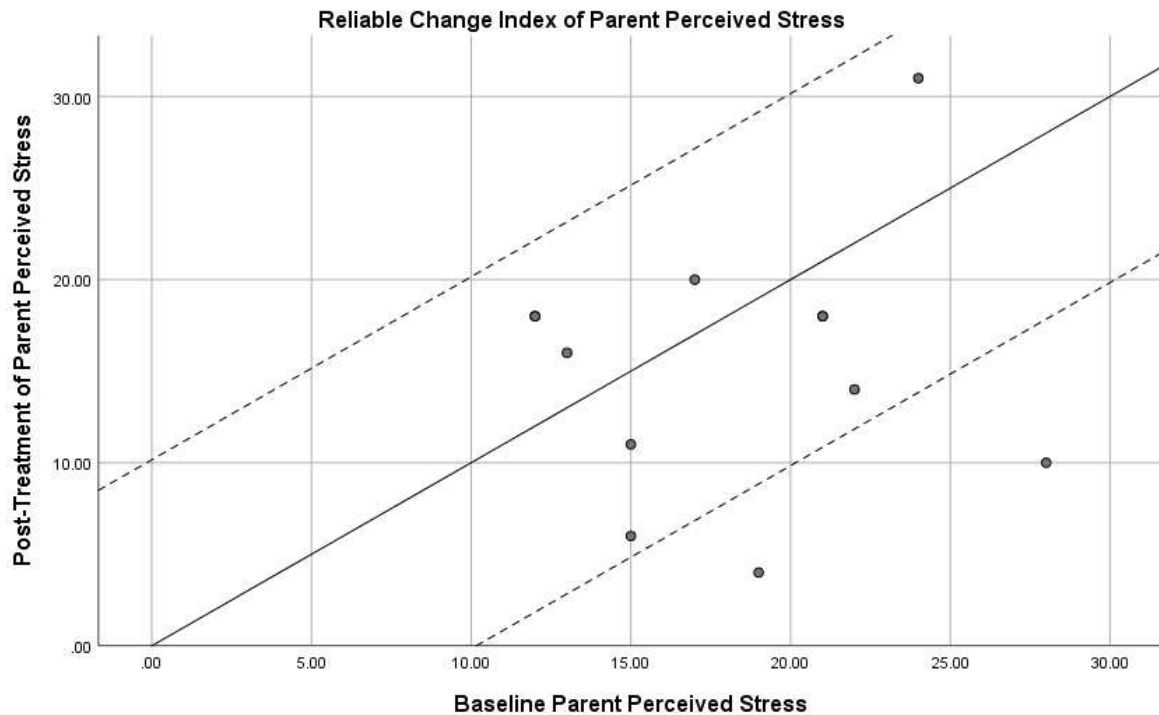
Fig. 4 Reliable change index for parental stress

Note: Change in perceived stress for parents with a band of reliable change ($SE_{MEAS} = 10.15$).

Results for maternal stress were mixed as four participants experienced increases in stress and four experienced decreases in stress. These increases and decreases were within the reliable change index band suggesting that while eight parents experienced a change in perceived stress, the change was not reliable. There were a total of two parent participants who experienced reliable change in decreases in stress (i.e., scores outside of the band) with one parent in the mindfulness+lifestyle condition and one parent in the lifestyle only condition.

Exploration of Correspondence of Baseline Family Chaos and Parent Depression/Stress and Changes in Parent Depression/Stress with Changes in Adolescent Depression/Stress (Aim 2)

Correlation analyses were used to explore patterns of correspondence among baseline family chaos, baseline maternal depression/stress, changes in maternal depression/stress, and

baseline and changes in adolescents' depression/stress. In the total sample (**Table 4a**), baseline family chaos did not relate to baseline or change in maternal or adolescent depression/stress. Baseline maternal depression and parent stress tended to be related to each other ($r = .41$, $p = .09$), and higher baseline maternal depression tended to be associated with greater decreases in adolescent perceived stress from baseline to six-months follow-up ($r = -.55$, $p = .08$). Likewise, higher baseline maternal perceived stress related to trend-level, greater decreases in mothers' own stress at post-treatment ($r = -.52$, $p = .08$) and significantly greater decreases in mothers' stress at six-month follow-up ($r = -.75$, $p = .005$).

With respect to changes in maternal depression/stress, mothers' change in depression from baseline to post-treatment corresponded positively and significantly with adolescents' change in stress from baseline to six-month follow-up ($r = .79$, $p = .003$), whereas changes in maternal stress did not relate to change in teen depression or stress at either interval. Among adolescents, their depression and stress corresponded at baseline ($r = .56$, $p = .01$) and generally, adolescents' greater baseline depression/stress to begin with related to their greater decreases in these symptoms following the interventions.

I next explored correlations stratified by condition (**Table 4b**). Within the mindfulness+lifestyle condition, mothers' baseline perceived stress was associated with greater decreases in mothers' own perceived stress from both baseline to post-treatment ($r = -.94$, $p = .001$) and greater declines in mothers' perceived stress from baseline to six-month follow-up ($r = -.87$, $p = .01$). Baseline maternal depression tended to relate to greater decreases in adolescent stress from baseline to six-month follow-up ($r = -.63$, $p < .10$). Adolescents' greater baseline

Table 4a. Correlations of baseline family chaos and baseline and changes in parent depression symptoms and parent perceived stress with adolescent baseline and changes in depression symptoms and perceived stress in the whole sample

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Family chaos	1	--	--	--	--	--	--	--	--	--	--	--	--
2. Parent depress	.11	1	--	--	--	--	--	--	--	--	--	--	--
3. Parent stress	-.04	.41+	1	--	--	--	--	--	--	--	--	--	--
4. Parent depress 6wk Δ	-.24	-.41	.03	1	--	--	--	--	--	--	--	--	--
5. Parent depress 6mo Δ	-.16	-.14	-.32	.25	1	--	--	--	--	--	--	--	--
6. Parent stress 6wk Δ	.30	.44	-.52+	-.00	.41	1	--	--	--	--	--	--	--
7. Parent stress 6mo Δ	.22	.07	-.75**	-.20	.69*	.70*	1	--	--	--	--	--	--
8. Teen depress	.07	.20	.23	.22	-.15	-.07	-.27	1	--	--	--	--	--
9. Teen stress	.25	.12	.15	.09	-.23	.14	-.18	.56*	1	--	--	--	--
10. Teen depress 6wk Δ	-.10	-.28	-.06	.09	.02	-.16	-.12	-.62*	-.64*	1	--	--	--
11. Teen depress 6m Δ	-.02	-.49	-.33	.21	.05	-.06	-.02	-.46	-.80**	.79**	1	--	--
12. Teen stress 6wk Δ	.07	-.46	-.14	.18	.07	-.22	-.12	-.28	-.83***	.56	.89***	1	--
13. Teen stress 6mo Δ	.04	-.55+	-.13	.79**	.16	-.19	-.11	.28	-.36	.21	.55+	.63*	1

Note: +p <.10. *p < .05. **p < .01 ***p < .001

Table 4b. Correlations of baseline family chaos and baseline and changes in parent depression symptoms and parent perceived stress with adolescent baseline and changes in depression symptoms and perceived stress by condition

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Family chaos	1	.12	.10	-.53	-.45	.44	.10	-.10	.24	.07	.30	.10	-.25
2. Parent depress	.40	1	.30	-.53	-.35	.16	-.09	.23	.08	.11	-.26	-.29	-.63
3. Parent stress	.50	.84*	1	.12	-.42	-.94**	-.87*	.24	.31	.00	-.51	.11	-.12
4. Parent depress 6wk Δ	.04	-.33	-.09	1	-.09	-.06	-.28	.17	.40	-.00	.08	-.22	.70
5. Parent depress 6mo Δ	-.01	.05	.25	.89*	1	.34	.79*	-.34	-.36	.01	-.16	-.29	-.20
6. Parent stress 6wk Δ	-.14	.77	.76	.05	.49	1	.80*	-.21	-.05	-.04	.31	-.27	-.06
7. Parent stress 6mo Δ	.55	.95*	.98**	-.21	.08	.63	1	-.40	-.42	-.00	.21	-.16	-.13
8. Teen depress	.44	.16	.39	.32	.32	.21	.71	1	.38	-.87**	-.36	.13	.35
9. Teen stress	.09	.21	.25	-.23	-.12	.35	.77	.81*	1	-.20	-.43	-.63+	-.19
10. Teen depress 6wk Δ	.09	-.48	-.38	.24	.22	-.18	-.46	-.57	-.92*	1	.21	-.28	-.43
11. Teen depress 6m Δ	-.10	-.62	-.54	.33	.26	-.23	-.64	-.64	-.98**	.97**	1	.54	.68
12. Teen stress 6wk Δ	-.10	-.69	-.58	.44	.33	-.28	-.68	-.58	-.97**	.95*	.99**	1	.78+
13. Teen stress 6mo Δ	.37	-.51	-.24	.86+	.62	-.32	-.30	.23	-.44	.51	.54	.63	1

Note: The top half of the diagonal is the mindfulness+lifestyle condition and the bottom half of the diagonal is the lifestyle only condition. +p <.10. *p < .05. **p < .01

depression was associated with greater decreases in adolescents' depression at post-treatment (r = -.87, p = .005) and adolescents' baseline stress tended to relate to greater decreases in perceived stress from baseline to post-treatment (r = -.63, p = .09).

There were notable differences in patterns of correspondence within the lifestyle only condition. In contrast to the patterns observed in the total sample or mindfulness+lifestyle condition, in the lifestyle only group, mothers' baseline depressive symptoms (r = .95, p = .01) and baseline perceived stress (r = .98, p = .003) were correlated with greater increases in mothers' perceived stress from baseline to six-month follow-up. Change in maternal depression from baseline to post-treatment and change in adolescents' stress from baseline to six-months tended to positively correspond (r = .86, p = .06). Adolescents' baseline stress related to greater decreases in their depression at both follow-ups (r = -.92 and -.98, ps < .05) and to greater decreases in their stress at post-treatment (r = -.97, p = .006).

Changes in adolescent depression were explored using reliable change from baseline to post-treatment. As depicted in **Fig. 5**, seven adolescents experienced decreases in depressive symptoms, while two teens experienced increases in depressive symptoms and two teens experienced no change. The majority of adolescents saw decreases in depressive symptoms however, only one adolescent in the lifestyle only condition had a reliable change in decrease in depressive symptoms.
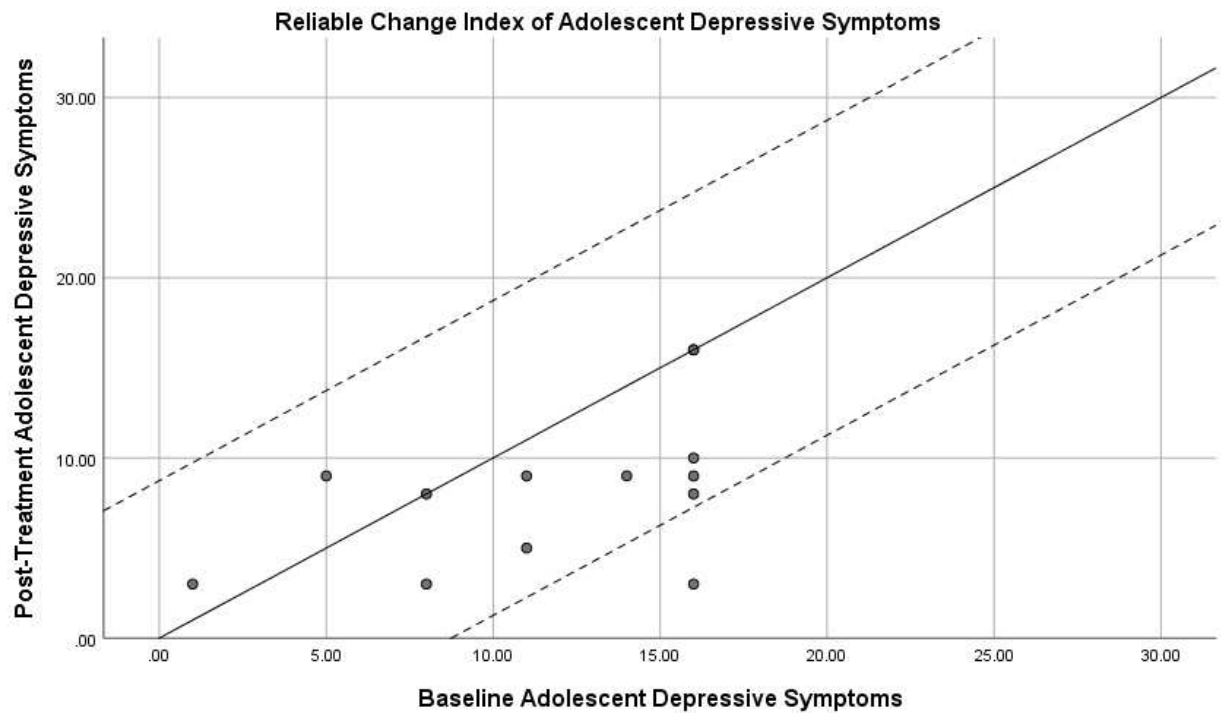
Fig. 5 Reliable change index for adolescent depression

Note: Change in depressive symptoms for adolescents with a band of reliable change (*SEMEAS* = 8.73).

Exploration of Correspondence of Baseline Family Chaos and Parent Depression/Stress and Changes in Parent Depression/Stress with Changes in Adolescent Risk for T2D (Aim 3)

Correlation analyses were used to explore the correspondence of baseline family chaos and parent depression/stress, changes in parent depression/stress and changes in adolescent BMI, insulin resistance, and fasting glucose. Within the total sample overall (**Table 5a**), mothers' baseline perceived stress was correlated with greater increases in adolescents' BMI from baseline to post-treatment ($r = .68$, $p = .01$) and greater increases in BMI from baseline to six-months ($r = .68$, $p = .01$). However, change in mothers' stress from baseline to six-month was inversely related to change in adolescents' BMI from baseline to six-month follow-up, meaning that the

32

Table 5a. Correlations of baseline family chaos and baseline and changes in parent depression symptoms and parent perceived stress with adolescent baseline and changes in BMI, fasting glucose, and insulin resistance in the whole sample

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Family chaos	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2. Parent depress	.11	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3. Parent stress	-.04	.41	1	--	--	--	--	--	--	--	--	--	--	--	--	--
4. Parent depress 6wk Δ	-.24	-.41	.03	1	--	--	--	--	--	--	--	--	--	--	--	--
5. Parent depress 6mo Δ	-.16	-.14	-.32	.25	1	--	--	--	--	--	--	--	--	--	--	--
6. Parent stress 6wk Δ	.30	.44	-.52+	-.00	.41	1	--	--	--	--	--	--	--	--	--	--
7. Parent stress 6mo Δ	.22	.07	-.75**	-.20	.69*	.70*	1	--	--	--	--	--	--	--	--	--
8. Teen BMI	.34	.01	-.26	.22	-.33	.38	.01	1	--	--	--	--	--	--	--	--
9. Teen glucose	-.15	-.25	.05	.15	.13	-.43	-.00	-.36	1	--	--	--	--	--	--	--
10. Teen IR	.38	.05	-.26	-.32	-.61*	.14	-.08	.68**	.01	1	--	--	--	--	--	--
11. Teen BMI 6wk Δ	.16	.35	.68*	.39	-.09	-.31	-.50	.25	.13	-.02	1	--	--	--	--	--
12. Teen BMI 6m Δ	-.33	.08	.68*	.38	-.16	-.31	-.64*	.11	-.01	-.12	.69*	1	--	--	--	--
13. Teen glucose 6wk Δ	.26	.23	-.20	-.33	.17	.36	.44	.00	-.18	.20	-.39	-.46	1	--	--	--
14. Teen glucose 6mo Δ	-.05	.01	.00	.45	.26	.19	.21	.42	-.02	-.04	.36	-.14	.18	1	--	--
15. Teen IR 6wk Δ	-.28	-.10	.02	.17	.43	.09	.25	-.15	-.48+	-.55*	-.02	.01	.30	.45	1	--
16. Teen IR 6mo Δ	-.11	-.07	.44	.48	.10	-.38	-.36	-.11	-.01	-.51+	.67*	.22	-.48	.47	.29	1

Note: +p <.10. *p < .05 **p < .01. Six week (6wk); Six month (6mo); Body mass index (BMI); Insulin resistance (IR).

more stress increased in mothers, the more BMI decreased in the total sample in adolescents (r = -.64, p = .02). In the sample as a whole, baseline maternal depression/stress did not relate to baseline or change in adolescent insulin resistance or fasting glucose.

Correlations explored by condition (**Table 5b**) revealed notable differences between the mindfulness+lifestyle condition and lifestyle only conditions. In the mindfulness+lifestyle condition, higher baseline household chaos was associated with greater decreases in insulin resistance baseline to post treatment (r = -.81, p = .01). Similarly, baseline maternal depression was associated with greater decreases in insulin resistance baseline to post-treatment (r = -.74, p = .03). Maternal change in stress at post-treatment and six-months both related inversely to adolescent BMI change from baseline to six-months, meaning the more maternal stress increased, the more adolescent BMI decreased (r = -.81 and -.81, ps < .05).

In contrast to the mindfulness+lifestyle condition, in the lifestyle only condition household chaos did not relate to changes in maternal depression/stress or changes in adolescent BMI, insulin resistance, or fasting glucose. Change in maternal stress from baseline to post-treatment also tended to be correlated with change in adolescent BMI, in that greater increase in maternal stress was associated with a greater increase in adolescent BMI baseline to six-month follow-up (r = .81, p = .09), and likewise, increase in maternal stress at six-months tended to be correlated positively with adolescent BMI gain from baseline to post-treatment (r = .81, p = .09). Maternal change in stress from baseline to six-months in the lifestyle only condition was also positively correlated with change in adolescent insulin resistance baseline to post-treatment (r = .90, p = .03).

Table 5b. Correlations of baseline family chaos and baseline and changes in parent depression symptoms and parent perceived stress with adolescent baseline and changes in BMI, fasting glucose, and insulin resistance by condition

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Family chaos	1	.12	.10	-.53	-.45	.44	.10	.33	-.15	.51	-.11	-.42	.45	-.28	-.81*	-.52
2. Parent depress	.40	1	.30	-.53	-.35	.16	-.09	-.28	.33	.06	.24	-.18	.26	-.07	.-74*	-.04
3. Parent stress	.50	.84*	1	.12	-.42	-.94**	-.87*	-.36	.35	-.23	.75*	.82*	-.57	-.24	-.30	.63
4. Parent depress 6wk Δ	.04	-.33	-.09	1	-.09	-.06	-.28	.54	-.06	-.01	.44	.48	-.63	.60	.32	.40
5. Parent depress 6mo Δ	-.01	.05	.25	.89*	1	.34	.79*	-.32	.28	-.50	-.26	-.41	.29	.41	.66	-.04
6. Parent stress 6wk Δ	-.14	.77	.76	.05	.50	1	.80*	.45	-.13	.38	-.58	-.81*	.58	.44	-.11	-.45
7. Parent stress 6mo Δ	.55	.95*	.98**	-.21	.08	.63	1	-.05	.11	-.06	-.67	-.81*	.68+	.29	.28	-.47
8. Teen BMI	.33	.79*	.51	-.90*	-.74	.15	.58	1	-.26	.80**	.24	.12	.04	.59	-.30	-.07
9. Teen glucose	-.36	-.94**	-.71+	.37	-.06	-.81+	-.81+	-.72+	1	.13	.30	.22	.16	-.02	-.33	-.25
10. Teen IR	-.05	.06	-.28	-.93*	-.94*	-.33	-.12	.22	-.22	1	.10	.01	.41	.07	-.77*	-.46
11. Teen BMI 6wk Δ	.66	.63	.78	.26	.33	.32	.81+	.17	-.34	-.51	1	.79*	-.61	.36	-.25	.68+
12. Teen BMI 6m Δ	-.51	.52	.46	.17	.47	.81+	.35	-.00	-.38	-.43	.24	1	-.56	-.07	.01	.37
13. Teen glucose 6wk Δ	.89	.51	.69	.15	.29	.27	.68	.12	-.55	-.26	.67	-.22	1	-.22	-.20	-.87*
14. Teen glucose 6mo Δ	.88	.25	.45	.30	.16	-.16	.52	.04	-.02	-.38	.85+	-.28	.72	1	.23	.42
15. Teen IR 6wk Δ	.84	.74	.87+	.02	.19	.39	.90*	.35	-.63	-.25	.88+	.03	.91*	.79	1	.27
16. Teen IR 6mo Δ	.65	-.23	.04	.69	.42	-.36	.06	-.48	.39	-.62	.59	-.35	.50	.84+	.42	1

Note: The top half of the diagonal is the mindfulness+lifestyle condition and the bottom half of the diagonal is the lifestyle only condition. +p <.10. *p < .05 **p < .01. Six week (6wk); Six month (6mo); Body mass index (BMI).

DISCUSSION

Despite the Latino population being the fastest growing minority group in the United States, this group continually faces health disparities including in preventable, serious chronic diseases such as T2D (Hales et al., 2017; Ogden et al., 2014). This master's thesis was a secondary and exploratory data analysis of a pilot randomized controlled comparative trial. The primary aim was to explore the potential salutary effects on parents of a mindfulness-based intervention, delivered as part of a culturally tailored lifestyle intervention within a community setting, to Latino adolescents at risk for developing T2D. Secondly, I sought to explore how family-level and parent-level psychosocial characteristics, initially and in response to the intervention, corresponded with changes in adolescent psychosocial adjustment and T2D risk.

I hypothesized that parents of adolescents who were randomized to a mindfulness+lifestyle intervention would show a pattern of experiencing greater decreases in depression and perceived stress directly after the intervention and at six-months follow-up, relative to parents in the lifestyle only intervention. Parents of participating adolescents who completed surveys with 100% mothers. Contrary to hypothesis, condition was not related, significantly or at trend-level, to differential changes in mothers' global stress nor depression over either interval. Further, neither maternal stress nor depression changed from the start of the intervention to the end of the intervention or six-months later. There are numerous possible explanations for this result. Foremost, due to the small sample size, it is likely that, by design, a lack of adequate power led to nulls results. The sample only would have had power to detect large effects, and often psychosocial changes in response to interventions are small (Harkness et al., 2010). Using reliable change index, change in parent depression and parent stress were

characterized. Although multiple parents experienced a change in depression and stress from baseline to post-treatment, for the vast majority, change was not reliable. One parent from each condition experienced a reliable change in perceived stress, and only one parent in the lifestyle only condition had a reliable change decrease in depressive symptoms. Exploratory outcomes of reliable change are consistent with the ANCOVA results. Most mothers' depression and stress did not reliably change during the intervention and follow-up period and changes did not differ between conditions. The small sample size or insufficient distinction between the parent components of the intervention may be explanatory.

Another possibility for the lack of between-group or within-group differences over time is that because the sample was not selected specifically to be uniformly high in levels of depression or stress in families (i.e., parents or teens), mothers may not have reported uniformly high enough levels of depressive symptoms or stress to detect differences or change. Nevertheless, more than half of the parents in the mindfulness+lifestyle and lifestyle only conditions reported elevated stress, and 55% of parents in the mindfulness+lifestyle and 42% of parents in lifestyle only condition endorsed elevated depressive symptoms. Interventions that specifically target samples that have uniformly elevated distress, such as elevated stress or depression, tend to see more significant changes in outcomes, particularly for mindfulness-based interventions (Creswell et al., 2019). In the current study, adolescents at-risk for T2D and their parents/guardians, with no specific psychological inclusion criterion were included.

Another possibility is that neither intervention contained sufficient mindfulness-based training for parents to significantly improve maternal stress and depression, and thus, the mindfulness+lifestyle intervention may require more tailoring to include a stronger mental health component for parents. Multifaceted intervention approaches that target mental and physical

health are more effective than lifestyle only interventions for improving mental health in patients with T1D and T2D (Harkness et al., 2010). Whereas adolescents received the complete L2B curriculum, the brief mindfulness-based training that parents received (about six 10-20 minute exposures) could be lengthened or the content may require adjustments in order to effectively reduce Latino parents' depression and stress. Future qualitative research (e.g., open-ended, structured interviews with parents) as well as mixed-methods research on parents' use or application of practices in between sessions and after the intervention ends, may shed light on helpful adaptations to optimize the parent mindfulness module. More comprehensive feedback from parents could inform what aspects of the mindfulness+lifestyle program were perceived strengths and facilitators of change, as well as understanding barriers to change and what further adaptations should be carried to optimize benefits to Latino families.

Correlation analyses were carried out to characterize patterns of correspondence between family/parent characteristics at baseline and in response to the intervention, with adolescent psychosocial changes. Correlation findings generally were inconsistent with the initial hypothesis that regardless of condition, greater baseline family chaos and greater baseline/increases in parental depression/stress would show a pattern of correspondence with lower decreases in adolescents' depression and stress over the intervention period and at six-month follow-up. Likewise, patterns were often different between conditions, and thus, I focus here on within-condition correlations.

In the mindfulness+lifestyle condition, higher baseline maternal depression tended to relate to greater decreases in adolescent stress from baseline to six-month follow-up. This was contrary to the hypothesis that higher parent psychosocial challenges would interfere with adolescents' ability to change. One possible explanation could be that receipt of mindfulness-

based training helped adolescents with more depressed mothers to cope more effectively. It is interesting to note that change in maternal depression did not relate to change in adolescent depression and change in maternal stress did not relate to change in adolescent stress in either condition. As sample sizes were small, particularly when correlations were examined separately by condition, these results must be considered highly tentative. Correlations also have the caveat of not accounting for any covariates or possible confounds; yet, they are appropriate for hypothesis generation. Reliable change was also explored for adolescent depression, and only one adolescent in the lifestyle only condition experienced a reliable change decrease in depressive symptoms. Similarly to the parents' reliable change analyses, perhaps there were insufficient numbers of adolescents with elevated depressive symptoms to detect changes, or more potent mindfulness-based training may be needed at the individual level or family level. Parental stress has been identified as a predictor of lower reported family functioning (Lorenzo-Blanco et al., 2016) and family conflict has been linked to depressive symptoms in adolescents (Young, 2016), in the absence of any intervention. In Mexican-American families greater reported depressive symptoms are associated with lower familism (Keeler, Siegel & Alvaro, 2014). Thus, the Latino family has the potential to play a key role in changes with respect to adolescent mental and physical health and this merits continued investigation in future research.

Exploratory results partially aligned with the hypothesis that greater baseline family chaos and greater baseline/increases in parental depression and parental stress would show a pattern of correspondence with greater decreases in adolescents' T2D risk. Specifically, higher baseline family chaos and maternal depressive symptoms in the mindfulness+lifestyle condition were associated with greater decreases in adolescents' insulin resistance. Conversely, in the lifestyle only condition, increase in maternal stress from baseline to six-months was associated

with increases in adolescent insulin resistance from baseline to post-treatment. These results could be considered in line with the result for maternal baseline depression and adolescent changes in perceived stress, and suggest that families with higher family chaos or parents experiencing more depressive symptoms could benefit particularly from the combination of the mindfulness+lifestyle intervention. Furthermore, in the mindfulness+lifestyle intervention, maternal changes in stress at post-treatment and six-months related to change in adolescent BMI from baseline to six-months such that the more mothers' stress increased, the more adolescent BMI decreased. However in the lifestyle only condition, the correlation in contrast, reflected that increase in maternal stress correlated with increase in adolescents' BMI from baseline to six-months follow-up. It is possible that BMI or insulin resistance change occurred through decreasing depression. Although this hypothesis could not be formally tested in the current pilot study, depression has been posited to decrease excess weight and insulin resistance through improving stress-related behaviors and physiology (Shomaker et al., 2017).

Although these relationships must be considered highly tentative, these results suggest that, at the very least, change in parent psychosocial functioning may have a relationship with adolescent T2D risk. One possibility is that intervention programs that target families with parents experiencing more stress may identify adolescents who are more likely to benefit from a mindfulness+lifestyle T2D intervention. These preliminary findings support the literature highlighting family functioning as one factor relevant to adolescent health outcomes including adolescent risk for obesity (Halliday et al., 2014). Longitudinal studies have found associations between higher levels of family cohesion and lower levels of family conflict with greater decreases in adolescent girls' BMI over a five-year period (Heredia et al., 2019). Thus, continuing to understand the role that family and parent health of Latino families play in

adolescents' response to mindfulness+lifestyle interventions is an important avenue of future research.

Limitations and Future Directions

It is important to note limitations to the current project. By having less than 15 participants in each arm, the current study was not powered to detect differences. A larger sample size would allow for more reliable estimates and potential detection of small to moderately sized associations between parent depression/stress and adolescent depression/stress. Also, family functioning was only measured as family chaos, as opposed to many other dimensions – including dimensions such as familism or support – which warrant study in future research. In addition, family chaos was measured only at baseline and was not measured at post-intervention or at six-month follow-up. Therefore, any possible changes in family functioning and their correspondence with adolescent outcomes could not be explored. It also important to note that while programs were designed for families, greater emphasis for the mindfulness component was incorporated within the youth-specific intervention components (i.e., a youth mindfulness group). Making adjustments to what parents receive in the intervention that more equally correspond to the youth component may result in greater change in parental psychosocial outcomes. Lastly, it is also important to note that all parents who completed measures were mothers. Fathers also play key roles in their family's functioning (Glass & Owen, 2010) as well as families' food choices (Penilla et al., 2017). With fathers not represented in the current sample, potential associations between father psychosocial adjustment and teen psychosocial adjustment or father psychosocial adjustment and teen T2D risk could not be explored. These areas warrant further exploration and may have future implications for the continued development, testing, and implementation of the program.

Despite these limitations, the current study has some strengths. To our knowledge, only a handful of T2D lifestyle intervention programs have been culturally adapted for Latino families, none of which have incorporated a mindfulness-based training component. Adolescents who develop T2D often face many social and environmental stressors (Nadeau et al., 2016); therefore, targeting not only physical health of adolescents but their families' psychosocial needs through the inclusion of a mindfulness-based training offers tools for coping with stress. Family involvement, which is consistent with the Latino cultural value of familism, allowed for the exploration of family functioning and recognizes that the family system plays an important role in youth functioning. Additional strengths include the relatively pragmatic duration of the programs, Spanish language incorporation, and overall cultural adaptation of the interventions.

In conjunction with Bronfenbrenner's social ecological theory highlighting the influence of the social system (Soltero et al., 2017), programs that target factors beyond the individual level are more likely to view sustained effects as all individuals are part of a larger system (Sung-Chan et al., 2012). The continued incorporation of parents in the intervention are likely to play an important role in affecting adolescent health outcomes. Interventions should continue to aim towards integrating methods that address physical and psychosocial outcomes into one program. Future studies can continue with a family systems approach by including mindfulness-based training for parents to create a dyadic mindfulness intervention. The effects of a mindfulness intervention for parents demonstrated a reduction in stress and improved parent-adolescent relationship quality relative to a control group from eight-weeks pre to post intervention (Chaplin et al., 2018). In a review of Latino participation in mindfulness interventions, studies examining mindfulness effects on stress reported significant reductions post program and studies examining depression reported similar outcomes (Cotter & Jones,

2019). Very few studies included a description of the cultural adaptation for Hispanic/Latino

population for mindfulness-based training (Cotter & Jones, 2019), however, offering materials in

the Spanish language and having facilitators who identify as Latino are promising actions toward

a culturally-adapted mindfulness intervention. Through potential feedback from parents, more

information can be acquired on how to gain more involvement from fathers in the intervention.

As a family-based intervention, participation from more than one parent will provide further

insight on family dynamics. Future research should explore mindfulness-based training that can

incorporate mindfulness when eating through family food practices or with spirituality as it

relates to culture for the Latino population. Continued community-based research is important in

demonstrating whether these exploratory pilot outcomes are replicable. Coordinating care for

the continued integration of physical and mental health in interventions must continue to be of

importance for this population.

REFERENCES

Annameier, S. K., Kelly, N. R., Courville, A. B., Tanofsky-Kraff, M., Yanovski, J. A. &

Shomaker, L. B. (2018). Mindfulness and laboratory eating behavior in adolescent girls at

risk for type 2 diabetes. *Appetite, 125,* 48-56. doi: 10.1016/j.appet.2018.01.030

Arauz Boudreau, A. D., Kurowski, D. S., Gonzalez, W. I., Dimond, M. A., & Oreskovic, N. M.

(2013). Latino families, primary care, and childhood obesity: A randomized controlled

trial. *American Journal of Preventative Medicine, 44*(3 Suppl 3), S247-57. doi:

10.1016/j.amepre.2012.11.026

Ayón, C., Marsiglia, F. F., & Bermudez-Parsai, M. (2010). LATINO FAMILY MENTAL

HEALTH: EXPLORING THE ROLE OF DISCRIMINATION AND

FAMILISMO. *Journal of Community Psychology*, *38*(6), 742–756.

doi:10.1002/jcop.20392

Baik, S. H., Fox, R. S., Mills, S. D., Roesch, S. C., Sadler, G. R., Klonoff, E. A., & Malcarne, V.

L. (2019). Reliability and validity of the Perceived Stress Scale-10 in Hispanic

Americans with English or Spanish language preference. *Journal of Health

Psychology*, *24*(5), 628–639. https://doi.org/10.1177/1359105316684938

Berge, J. M., Wall, M., Larson, M., Loth, K. A. & Neumark-Sztainer, D. (2012). Family

Functioning: Associations with Weight Status, Eating Behaviors, and Physical Activity in

Adolescents. *Journal of Adolescent Health, 52,* 351-357.

Broderick, P.C. & Metz, S. (2011). Learning to BREATHE: A pilot trial of a mindfulness

curriculum for adolescents. *Advances in School Mental Health Promotion, 2,* 35-46.

Brown, K.W., Ryan, R.M., Creswell, J.D. (2007). Mindfulness: Theoretical foundations and

evidence for its salutary effects. *Psychological Inquiry.* 18:211–237.

doi:10.1080/10478400701598298.

Caprio, S., Daniels, S.R., Drewnowski, A., Kaufman, F.R., Palinkas, L.A., Rosenbloom, A.L., &

Schwimmer, J.B. (2008). Influence of Race, Ethnicity, and Culture on Childhood

Obesity: Implications for Prevention and Treatment. Diabetes Care, 11. 2211-2221.

Retrieved from: care.diabetesjournals.org/content/31/11/2211.long

Chaplin, T. M., Turpyn, C. C., Fischer, S., Martelli, A. M., Ross, C. E., Leichtweis, R. N.,

Miller, A. B. & Sinha, R. (2018). Parenting-focused mindfulness intervention reduces

stress and improves parenting in highly stressed mothers of adolescents. *Mindfulness*.

https://doi-org.ezproxy2.library.colostate.edu/10.1007/s12671-018-1026--9

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress.

Journal of Health and Social Behavior, 24, 386-396.

Coleman, K. J., Ocana, L. L., Walker, C., Araujo, R. A., Gutierrez, V., Shordon, M., … Philis

Tsimikas, A. (2010). Outcomes From a Culturally Tailored Diabetes Prevention Program

in Hispanic Families From a Low-Income School. *The Diabetes Educator*, *36*(5), 784–

792. https://doi.org/10.1177/0145721710377360

Cotter, E. W. & Jones, N. (2019). A review of latino/latinx participants in mindfulness-based

intervention research. *Mindfulness*. https://doi-

org.ezproxy2.library.colostate.edu/10.1007/s12671-019-01266-9

Creswell, J. D, Lindsay, E. K, Villalba, D. K & Chin, B. (2019). Mindfulness Training and

Physical Health: Mechanisms and Outcomes. *Psychosomatic Medicine*, *81*(3):224-232.

doi:10.1097/PSY.0000000000000675

Cupito, A.M., Stein, G.L., Gonzalez, L.M., & Supple, A.J. (2016). Familism and Latino

    adolescent depressive symptoms: The role of maternal warmth and support and school

    support. *Cultural Diversity and Ethnic Minority Psychology, 22*(4), 517-523. https://doi-

    org.ezproxy2.library.colostate.edu/10.1037/cdp0000097

Davis, J. N., Ventura, E.E., Alexander, K.E., Salguero, L.E., Weigensberg, M.J., Crespo, N.C.,

    Spruijt-Metz, D., & Goran, M.I. (2009). Feasibility of a home-based versus classroom-

    based nutrition intervention to reduce obesity and type 2 diabetes in Latino youth.

    International Journal of Pediatric Obesity, 2:1, 22-30

    http://doi.org/10.1080/17477160601133077

Davis, J.N., Kelly, L.A., Lane, C.J., Ventura, E.E., Byrd-Williams, C.E., Alexander, K.A., Azen,

    S.P., Chou, C.P., Spruijt-Metz, D., Weigensberg, M.J., Berhane, K., & Goran, M.I.

    (2009). Randomized control trial to improve adiposity and insulin resistance in

    overweight Latino adolescents. *Obesity (Silver Spring, Md.), 17*(8), 1542-8. doi:

    10.1038/oby.2009.19

Davis, J. N., Tung, A., Chak, S. S., Ventura, E. E., Byrd-Williams, C. E., Alexander, K. E., Lane,

    C. J., Weigensberg, M. J., Spruijt-Metz, D., … Goran, M. I. (2009). Aerobic and strength

    training reduces adiposity in overweight Latina adolescents. *Medicine and Science in*

    Sports and Exercise, *41*(7), 1494-503.

Davis, J.N., Gyllenhammer, L.E., Vanni, A.A., Mejia, M., Tung, A., Schroeder, E.T., Spruijt

    Metz, D., & Goran, M.I. (2011). Startup circuit training program reduces metabolic risk

    in Latino adolescents. *Medicine and Science in Sports and Exercise, 43*(11), 2195-203.

    doi: 10.1249/MSS.0b013e31821f5d4e

Dawson, B.A., Perez, R.M., & Suárez-Orozco, C. (2012). Exploring differences in family

involvement and depressive symptoms across Latino adolescent groups. *Journal of Human Behavior in the Social Environment, 22*(2), 153-171. https://doi-org.ezproxy2.library.colostate.edu/10.1080/10911359.2012.647473

DiMatteo, M. R. (2004). Social Support and Patient Adherence to Medical Treatment: A Meta Analysis. *Health Psychology, 23(*2), 207-218. http://doi-org.ezpeoxy2.library.colostate.edu/10.1037.0278-6133.23.2.207.supp

Falbe, J., Cadiz, A.A., Tantoco, N.K., Thompson, H.R., Madsen, K.A. (2015). Active and Healthy Families: A Randomized Controlled Trial of a Culturally Tailored Obesity Intervention for Latino Children. *Academic Pediatrics, 15*(4), 386-395. http://doi.org/10.1016/j.acap.2015.02.004

Foster, G. D., Linder, B., Baranowski, T., Cooper, D. M., Goldberg, L., Harrell, J.S., Kaufman, F., Marcus, M. D., Treviño, R. P., Hirst, K. (2010). A school-based intervention for diabetes risk reduction. *The New England Journal of Medicine*, *363*(5), 443-53.

Friis, A. M., Johnson, M. J., Cutfield, R. G. & Consedine, N. S. (2016). Kindness Matters: A Randomized Controlled Trial of a Mindful Self-Compassion Intervention Improves Depression, Distress, and HbA1c Among Patients with Diabetes. Diabetes Care, 39(11), 1963-1971. Doi: 10.2337/dc16-0416

Glass, J., & Owen, J. (2010). Latino fathers: The relationship among machismo, acculturation, ethnic identity, and paternal involvement. *Psychology of Men & Masculinity, 11*(4), 251-261.

González, P., Nuñez, A., Merz, E., Brintz, C., Weitzman, O., Navas, E.L., … Gallo, L.C. (2017).

Measurement properties of the Center for Epidemiologic Studies Depression Scale (CES-D 10): Findings from HCHS/SOL. *Psychological Assessment, 29*(4), 372-381. http://doi-org.ezproxy2.library.colostate.edu/10.1037/pas0000330

Goran, M. I., Bergman, R. N., Cruz, M. L. & Watanabe, R. (2002). Insulin Resistance and Associated Compensatory Responses in African-American and Hispanic Children. *Diabetes Care, 25,* 2184-2190. https://doi.org/10.2337/diacare.25.12.2184

Gregg, J. A., Callaghan, G. M., Hayes, S. C., & Glenn-Lawson, J. L. (2007). Improving diabetes self-management through acceptance, mindfulness, and values: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 75*(2), 336-343. http://dx.doi.org/10.1037/0022-006X.75.2.336

Gruber, K. J., & Haldeman, L. A. (2009). Using the family to combat childhood and adult obesity. *Preventing Chronic Disease*, *6*(3), A106.

Haack, L.M., Gerdes, A., Schneider, B.W., Hurtado, G.D. (2013). Advancing our knowledge of ADHD in Latino Children: Psychometric and Cultural Properties of Spanish-Versions of Parental/Family Functioning Measures. *Journal of Abnormal Child Psychology, 39,* 33-43.

Hales, C.M, Carroll, M.D, Fryar, C.D, Ogden, C.L. (2017). Prevalence of obesity among adults and youth: United States, 2015–2016. *Mortality in the United States,* (288), 1-8.

Halliday, J. A., Palma, C. L., Mellor, D., Green, J. & Renzaho, A. M. N. (2014). The relationship between family functioning and child and adolescent overweight and obesity: A systematic review. *International Journal of Obesity 38,* 480-493.

Harkness, E., Macdonald, W., Valderas, J., Coventry, P., Gask, L., & Bower, P. (2010).

Identifying psychosocial interventions that improve both physical and mental health in

patients with diabetes: a systematic review and meta-analysis. *Diabetes Care 33*, 926-

930.

Hartmann, M., Kopf, S., Kircher, C., Faude-Lang, V., Djuric, Z., Augstein, F., Friederich, H.,

Kieser, M., Bierhaus, A., Humpert, P. M., Herzog, W. & Nawroth, P. (2012). Sustained

Effects of a Mindfulness-Based Stress-Reduction Intervention in Type 2 Diabetic

Patients. *Diabetes Care, 35*(5), 945-947. https://doi.org/10.2337/dc11-1343

Heredia, N. I., Wilkinson, A. V., Forman, M. R., Christie, I. C., Wang, J., Daniel, C. R., Zhao,

H., Bondy, M. L. & Strong, L. L. (2019). Longitudinal associations of family functioning

with body mass index in Mexican-origin adolescents living in the U.S. *Preventative

Medicine 118,* 309-316.

Katsuki, A., Sumida, Y., Gabazza, E.C., Murashima, S., Furuta, M., Araki-Saski, R., Hori, Y.,

Yano, Y. & Adachi, Y. (2001). Homeostasis Model Assessment is a Reliable Indicator of

Insulin Resistance During Follow-up of Patients With Type 2 Diabetes. *Diabetes Care,

24*(2), 362-365. doi: 10.2337/diacare.24.2.362

Keeler, A.R., Seigel, J.T., & Alvaro, E.M. (2014). Depression and help seeking among Mexican

Americans: The mediating role of familism. *Journal of Immigrant and Minority Health*,

16(6), 1225-1231. http://doi-org.ezproxy2.library.colostate.edu/10.1007/s10903-013-

9824-6

Kelly, L., Loza, A., Lin, X., Schroeder T.D., Hughes, A., Kirk, A. & Knowles A.M. (2015). The

effect of a home-based strength training program on type 2 diabetes risk in obese Latino

boys. *Journal of Pediatric Endocrinology and Metabolism*, *28*(3-4), pp. 315-322.

doi:10.1515/jpem-2014-0470

Kelsey, N.M. & Zeitler, P.S. (2016). Insulin Resistance of Puberty. *Current Diabetes Reports.*
    16(7). doi: 10.1007/s11892-016-0751-5

Kostovski, M., Simeonovski, V., Mironska, K., Tasic, V., & Gucev, Z. (2018). Metabolic
    Profiles in Obese Children and Adolescents with Insulin Resistance. *Open access*
    Macedonian journal of medical sciences, *6*(3), 511–518.
    https://doi.org/10.3889/oamjms.2018.097

Jacobson, N. S., & Truax, P. (1991). Clinical Significance: A Statistical Approach to Defining
    Meaningful Change in Psychotherapy Research. *Journal of Consulting and Clinical*
    Psychology, 59, 12-19.

Lorenzo-Blanco, E. I., Meca, A., Unger, J. B., Romero, A., Gonzales-Backen, M., Piña-Watson,
    B., Cano, M. Á., Zamboanga, B. L., Des Rosiers, S. E., Soto, D. W., Villamar, J. A.,
    Lizzi, K. M., Pattarroyo, M., … Schwartz, S. J. (2016). Latino parent acculturation stress:
    Longitudinal effects on family functioning and youth emotional and behavioral
    health. *Journal of family psychology : JFP : Journal of the Division of Family*
    Psychology of the American Psychological Association (Division 43), *30*(8), 966-976.
    10.1037/fam0000223

Lorenzo-Blanco, E.I., Meca, A., Unger, J.B., Romero, A., Szapocznik, J., Piña, W.B.,
    &Schwartz, S.J. (2017). Longitudinal effects of Latino parent cultural stress, depressive
    symptoms, and family functioning on youth emotional well-being and health risk
    behaviors. *Family Process, 56*(4), 981-996. https://doi-
    org.ezproxy2.library.colostate.edu/10.1111.famp.12258

Matheny, A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing order out of chaos:

Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology, 16*(3), 429-444.

http://dx.doi.org/10.1016/0193-3973(95)90028-4

Mayer-Davis, E. J., Lawrence, J. M., Dabelea, D., Divers, J., Isom, S., Dolan, L., … SEARCH for Diabetes in Youth Study (2017). Incidence Trends of Type 1 and Type 2 Diabetes among Youths, 2002-2012. *The New England Journal of Medicine*, *376*, 1419–1429. doi:10.1056/NEJMoa1610187

Metz, S. M., Frank, J. L., Reibel, D., Cantrell, T., Sanders, R., & Broderick, P. C. (2013). The effectiveness of the Learning to BREATHE program on adolescent emotion regulation. *Research in Human Development, 10*(3), 252-272.

McCurley, J.L., Crawford, M.A.& Gallo, L.C. (2017). Prevention of Type 2 Diabetes in the U.S. Hispanic Youth: A Systematic Review of Lifestyle Interventions. *American Journal of Preventative Medicine, 53*(4), 519-532. 10.1016/j.amepre.2017.05.020

Miller, T. A., & Dimatteo, M. R. (2013). Importance of family/social support and impact on adherence to diabetic therapy. *Diabetes, metabolic syndrome and obesity : targets and therapy*, *6*, 421–426. doi:10.2147/DMSO.S36368

Moores, C. J., Bell, L. K., Miller, J., Damarell, R. A., Matwiejczyk, L., & Miller, M. D. (2018). A systematic review of community-based interventions for the treatment of adolescents with overweight and obesity. Obesity Reviews, 19(5), 698-715. https://doi.org/10.1111/obr.12660

Nadeau, K. J., Anderson, B. J., Berg, E. G., Chiang, J. L., Chou, H., Copeland, K. C., Hannon, T.

S., Huang, T. T., Lynch, J. L., Powell, J., Sellers, E., Tamborlane, W. V. & Zeitler, P. (2016). Youth-Onset Type 2 Diabetes Consensus Report: Current Status, Challenges, and Priorities. *Diabetes Care, 39:* 1635-1642. doi: 10.2337/dc16-1066.

Ogden C.L., Carroll M.D., Kit B.K., Flegal K.M. (2014). Prevalence of Childhood and Adult Obesity in the United States, 2011-2012. *JAMA. 311*(8):806–814. doi:10.1001/jama.2014.732

Patrick, K., Norman, G.J., Davila, E.P., Calfas, K.J., Raab, F., Gottschalk, M., Sallis, J.F., Godbole, S., Covin, J.R. (2013). Outcomes of a 12-Month Technology-Based Intervention to Promote Weight Loss in Adolescents at Risk for Type 2 Diabetes. *Journal of Diabetes Science and Technoogy, 7*(3), 759-770. doi: 10.1177/193229681300700322

Penilla, C., Tschann, J M., Deardorff, J., Flores, E., Pasch, L A., Butte, N F., Gregorich, S E., Greenspan, L C., Martinez, S M. & Ozer, E. (2017). Fathers' feeding practices and children's weight status in Mexican American families. *Apetite, 117,* 109-116.

Pivarunas, B., Kelly, N. R., Pickworth, C. K., Cassidy, O., Radin, R. M., Shank, L. M., … Shomaker, L. B. (2015). Mindfulness and eating behavior in adolescent girls at risk for type 2 diabetes. *The International Journal of Eating Disorders*, *48*, 563–569. doi:10.1002/eat.22435

Radloff, L.S. (1977) 'The CES-D scale: A self report depression scale for research in the general population'. Applied Psychological Measurement 1: 385-401. http://dx.doi.org/10.13072/midss.120

RosenBaum, M., Nonas, C., Weil, R., Horlick, M., Fennoy, I., Vargas, I., Kringas, P. (2007). School-Based Intervention Acutely Improves Insulin Sensitivity and Decreases Inflammatory Markers and Body Fatness in Junior High school students. *The Journal of*

*Clinical Endocrinology & Metabolis, 92(*2), 504-508. http://doi.org/10.1210/jc.2006-1516

Savoye, M., Nowicka, P., Shaw, M., Yu, S., Dziura, J., Chavent, G., … Caprio, S. (2011). Long term results of an obesity program in an ethnically diverse pediatric population. *Pediatrics*, *127*(3), 402–410. doi:10.1542/peds.2010-0697

Shaibi, G.Q., Cruz, M.L., Ball, G.D., Weigensberg, M.J., Salem, G.J., Crespo, N.C., Goran, M.I. (2006). Effects of resistance training on insulin sensitivity in overweight Latino adolescent males. *Medicine and Science in Sports and Exercise. 38(*7), 1208-1215. doi: 10.1249/01.mss.0000227304.88406.0f

Shaibi, G. Q., Greenwood-Ericksen, M. B., Chapman, C. R., Konopken, Y., & Ertl, J. (2010). Development, Implementation, and Effects of Community-Based Diabetes Prevention Program for Obese Latino Youth. *Journal of Primary Care & Community Health*, 206–212. https://doi.org/10.1177/2150131910377909

Shaibi, G.Q., Konopken, Y., Hoppin, E., Keller, C.S., Ortega, R., & Castro, F.G. (2012). Effects of a Culturally Grounded Community Based Diabetes Prevention Program for Obese Latino Adolescents. *The Diabetes Educator, 38*(4), 504-512. http://doi.org/10.1177/0145721712446635

Shaw, M., Savoye, M., Cali, A., Dziura, J., Tamborlane, W. V., & Caprio, S. (2009). Effect of a successful intensive lifestyle program on insulin sensitivity and glucose tolerance in obese youth. *Diabetes Care*, *32*(1), 45–47. doi:10.2337/dc08-0808

Shomaker, L. B., Tanofsky-Kraff, M., Stern, E. A., Miller, R., Zocca, J. M., Field, S. E., …

Yanovski, J. A. (2011). Longitudinal study of depressive symptoms and progression of

insulin resistance in youth at risk for adult obesity. *Diabetes Care*, *34*(11), 2458–2463.

doi:10.2337/dc11-1131

Shomaker, L. B., Bruggink, S., Pivarunas, B., Skoranski, A., Foss, J., Chaffin, E., … Bell, C.

(2017). Pilot randomized controlled trial of a mindfulness-based group intervention in

adolescent girls at risk for type 2 diabetes with depressive symptoms. *Complementary*

therapies in medicine, *32*, 66–74. doi:10.1016/j.ctim.2017.04.003

Shomaker, L. B., Kelly, N. R., Radin, R. M., Cassidy, O. L., Shank, L. M., Brady, S. M., …

Yanovski, J. A. (2017). Prevention of insulin resistance in adolescents at risk for type 2

diabetes with depressive symptoms: 1-year follow-up of a randomized trial. *Depression*

and Anxiety, *34*(10), 866–876. doi:10.1002/da.22617

Shomaker, L. B., Pivarunas, B., Annameier, S. K., Gulley, L., Quaglia, J., Brown, K. W.,

Broderick, P. & Bell, C. (2019). One-Year Follow-Up of a Randomized Controlled Trial

Piloting a Mindfulness-Based Group Intervention for Adolescent Insulin Resistance.

Frontiers in Psychology, https://doi.org/10.3389/fpsyg.2019.01040

Soltero, E.G., Konopken, Y.P., Olson, M.L., Keller, C.S., Castro, F.G., Williams, A.N., Patrick,

D.L., Ayers, S., Hu, H.H., Sandoval, M., Pimentel, J., Knowler, W.C., Frick, K. D.,

Shaibi, G.Q. (2017). Preventing Diabetes in obese Latino youth with prediabetes: a study

protocol for a randomized controlled trial. *BMC Public Health,*

http://doi.org/10.1186/s12889-017-4174-2

Soltero, E. G., Olson, M. L., Williams, A. N., Konopken, Y. P., Castro, F. G., Arcoleo, K. J., …

Shaibi, G. Q. (2018). Effects of a Community-Based Diabetes Prevention Program for

Latino Youth with Obesity: A Randomized Controlled Trial. *Obesity (Silver Spring, Md.)*, *26*(12), 1856–1865. doi:10.1002/oby.22300

Stein, G. L., Gonzalez, L. M., Cupito, A. M., Kiang, L., & Supple, A. J. (2015). The Protective

Role of Familism in the Lives of Latino Adolescents. *Journal of Family Issues*, *36*(10), 1255–1273. https://doi.org/10.1177/0192513X13502480

Stockings, E., Degenhardt, L., Lee, L.L., Mihalopoulos, C., Liu, A., Hobbs, M. & Patton, G.

(2015). Symptom screening scales for detecting major depressive disorder in children and adolescents: a systematic review and meta-analysis of reliability, validity, and diagnostic utility. *Journal of Affective Disorders, 174,* 447-463.

Suglia, S. F., Demmer, R. T., Wahi, R., Keyes, K. M., & Koenen, K. C. (2016). Depressive

Symptoms During Adolescence and Young Adulthood and the Development of Type 2 Diabetes Mellitus. *American Journal of Epidemiology*, *183*(4), 269–276. doi:10.1093/aje/kwv149

Sung-Chan, P., Sung, Y. W., Zhao, X. & Brownson, R. C. (2012). Family-based models for

childhood-obesity intervention: a systematic review of randomized controlled trials. *Obesity Reviews, 14,* 265-278. https://doi.org/10.1111/obr.12000

Treviño, R. P., Yin, Z., Hernandez, A., Hale, D. E., Garcia, O. A., & Mobley, C. (2004). Impact

of the Bienestar school-based diabetes mellitus prevention program on fasting capillary glucose levels: a randomized controlled trial. *Archives of pediatrics & adolescent medicine*, *158*(9), 911–917. doi:10.1001/archpedi.158.9.911

Van der Heijden, G.J., Wang, Z.J., Chu, Z.D., Sauer, P.J., Haymond, M.W., Rodriguez, L.M., &

Sunehag, A.L. (2012). A 12-week aerobic exercise program reduces hepatic fat accumulation and insulin resistance in obese, Hispanic adolescents. *Obesity 18*(2), 384–390.

Van Son, J., Nyklicek, I., Pop, V., Blonk, M.C., Erdtsieck, R.J. & Pouwer, F. (2013). Mindfulness-based cognitive therapy for people with diabetes and emotional problems: Long-term follow-up findings from the DiaMind randomized control trial. *Journal of Psychosomatic Research, 77,* 81-84.

Venditti, E. M., Tan, K., Chang, N., Laffel, L., McGinley, G., Miranda, N., … TODAY Study Group (2018). Barriers and strategies for oral medication adherence among children and adolescents with Type 2 diabetes. *Diabetes Research and Clinical Practice*, *139*, 24–31. doi:10.1016/j.diabres.2018.02.001

Viner, R., White, B., & Christie, D. (2017). Type 2 Diabetes in adolescents: a severe phenotype posing major clinical challenges and public health burden. *The Lancet, 10085,* 2252-2260. https://doi.org/10.2337/diaspect.23.4.213

Vivian, E. M. (2010). Strategies and Considerations for Community-Based Participatory Research in the Prevention of Type 2 Diabetes in Youth. *Diabetes Spectrum, 23*(4), 213-215.

Walders-Abramson, N., Nadeau, K. J., Kelsey, M. M., Schmiege, S. J., Ellert, S., Cejka, A., … Zeitler, P. (2013). Psychological functioning in adolescents with obesity co-morbidities. *Childhood Obesity (Print)*, *9*, 319–325. doi:10.1089/chi.2012.0120

Weigensberg MJ, Lane CJ, Avila Q, et al. (2014). Imagine HEALTH: results from a randomized

Pilot lifestyle intervention for obese Latino adolescents using Interactive Guided
ImagerySM. BMC Complement Alternative Medicine,
14:28. https://doi.org/10.1186/1472-6882-14-28.

Whitehead, A. L., Julious, S. A., Cooper, C. L., & Campbell, M. J. (2016). Estimating the sample
size for a pilot randomized trial to minimize the overall trial sample size for the external
pilot and main trial for a continuous outcome variable. Statistical Methods in Medical
Research, 25, 1057-1073.

Williams, A.N., Konopken, Y.P., Keller, C.S., Castro, F.G., Arcoleo, K.J., Barraza, E., Patrick,
D.L., Olson, M.L., Shaibi, G.Q. (2017). Culturally-grounded diabetes prevention program
for obese Latino youth: Rationale, design, and methods. *Contemporary Clinical Trials,
71,* https://doi.org/10.1016/j.cct.2017.01.004

Young, C.C. (2016). Familial factors, cognitive vulnerabilities, and stressful events related to
depressive symptoms in Latino adolescents. *Hispanic Journal of Behavioral Sciences,
38*(3), 360-377.

http://www.doi.org.ezproxy2.library.colostate.edu/10.1177/0739986316644734