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The Joint Impact Of Parent Health Efficacy And Child Temperament On Child Health Outcomes

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The Joint Impact of Parent Health Efficacy And Child Temperament On Child Health Outcomes

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Biography

The author was born in Würzburg, Germany June 9th, 1995. She received her Bachelor of Arts degree in Psychology with a minor in Biology from Ohio University in 2017 and a certificate in Data Science and Visualization from Northwestern University in 2021. Emma is in the process of completing her Master of Science in Psychology from DePaul University. She is currently an analyst at a leading CX Design Engineering Company. She reviews customer satisfaction and other operational metric results to identify trends in performance and produces monthly management reports in a variety of industries. This includes analyzing qualitative and quantitative data to identify performance improvement opportunities using a variety of tools. She will often coordinate with statisticians for development of key driver analysis, statistical linages and calibration between customer satisfaction and other operational metrics. She is skilled in statistics, human analytics, and data visualization. Her passion includes drawing insight from data to create actionable solutions while addressing the human aspect behind the data.

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Abstract

Children and adolescents in the United States have high rates of obesity due to several factors including low rates of physical exercise. Parents greatly impact children's short and long-term health behaviors through multiple mechanisms. The role of parental factors such as health self-efficacy in interaction with child temperament is underexplored. This present study had two primary aims: 1) to examine the main effects of parent health efficacy on child physical activity and body mass index (BMI) percentile; 2) to explore the impact of parent health efficacy as a function of child temperament and the main effects of temperament on children's physical activity and BMI percentile. In the present study, 123 mother and child pairs from the greater Chicago area completed self-report measures regarding physical activity, child BMI percentile, and personality along with tracking child's physical activity with a fitness tracker. A series of regressions were conducted showing that: the interaction term of parental nutritional efficacy and child temperament of effortful control significantly predicted child physical activity ($b = 2.029$, $p < .049$) and the interaction term of parental nutritional efficacy and child temperament of surgency significantly predicted child BMI percentile ($b = 2.095$, $p < .033$). This study was conducted to better understand the impact parents' self-efficacy of their own health behaviors on child's health outcomes. This study also has the potential to identify subgroups of families who may benefit from culturally tailored interventions to improve health outcomes.

Introduction

Obesity affects “1 in 5 children and adolescents in the United States” (U.S. Centers for Disease Control and Prevention, 2019). Obesity is prevalent among 18.4% of 6-to-11-years-olds and 20.6% of 12-to-19-year-olds within the United States (U.S. Centers for Disease Control and Prevention, 2019). While there are multiple contributors to childhood obesity, one of the primary contributors is physical inactivity (U.S. Centers for Disease Control and Prevention, 2021; Gray et al., 2018). According to the United States Department of Health & Human Services, most children in the United States fail to meet recommended guidelines for daily physical activity (2017). This is especially true for Black and Hispanic youth who are less active than White youth and were found to sometimes have a rate of obesity that was 3 - 4.5 times greater than White participants (Basch, 2011; Devlin et al., 2023). Despite much research and policy aimed at decreasing obesity rates, obesity continues to have a consistently high prevalence in society for youth in the United States. Obesity in childhood can cause many lifelong health issues such as decreased lung function, functional impairment, diabetes, and heart disease (Forno et al., 2018; Heo et al., 2012; Nguyen et al., 2011; Wanahita et al., 2008; Gray et al., 2018). Therefore, these developmental stages among school-aged children are important in obesity research as they are when children “obtain the cognitive skills they need to make decisions about health behaviors they will select and pursue” into adulthood (Eo & Kim, 2019).

Primary caretakers impact children's health outcomes (Ice, Neal & Cottrell, 2012) and one important factor is parent’s self-efficacy. Self-efficacy is generally defined as “beliefs in [ones] ability to influence events that affect [ones] lives” (Bandura, 2010). There are many different forms of self-efficacy varying from general self-efficacy to context specific self-efficacy (Heerman et al., 2017). One example is *parenting* self-efficacy which is a parent’s self-

efficacy in their parenting abilities and has shown that it is an important cognitive component in child health behaviors (Heerman et al., 2017). For example, previous research has found that parents who have high self-efficacy in parenting on health behaviors had children who consume more vegetables and are more physically active (Ice et al., 2014; Sagui-Henson et al., 2020). Children learn from parents sometimes indirectly through a process called Imitative Learning (Tomasello, 2016). Imitative learning is when a child not only mimic behaviors of their primary caregiver but mimic the goals of that primary giver (Tomasello, 2016). To gain a better understanding of the different parental characteristics that influence a child's weight and physical activity levels, more research is needed specifically on the influence of parents' self-efficacy of their own health related behaviors on child health behaviors.

Despite the strong influence of parental factors on children, individuals have other independent risk factors for health outcomes regardless of their environment (Belsky & Pluess, 2009). These differences in vulnerability for positive or negative health outcomes may in part be dependent on the child's behavioral and temperamental character (Belsky & Pluess, 2009). Previous research has shown that resulting child health outcomes are partly dependent on infant temperament (Anzman-Frasca et al., 2013). However, temperament's effect on health behavior remains understudied in school-aged children who are at the greatest risk of developing obesity (Huffman et al., 2010). Overall, parenting factors like health self-efficacy and child factors like temperament may have an impact on obesity and physical activity rates. It is important to investigate both parent and child factors impacting BMI and physical activity in diverse youth to identify risk and protective factors and inform future interventions for decreasing obesity among our youth.

Conceptual Frameworks

Two theories were applied to better understand the relationship between parenting self-efficacy, child temperament, and child health outcomes: the Social Cognitive Theory (Bandura, 1986) and The Differential-Susceptibility Theory (Belsky, 1997). Bandura's Social Cognitive Theory (SCT; 1986) explains how behavior occurs through observational learning with emphasis that efficacy is essential to produce a change in behavior (Rosenstock, 1988). SCT highlights the role of parental efficacy in this relationship. With respect to parent-child relationships, the parent may serve as a source of observational learning for the child. SCT has been used to look at self-efficacy roles in health outcomes (Bandura, 1998). According to the DST, individuals show different susceptibility to their environment leading to different behavioral development (Belsky, 1997; Belsky & Pluess, 2009). Belsky's and Pluess' research has found that one's environment can be supportive or unsupportive to development and survival explaining why we have different responses and levels of adversity (2009). This differential susceptibility may be due to different temperamental and emotional characteristics of children (Belsky & Pluess, 2009). In other words, even with parent self-efficacy you may see differences in outcomes based on temperament. Therefore, the vulnerability to negative outcomes is dependent on the child's behavioral and temperamental character (Belsky & Pluess, 2009). The DST has also been utilized to examine different parental effects when moderated by a child's temperament to predict developmental outcomes of the child (Stright et al., 2008; Belsky & Pluess, 2009). For example, Stright and colleagues research found that children with positive emotional and autonomic support by their parents have better academic and social skills (2008). Other research has used temperament to predict certain health behaviors and outcomes. For example, children who scored low for constraint were more likely to practice health-risk behaviors (Caspi et al., 1997).

Additionally, negative emotionality predicted higher levels of different cardiovascular risk factors (Ravaja et al.,2001).

Parent Health Efficacy and Child Health Outcomes

Some research has been conducted that evaluates the impact a variety of parental factors has on child health outcomes, such as physical activity and BMI.

BMI. Previous research suggests that parental self-efficacy of parenting abilities about health-related behaviors may be related to a child's eating behaviors (Sagui-Henson et al., 2020). Sagui-Henson and colleagues (2020) suggest that parents with high self-efficacy in parenting of health-related behaviors have children who consume more fruit and vegetables and less sweets and soda (Sagui-Henson et al., 2020). Similarly, researchers found that parental efficacy along with parental role modeling was significant in predicting a child's vegetable intake (Ice et al., 2012). Parents with lower self-efficacy tend to have children with higher BMIs (Ice et al., 2012). These findings supported the Social Cognitive model in that general parenting self-efficacy is associated with child eating behaviors. More research is needed to evaluate the effects of parental self-efficacy for their own health behaviors and the effects that may have on their child's BMI. Most of these studies also lack addressing how ethnicity, income and intuitive eating may influence the relationship between parental self-efficacy and child BMI.

Physical Activity. Parent physical activity can influence children’s physical activity (Hutchens & Lee, 2017; Ice et al., 2012). This pattern may be most specific for children's moderate and vigorous physical activity as compared to mild physical activity. However, like eating behaviors, most of these studies use general parenting self-efficacy and not a specific measure of their own health self-efficacy (Hutchens et al., 2017). Some researchers have found that parents' self-efficacy does not directly affect children's physical activity behavior (Heerman

et al., 2017), but it is possible that parental health self-efficacy may directly affect the child's health outcomes as a main effect or in conjunction with children's temperament.

Temperament Characteristics and Child Health Outcomes

Temperament is the core of "personality and influence directions for development" (Rothbart & Bates, 2007) and represents the process through which different characteristics create different behavioral responses and styles for every individual (Anzman-Frasca et al., 2013). These different behavioral responses explain why individuals in the same context vary in their risk for developing obesity (Anzman-Frasca et al., 2013). Most studies examine temperament by grouping the different dimensions into broad temperament factors: *negative emotionality, surgency/extraversion, high intensity pleasure, effortful control/self-regulation, and agreeableness/adaptability* (Rothbart & Bates, 2007). In these childhood studies, negative emotionality refers to dimensions of fear, shyness, and frustration/irritability (Rothbart & Bates, 2007). Surgency/extraversion defined as positive anticipation and high activity level (Rothbart & Bates, 2007). High intensity pleasure is defined as having traits high in sociability (Rothbart & Bates, 2007). Effortful control/self-regulation temperament shows traits of inhibitor control, attentional focusing, low intensity pleasure and perceptual sensitivity (Rothbart & Bates, 2007). Lastly, agreeableness/adaptability is defined as traits of manageability and affiliation (Rothbart & Bates, 2007).

There is preliminary evidence that child temperament predicts child BMI with the strongest evidence that negative reactivity increases risk and self-regulation reduces risk (Anzman-Frasca et al., 2012; Martocio et al., 2021). Researchers conducted a study looking at adopted children and found that there are genetic factors that impact BMI but also found that child temperament impacts BMI (Liu et al., 2023). This study found that children with high

temperament scores in negative affectivity had lower BMI scores but also had liable BMI across childhood (Liu et al., 2023). The study suggested that children high in negative affectivity were more likely to fall into a pattern of following emotional cues for eating versus listening to their hunger and satiety cues, this leads to more liable BMI scores over childhood (Liu et al., 2023).

There is more substantial evidence that child temperament is relate to child physical activity. The temperamental characteristic of activity level predicts physical activity in boys, but not girls (Janssen et al., 2017). This effect may be strongest in middle childhood and disappear by late childhood/early adolescence (Song et al., 2017) although there is some evidence that the relationship exists into adulthood, at least for men (Yang et al., 2016).

A meta-analysis by Karvonen and colleagues analyzed the different types of temperament and personality characteristics that could play a role in physical activity levels along with the different types of physical activity (2020). Results found that women who scored high in extraversion and men who scored high in agreeableness were more likely to engage in vigorous physical activity (Karvonen et al., 2020). For women, overall physical activity had a positive relationship with temperament traits of orienting sensitivity and extraversion (Karvonen et al., 2020). For men, overall physical activity had a positive relationship with temperament traits of orientating sensitivity and agreeableness (Karvonen et al., 2020).

Temperament Characteristics as a Moderator of Parent Efficacy on Child Health Outcomes

As suggested by Lipsanen and colleagues (2020), it is important that future research address what factors could be playing a role in the relationship between child's temperament and child's health behaviors (Lipsanen et al., 2020). There is very little research on a child's temperament as a moderator of the relationship between parental cognitive factors and child

health behaviors. According to Differential Susceptibility Theory, the impact of parenting on children's health behavior may vary as a function of children's temperament. For example, research with temperament as the moderator between parenting practices and child health outcomes has found significant and unique relationships (Holley et al., 2020). Holley and colleagues found that children who are considered "food fussy" even when involved in food choice and preparation is significantly moderated by the child's temperament (Holley et al., 2020). However, the relationship between children participating in food preparation and food fussiness was not associated with children who were highly emotional or low in sociability (Holley et al., 2020). These researchers concluded that parental food practices may change based on the child's temperament and that children who are highly sociable are more likely to react positively to parental involvement in food related behavior (Holley et al., 2020; Kaukonen et al., 2019). Previous research has also examined different temperaments of children and eating behaviors finding that for every unit increase in child surgency, there was a 37% increase in daily vegetable consumption (Kaukonen et al., 2019). Kaukonen and colleagues (2019) results suggest that children who have a temperament where they are more inclined to react to social influences with parents who have positive practices result in higher intake of vegetables (Kaukonen et al., 2019). Overall, there is a link between many parental factors and child outcomes. However, temperaments' role in health-related research is still not very well understood suggesting the need for more research in how temperament can affect health outcomes of children.

Purpose of Study and Hypothesis

As previously discussed, children learn through observation and have different susceptibility to their environment and behavioral development (Bandura, 1986; Rosenstock,

1988; Belsky, 1997). Observational learning has been observed in food consumption, such as parents' health related self-efficacy significantly impacting vegetable intake (Ice et al., 2012). Parenting self-efficacy could also vary as a function of child temperament as child temperament could significantly impact feeding practices (Holley et al., 2020; Kaukonen et al., 2019). Observational learning and physical activity have conflicting evidence on the effects parents' self-efficacy on child health outcomes (Hutchens & Lee, 2017; Ice et al., 2012; Heerman et al., 2017). However, there is a relationship between temperament and physical activity in adult studies (Karvonen et al., 2020). Therefore, previous research has gaps regarding how ethnicity and income may influence the relationship between parental self-efficacy and child BMI. There is also many gaps in the role child temperament may play in the relationship between parent self-efficacy and child health outcomes.

Using Social Cognitive Theory and Differential Susceptibility Theory, this proposal aims to examine the joint impact of parental health self-efficacy and children's temperament on child's BMI percentile and physical activity in an ethnically diverse sample of urban youth. It is particularly important to examine predictors of health outcomes in this population as ethnic minority youth are at the greatest risk for obesity, poor diet quality, and low physical activity (Byrd et al., 2018).

Research Question 1: What are the main effects of parent health efficacy on children's physical activity?

Research Question 2: What are the main effects of parent health efficacy on children's BMI percentile?

Research Question 3: Which dimensions of temperament are most closely related to physical activity and BMI percentile?

Research Question 4: Does the impact of parent health efficacy on children's BMI percentile vary as a function of child temperament?

Hypothesis 1: The impact of parental health efficacy on BMI percentile will be moderated by child positive emotionality (and no other temperament variables).

Research Question 5: Does the impact of parent health efficacy on children's physical activity vary as a function of child temperament?

Hypothesis 2: The impact of parental health efficacy on children's physical activity will be moderated by child positive emotionality (and no other temperament variables).

Methods

Data

This study will use the existing and available dataset collected by Drs. Jocelyn Carter and Cynthia Putnam (2013) from DePaul University and Dr. Kristen Schneider (2013) from Rosalind Franklin University. The overall purpose of the original study was to investigate the impact active video games have in children regarding their overall physical activity and personality trains. Participants were recruited through different community centers in the area such as YMCAs and neighborhood Boys and Girls Clubs. Parents were handed flyers at those sites and would contact the lab to schedule appointments to come to DePaul University or Rosalind Franklin University for their study appointment. The study required access to participate in physical activity which included access to active video games and the ability for the child to wear a fitness tracker for two weeks. In accordance with IRB requirements, all participants received information on the study procedure [and were provided informed consent and assent] prior to participating. Following the completion of all tasks, participants were debriefed and compensated accordingly.

Research Participants

In total, 123 mother and child pairs were recruited from the greater Chicago area. The participants included mothers and their children who were between the ages of 7 to 15. On average, 52% of children were between the ages of 7 to 12 and 47% were teens between the ages of 13 and 15. Regarding sex, 35.6% of the sample were female and 64.4% of the sample were male. The sample was ethnically diverse: 31% of the sample identified as African American, 40% identified as White, 2% identified as Asian/Pacific Islander, 15.6% identified as Hispanic/Latino and 11% identified as multi-ethnic and 1% identified as other. Regarding income, 27.18% reported < $30,000, 26.21 % reported $30 - $55,000, 17.47% reported $55 – 75,000, and 29.12% reported over $75,000.

Materials

Income: The average estimated household annual income was reported by parents. Income options were given in multiple choice format that were ranges that started from $0-15,000 dollars, increasing by $5,000 until hitting $75,000 dollars. Once at $75,000 dollars, the option was "Over $75,000". For this current study, the multiple-choice selection by parents were given a value of 1-14. 1 being the lowest income option and 14 being the highest income option.

Race/Ethnicity: The child's ethnicity was reported by parents. There were 6 multiple choice options given: African American, Asian/Pacific Islander, Caucasian (non-Hispanic White), Hispanic/Latino, Multi-ethnic, and other. For this study, the ethnicity variables were dummy coded for analyses.

Parents Health Efficacy: Parent's health efficacy was measured by the Self Rated Abilities Health Practices scale (Becker, Stuifbergen, Oh, & Hall, 1993). This measure was developed to assess parental beliefs about exercise and nutrition and their self- perceived ability

to implement health-promoting programs (Becker, Stuifbergen, Oh, & Hall, 1993). This 28-item self-report measures four different types of health efficacy. These four subscales included: Nutrition, Psychological Well Being, Exercise, and Responsible Health Practices. Participants rated each statement 1 through 5 as *1= Not at all*, *2= A little*, *3= Somewhat*, *4 = Mostly and 5 = Completely*. The higher the number for each subscale represented the stronger the participant felt about that health efficacy attitude. For this current study, only Nutrition and Exercise self-efficacy were used. Some sample items to measure Nutrition include "I am able to find healthy foods that are within my budget" and "I am able to eat a balanced diet". Some sample items to measure Exercise include "I am able to fit exercise into my regular routine" and "I am able to find ways to exercise that I enjoy". Becker and colleagues reported the measure to be reliable and consistent with a Cronbach alpha of .94 for the total scale and reported reliable alphas for each subscale (nutrition $\alpha = .81$; exercise $\alpha = .92$; Becker et al., 1993). Previous research of this measure also confirmed Becker's and colleagues (1993) results as showing the scale to have good reliability and validity for all 4 subscales (e.g., Callaghan, 2003).

Child Temperament: The EATQ-R short self-report measure on the child's survey was used to measure the child's temperament (Elise & Rothbart, 2001). In total, there were 12 subscales of temperament measured in this scale. The measure includes a total of 65 questions. The youth participants rated each statement 1 through 5 as *1= Almost always untrue*, *2= Usually untrue*, *3= Sometimes true, sometimes untrue*, *4 = Usually true* and *5 = Almost always true*. These questions create 10 subscales which are: Activation Control, Affiliation, Attention, Fear, Frustration, High-Intensity pleasure/Surgency, Inhibitory Control, Pleasure Sensitivity, Perceptual Sensitivity, and shyness along with two behavioral measures which are Depressive mood, and Aggression. These subscales are found to be good and reliable (Activation control $\alpha =$

.76; Affiliation α = .75; Attention α = .67; Fear α = .65, Frustration α = .70, High Intensity Pleasure α = .71, Inhibitory control α = .69, Perceptual Sensitivity α = .71, Pleasure Sensitivity α = .78, Shyness α = .82, Aggression α = .80, and Depressive Mood α = .69; Ellis & Rothbart, 2001). The current study used all 12 temperament subscales. These subscales of temperament were combined further to more broader constructs of Temperament such as *Negative Emotionality, Effortful Control, Positive Emotionality, and Surgency* (Ellis & Rothbard, 2001; Snyder et al., 2015). Effortful Control consisted of attention, inhibitory control, and activation control (Snyder et al., 2015). Negative emotionality consisted of aggression, depressed mood, fear, frustration, and shyness (Snyder et al., 2015). Positive Emotionality consisted of affiliation, pleasure sensitivity, and perceptual sensitivity (Snyder et al., 2015). Snyder and colleagues found the surgency items did not fit the positive emotionality factor adequately and suggested that the surgency subscale be used on its own (2015). Therefore, in this study, surgency was used as its own construct.

Child BMI Percentile: Researchers recorded child's height and weight in the lab. The height was recorded in inches and weight in pounds. The height and weight were calculated to create a BMI score. BMI scores were then transformed into BMI percentiles. As suggested by some researchers, "BMI z scores are known to be inaccurate at values greater than the 97th percentile" (Freedman & Berenson, 2017). Researchers state that in children's studies, when there are a wide range of BMIs, best practice would be to use the BMI percentile as the correlations are similar in the middle of the distribution but vary significantly at the tail ends of distributions (Freedman & Berenson, 2017). In this study, the BMI percentile is used.

Child Physical Activity: Child physical activity behavior is defined by the step count data collected using an activity monitor, The New Lifestyles-2000i, daily for 7 days. If there

were days with <100 steps, these days were coded as missing. If participants had at least 3 days of valid data, then the average number of steps per day was calculated. Along with wearing the tracker, participants were asked to record their daily average step count in a logbook in case the activity monitor data was no longer available when the activity monitor what returned to the research team.

Procedure

Data collection for the present study was collected during 2013. The Institutional Review Boards of DePaul University and Rosalind Franklin University and Medical School approved the larger study that the data from this present study comes from. Both mother and child would arrive to their initial study appointment at the University of their choice. Both mother and child completed separate self-report measures. Researchers would then record both child's height and weight in the lab. The child would then be fitted for the fitness tracker and instructed to wear the tracker for 2 full weeks. Participants returned the fitness tracker after the two weeks at their debriefing appointment.

Results

Descriptive Statistics

Means and standard deviations were collected for Age, Income, Child BMI percentile, and Child Physical Activity and these are presented in Table 1.1. The total number of individuals were collected for Sex and Ethnicity and are presented in Table 1.2.

Table 1.1
Descriptive statistics and correlations for parental health efficacy and child health outcomes

Variable	M	SD
1. Income	8.76	4.85
2. Age	12.00	1.83

3. Child BMI percentile	75.88	25.90
4. Child Step Count	7300.99	3280.50
5. Parental Nutritional Efficacy	22.59	4.51
6. Parental Exercise Efficacy	19.39	6.39

Note. M indicates the mean. SD indicates the Standard Deviation.
** p < .001.

Table 1.2
Descriptive Statistics for gender and ethnicity

Measure	N	%
Gender		
1. Female	32	36%
2. Male	58	64%
Ethnicity		
3. African American	28	31%
4. Asian, Pacific Islander	2	2%
5. Caucasian	36	40%
6. Hispanic/Latino	14	16%
7. Multi-ethnic	10	11%

Correlations

The present study found significant correlations between income and parental nutritional efficacy, $r = .433$, $p < 0.01$, as well as income and parental exercise efficacy, $r = .293$, $p < 0.05$. These correlations suggest that higher income is associated with higher parental exercise efficacy. Another significant correlation found was between parental nutritional efficacy and parental exercise efficacy, $r = .731$, $p < 0.01$. This correlation suggests that parents who feel they have strong health efficacy, such as feeling adequate in finding healthy food options within their budget, also feel confident in their physical efficacy, such as finding time exercise regularly.

Table 2.1
Descriptive statistics and correlations for parental health efficacy and child health outcomes

Variable	1	2	3	4	5

1. Income	-				
2. Age	0.370 **	-			
3. Child BMI percentile	-0.026	0.009	-		
4. Child Step Count	-0.004	-0.094	-0.131	-	
5. Parental Nutritional Efficacy	0.433**	0.119	-0.108	0.055	-
6. Parental Exercise Efficacy	0.293**	0.027	0.006	0.043	0.731**
7. Negative Emotionality	-0.140	-0.258*	0.185	-0.087	-0.256*
8. Effortful Control	0.291**	0.240*	-0.131	0.141	0.206
9. Positive Emotionality	0.142	0.106	-0.285**	-0.031	0.140
10. Surgency	-0.114	-0.026	-0.291**	0.195	0.178

** $p < 0.01$.
* $p < 0.05$.

Table 2.1 Continued

Variable	6	7	8	9	10
1. Income					
2. Age					
3. Child BMI percentile					
4. Child Step Count					
5. Parental Nutritional Efficacy					
6. Parental Exercise Efficacy	-				
7. Negative Emotionality	-0.248*	-			
8. Effortful Control	0.100	-0.432**	-		
9. Positive Emotionality	0.048	-0.056	0.407**	-	
10. Surgency	0.223*	-0.276*	0.071	0.269*	-

** $p < 0.01$.
* $p < 0.05$.

ANOVA

One-way ANOVA was performed to compare ethnic differences in parental nutritional efficacy and parental exercise efficacy. A one-way ANOVA revealed a statistically significant difference in parental nutritional efficacy and at least two ethnicity groups $F(4, 85) = 5.57$, $p < .001$. Tukey's HSD Test for multiple comparisons found that the mean value of parental nutritional efficacy was significantly different between Black participants ($M = 20.11$) and White participants ($M = 24.42$) *95% C.I.* = [-7.19, -1.43], $p < .01$ and between Black participants ($M = 20.11$) and multi-ethnic participants ($M = 24.90$) *95% C.I.* = [.58, 9.01], $p < .018$. In

general, Black participants had lower nutritional efficacy than White and multi-racial participants (F (4,85) = 5.576, p = <.001). There were no statistically significant differences in mean parental exercise efficacy based on ethnicity (F (4,85) = 1.078, p < .373).

Another one-way ANOVA was performed to compare gender differences in parental nutritional efficacy and parental exercise efficacy. There were no statistically significant differences between parental nutritional efficacy and gender (F (1, 88) = .350, p < .556) or parental exercise efficacy and gender (F (1, 88) = .543, p < .463) indicating that parents of boys and girls had similar levels of efficacy.

Lastly, another one-way ANOVA was performed to compare differences in child BMI percentile and child step count across racial/ethnic groups. The analysis revealed a statistically significant difference in child BMI percentile, F (4, 85) = 2.525, p < .047. Tukey's HSD Test for multiple comparisons found that the mean value of child BMI percentile was significantly different between Asian participants (M = 27.50) and Hispanic participants (M = 83.07) 95*% C.I.* = [-108.36, -2.76], p < .034 indicating that Hispanic participants had higher BMI percentile. There were no statistically significant differences in mean child BMI percentile and gender (F (4, 85) = .035, p < .852), child step count and ethnicity (F (4, 85) = .671, p < .651), or child step count and gender (F (4, 85) = .076, p < .783).

Parental Factors as Predictors

Predicting BMI percentile. A forward stepwise regression was used to test if parental nutritional efficacy significantly predicted child's BMI percentile controlling for income and ethnicity. The overall regression model was not statistically significant (R^2= .111, F (6,83) = 1.735, p < .123).

A forward stepwise regression was used to test if parental exercise efficacy significantly predicted child's percentile controlling for income and ethnicity. The overall regression model was not statistically significant (R^2= .110, F (6,83) = 1.707, p < .130).

Predicting Step Count. A forward stepwise regression was used to test if parental nutritional efficacy significantly predicted child's average step count controlling for income and ethnicity. The overall regression model was not statistically significant (R^2= .044, F (6,83) = .640, p < .698) .

A forward stepwise regression was used to test if parental exercise efficacy significantly predicted child's average step count controlling for income and ethnicity. The overall regression model was not statistically significant (R^2= .040, F (6,83) = .576, p < .749).

Temperament as a Predictor

Predicting BMI. A forward stepwise regression was used to test if our predictors (income and ethnicity) and child temperament (negative emotionality, effortful control, positive emotionality, and surgency) significantly predicted child's BMI percentile. The overall regression model was statistically significant (R^2 = .188, F (9,80) = 2.063, p < .043), however none of the temperament terms were significant therefore no further interpretation was conducted.

A forward stepwise regression was used to test if negative emotionality significantly predicted child's BMI percentile controlling for income and ethnicity. The overall regression model was not statistically significant (R^2 = .124, F (6, 83) = 1.955, p < .082).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and effortful control significantly predicted child's BMI percentile. The overall regression model was not statistically significant (R^2 = .108, F (6, 83) = 1.671, p < .138).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and positive emotionality significantly predicted child's BMI percentile . The overall regression model was statistically significant (R^2 = .143, F (6, 83) = 2.306, p < .042), however, the temperament term itself was not significant (b = -0.204, p = .066).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and surgency significantly predicted child's BMI percentile. Surgency significantly predicted average child's BMI (R^2 = .156, F (6, 83) = 2.506, p < .025). With a one unit increase in child surgency, child's BMI percentile decreased by -0.234 units (b = -0.234, p = .031).

Predicting Step Count. A forward stepwise regression was used to test if our predictors (income and ethnicity) and child temperament (negative emotionality, effortful control, positive emotionality, and surgency) significantly predicted child's average daily steps. The overall regression model was not statistically significant (R^2 = .101, F (9, 80) = .994, p < .452).

A forward stepwise regression was used to test if negative emotionality significantly predicted child's average step count. The overall regression model was not statistically significant (R^2 = .045, F (6, 83) = .659, p < .683).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and effortful control significantly predicted child's average step count. The overall regression model was not statistically significant (R^2 = 0.056, F (6, 83) = 0.824, p < .554).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and positive emotionality significantly predicted child's average step count. The overall regression model was not statistically significant (R^2 = .040, F (6, 83) = .575, p < .749).

A forward stepwise regression was used to test if our predictors (income and ethnicity) and surgency significantly predicted child's average step count. The overall regression model was not statistically significant (R^2 = .069, F (6, 83) = 1.018, p < .419).

Temperament x Parenting Interactions Predicting Step Count

To test predictions on if parental health efficacy impacts child's step count and varies as a function of child temperament, hierarchical regressions were conducted with three blocks of variables. The first block included the control variables income and ethnicity. Block two included child temperament and parental efficacy as predictor variables. Lastly, block three included the interaction of child temperament and parental efficacy. Child step count was entered as the dependent variable.

The interaction between parental nutritional efficacy and child negative emotionality was not significant in predicting child step count (R^2 = .064, F (8, 81) = .698, p < .692).

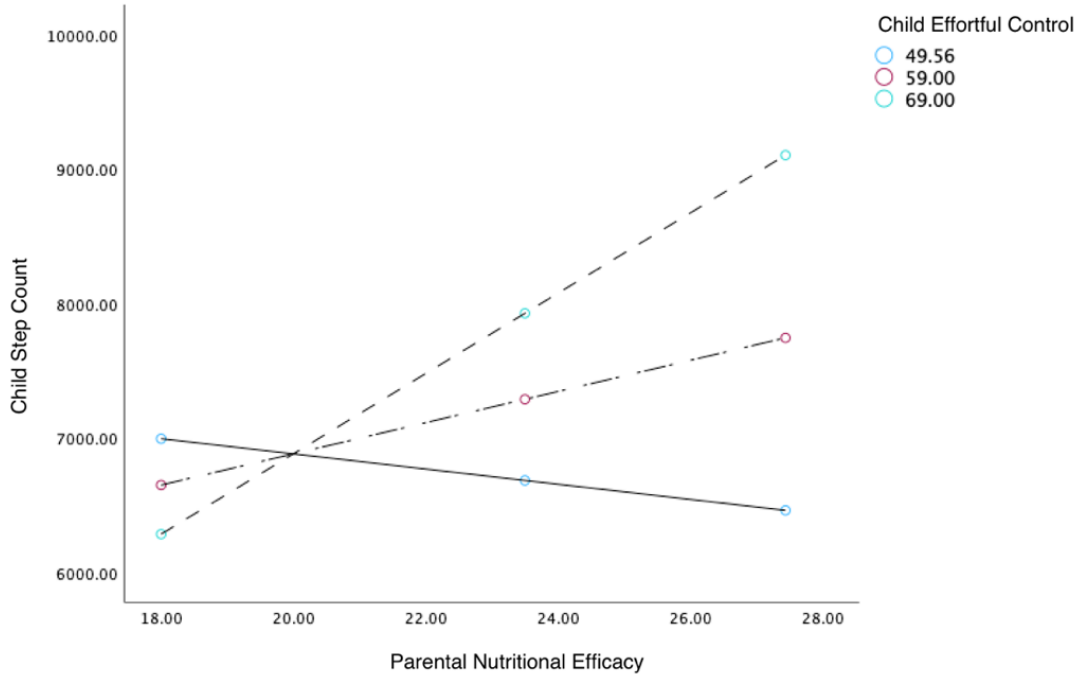
The interaction between parental nutritional efficacy and child effortful control was not significant in predicting child step count (R^2 = .105, F (8, 81) = 1.186, p < .318).

The interaction term of parental nutritional efficacy and child effortful control was significant (b = 2.029, p < .049) and while holding ethnicity and income at a constant, there was a one unit increase in the interaction of parental nutritional efficacy and child effortful control, child step count increases by 2.029 units (see Figure 1).

The interaction between parental nutritional efficacy and child positive emotionality was not significant in predicting child step count (R^2= .088, F(8, 81) = .971, p < .464) and no further interpretation was conducted. The interaction between parental nutritional efficacy and child surgency was not significant in predicting child step count (R^2= .071, F(8, 81) = .768, p < .631).

Figure 1

Parental Nutritional Efficacy X Child Effortful Control and Child Physical Activity



Note. Interaction term of parental nutritional efficacy and child temperament of effortful control impact on child physical activity.The interaction between parental exercise efficacy and child negative emotionality was not significant in predicting child step count (R^2 = .077, F (8, 81) = .841, p < .570). The interaction between parental exercise efficacy and child effortful control was not significant in predicting child step count (R^2 = .061, F (8, 81) = .657, p < .728). The interaction between parental exercise efficacy and child positive emotionality was not significant in predicting child step count (R^2 = .071, F (8, 81) = .770, p < .630). The interaction between parental exercise efficacy and child surgency was not significant in predicting child step count (R^2 = .090, F (8, 81) = 1.005, p < .439).

Temperament x Parenting Interactions Predicting BMI

To test predictions on if parental health efficacy impacts child's BMI percentile and varies as a function of child temperament, hierarchical regressions were conducted with three blocks of variables. The first block included the control variables income and ethnicity. Block

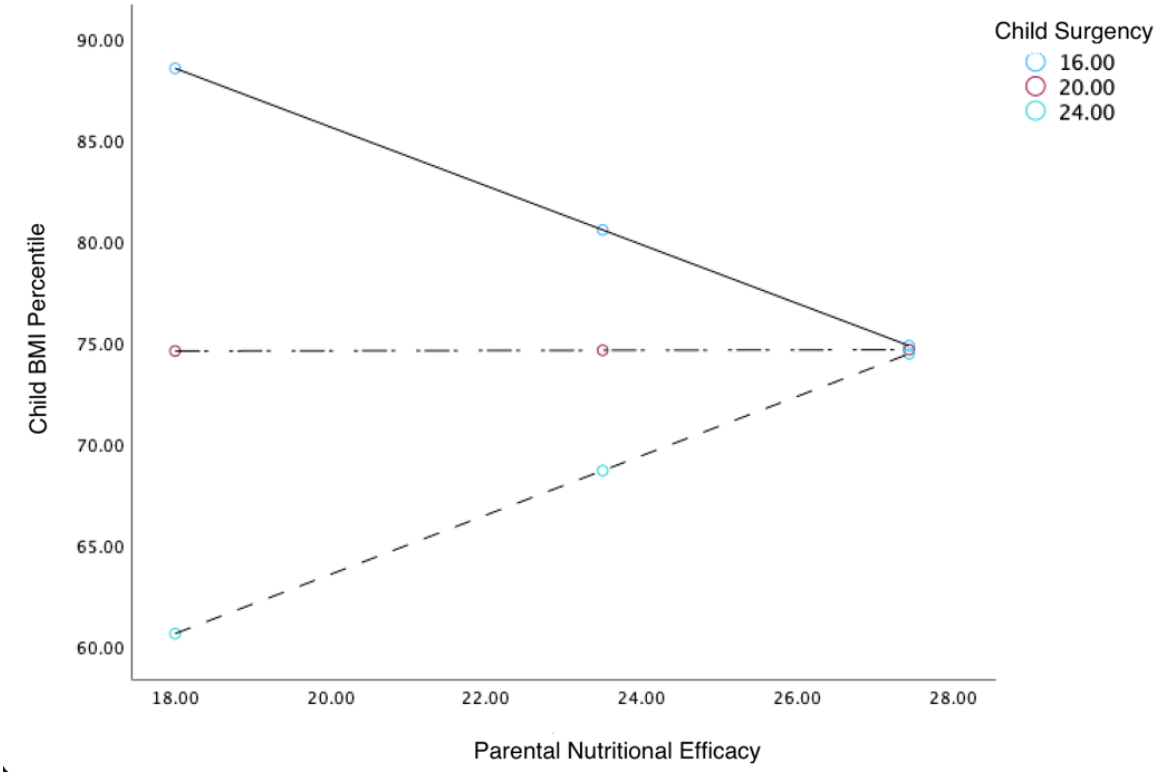
two included child temperament and parental efficacy as predictor variables. Lastly, block three included the interaction of child temperament and parental efficacy. Child BMI percentile was entered as the dependent variable.

The interaction between parental nutritional efficacy and child negative emotionality was not significant in predicting child BMI percentile ($R^2 = .144$, $F(8, 81) = 1.701$, $p < .111$). The interaction between parental nutritional efficacy and child effortful control was not significant in predicting child BMI percentile ($R^2 = .113$, $F(8, 81) = 1.295$, $p < .258$). The interaction between parental nutritional efficacy and child positive emotionality was not significant in predicting child BMI percentile ($R^2 = .154$, $F(8, 81) = 1.849$, $p < .080$.

The overall model that included parental nutritional efficacy, child temperament of surgency and the interaction between parental nutritional efficacy and child surgency was significant in predicting child BMI percentile ($R^2 = .202$, $F(8, 81) = 2.69$, $p < .015$). The interaction term of parental nutritional efficacy and child temperament of surgency was also significant ($b = 2.095$, $p < .033$). When the interaction between parental nutritional efficacy and child temperament of surgency increases, then BMI percentile will also increase by 2.095 units, with ethnicity and income held at a constant (see Figure 2). In other words, youth whose parents had lowest levels of nutritional efficacy and who had the lowest surgency had the highest BMI percentile. At high levels of child surgency, parent nutritional efficacy did not impact child BMI percentile.

Figure 2

Parental Nutritional Efficacy X Child Surgency and Child BMI percentile



Note. Interaction term of parental nutritional efficacy and child temperament of surgency impact on child BMI percentile.

The interaction between parental exercise efficacy and child negative emotionality was not significant in predicting child BMI (R^2= .131, $F(8, 81) = 1.528$, $p < .160$). The interaction between parental exercise efficacy and child effortful control was not significant in predicting child BMI (R^2= .127, $F(8, 81) = 1.480$, $p < .178$). The overall model including the interaction between parental exercise efficacy and child positive emotionality was significant in predicting child BMI percentile (R^2= .175, $F(8, 81) = 2.148$, $p < .04$), but, the interaction term itself was not significant in predicting child BMI percentile.

Discussion

The current study aimed to examine the associations of parental nutritional and physical efficacy and child temperament on the impact of child health outcomes, such as step count and

BMI percentile. This study explored 5 research questions and 2 hypothesis on the impact of parental healthy efficacy as moderated by child positive emotionality on child health outcomes. Researchers did not find that the 2 hypothesis regarding positive emotionality predicting child's BMI percentile or physical activity were supported. Originally, researchers believed that positive emotionality would correlate with child health outcomes as previous research suggests in preschoolers with low positive emotionality are more likely to be inflexible and rigid which impacts their ability to engage with their environment later in life (Ghassabian et al, 2014). Therefore, researchers hypothesized children low in positive emotionality would not engage in as much physical activity and children high in positive emotionality would have higher BMI percentile as they are high in pleasure sensitivity and therefore would eat less nutritious food or overeat. However, these hypothesis were not supported. This study was conducted on school-aged children and therefore, more research is needed to investigate temperaments roles in child development in school aged children. While neither hypothesis were supported, there were several interesting correlations between income and parental health efficacy variables as well as ethnic differences in parental health efficacy variables and child BMI percentile. The current study found that income had significant positive correlations with parental nutritional health efficacy and parental exercise efficacy. Ethnic differences were also observed in this study. For example, Black participants had parents with lower nutritional efficacy compared to White and Multi-ethnic participants. Asian participants were found to have lower child BMI percentile than Hispanic/Latino participants. Surgency was the only temperament characteristic associated with BMI percentile. In addition to surgency interacting with parent nutritional efficacy to predict BMI percentile, effortful control interacted with parent nutritional efficacy to predict physical activity in the form of step count.

Income and Health

Previous research has consistently found that income disparities significantly impact the ability of families to buy more nutritious food (Darmon & Drewnowski, 2015). Those with higher income often found food price not as important compared to those with lower income (Bowman, 2006). Our study found that parents with higher income scored higher in parental nutritional efficacy, and this may be because when there are less economic barriers perceived by parents, this allows parents to feel they can provide more nutritious food options for their children.

The role of income and exercise has been researched and many studies suggest that as income increases frequency and intensity of exercise increases (Maruyama& Yin, 2012; Meltzer, 2010). In one study, researchers struggled to support a causal association between exercise and cost, but they found an association between higher income and spending more money on high intensity exercise opportunities (Meltzer, 2010). Another study suggested that incomes impact on exercise may be more about the perceived barriers (Cowan, Nash, & Anderson-Erisman, 2012). Therefore, while cost is often seen as a barrier for lower income families it is not causal and inventions should target barriers "that are both highly prevalent and impactful or that have a low prevalence but a strong impact when they are perceived" (Cowan, Nash, & Anderson-Erisman, 2012). Our current study found a relationship between high income and high scores of parental exercise efficacy but found no relationship between parental exercise efficacy and child health outcomes. This may be because those with higher income are able to spend more on exercise and do not perceive any economic barriers that would prevent them from providing exercise opportunities to themselves or their children. Therefore, there may be different perceived barriers that impact individuals exercise outcomes other than cost.

Racial/Ethnic Differences in Health

In the current study, Black participants were more likely to have low parental nutritional efficacy compared to White and Multi-ethnic participants. Many researchers have found relationships between nutritional efficacy/outcomes and ethnicity with impacts from social economic status, time barriers, physiological, culture, and racism (Darmon & Drewnowski, 2015; Capri et al., 2008; Lupien et al., 2000; Yancey & Kumanyika, 2007). Racism is a social construct that by consequence, causes many health outcomes (Gravlee, 2009). For example, studies have found that the strongest predictor of blood pressure was not those who were genetically identified of African ancestry but the "cultural construction" of race (Singer et al., 2016; Gravlee, 2009). Therefore, while our study is unable to make a causal relationship, based on our findings and previous research we can infer that Black participants are more likely to endure structural and culturally constructed racism. This can be perceived as a significant barrier that results in lower scores of parental nutritional efficacy for Black participants compared to White and Multi-ethnic participants. Interestingly, one scoping review was interested in the types of family-based interventions aimed at preventing obesity in preschoolers from racial/ethnic minority groups (Wang et al, 2022). These researchers found that while there is a rising interest in studies addressing racial/ethnic health disparities, there is a significant gap in literature for culturally tailored interventions/programs for Black/African American children (Wang et al., 2022). Studies that were tailored to Black/African American participants were often found for adult populations (Kong et al., 2014; Wang et al., 2022). Researchers found that studies with tailored interventions for Black/African American adult women had significant changes in both diet and weight loss outcomes (Kong et al., 2014). Therefore, there is a

significant gap in research interventions for Black/African American school aged children and parents when it comes to addressing different health disparities.

Previous researchers have found culture to be a significant predictor of child BMI (Capri et al., 2008). One study found that individuals from collectivist cultures versus individualistic cultures had different motivational cues on when to eat (Orji & Mandryk, 2014) which could be one explanation for differences in child BMI. Studies also investigated generational trends and diet (Allen et al., 2007). These researchers found that Asian Americans were more likely to maintain or have positive generational nutritional trends, such as, higher serving of vegetable intake, similar fruit consumption and increased milk consumption, when compared to White Americans (Allen et al., 2007). Latino Americans in this study had worsening generational nutritional trends compared to White Americans, such as, decreasing in vegetable, fruit and milk consumption and increasing in soda consumption (Allen et al., 2007). Our findings suggested that Asian participants were found to have lower child BMI percentile than Hispanic/Latino participants. However, many interventions targeting the reduction of BMI/BMI percentile in diverse samples neglect the very positive role food plays in affirming and celebrating culture (Iwelinmor et al., 2014). There are still many gaps in research on the impact of culture and race and its impact on diet or other health outcomes. As previously mentioned, the "cultural construction" of race can have significant impact on health outcomes, (Singer et al., 2016; Gravlee, 2009). Previous research also saw gaps in culturally tailored components for both Asian and Hispanic populations (Wang et al., 2022). Many of the studies reviewed frequently addressed language barriers, food choices, relationships among family members and rapport building but this review found that none of the studies included all 4 (Wang et al., 2022). While this current study found Asian participants to have lower BMI percentile compared to Latino

participants, further research is needed to determine the impact culture and racism have on child BMI percentile. In addition, consistent with a "quantcrit" (Castillo & Gillhorn, 2023) perspective on quantitative research, future studies should include measurement of nationalities and cultural variation within these racial/ethnic groups to gain a more nuanced perspective on how these general patterns apply to member subgroups.

Previous research often looks at parental efficacy as one variable and in terms of overall parenting efficacy (Heerman et al., 2017). The current study was more interested in the specific aspects of parental efficacy and their impact on child health outcomes on school aged children. The current study did not find any effects between parental nutritional or exercise efficacy on child health outcomes but was able to identify, as mentioned earlier, demographic variables that influenced both parental nutritional efficacy and parental exercise efficacy.

Temperament and BMI

This study's findings do not align with current research that suggests surgency and BMI to have a positive relationship with each other (Leung et al., 2014). Instead, this study found that children high in surgency have lower BMI percentile. One study found that children high in surgency was associated with higher daily energy intake which led to increased daily activity (Pajulahti et al., 2023). However, research has also shown that parental feeding practices and parental eating behaviors interact together to influence child eating behaviors (Stone et al., 2022; Larsen et al., 2015). Some researchers have found that with the moderating effects of child temperament, different parental factors can impact child's BMI (Stone et al., 2022; Larsen et al., 2015). Research has suggested parental feeding practices play a role in the development of intuitive eating during childhood and intuitive eating has a strong inverse relationship with BMI along with a strong positive relationships with a variety of other psychological health outcomes

(Tylka et al., 2015; Dyke & Drinkwater, 2014). Evidence further suggests that for infants and preschoolers, a child's temperament impacts parental feeding practices (Bergmeier et al., 2014). Children with more of these externalizing temperaments are more likely to be fed obesogenic food and drinks (Bergmeier et al., 2014) Therefore, the inconsistency in the interactions found in this study could be methodological as participants in this study were recruited outside of community health centers. This could indicate a sample of children with a higher need for daily energy intake leading to exerting higher levels of energy further suggesting that school aged children high in surgency have lower BMI percentile because while they intake more food therefore exerting more energy and keeping a lower BMI percentile. However, parents with lower nutritional efficacy and children with externalizing temperaments, such as high surgency, may have parents question their ability to implement effective parental feeding practices leading to feeding children to cope with externalizing behavior and not because they require more food because they are exerting more energy.

Most of the research on the relationship between temperament and BMI/BMI percentile has been studied in infants and pre-school aged children whereas this current study is in school aged children (Anzman-Frasca et al., 2013). Further research should continue to investigate temperamental characteristics and child health outcomes. This current study did not find any significant relationships between child effortful control and step count, but the interaction of parental nutritional efficacy and child effortful control significantly predicted higher child step count. Some researchers suggest that parents influence a child's ability to regulate their emotions and that children with low emotional regulation are more likely to partake in emotional eating, sedentary lifestyle, and low physical activity levels (Aparicio et al., 2016). This research may

explain our finding that children with highest activity levels have strong self-regulation and parents with higher nutritional efficacy.

Overall, this study found that the child temperaments of surgency and effortful control impact step count and BMI percentile, respectively, and both interact with parental nutritional efficacy. In this study we did not find a significant relationship between step count and BMI percentile, but previous researchers have found relationships between child temperament, physical activity, and BMI (Pajulahti et al., 2023). While there are still many gaps in research, evidence so far suggests that parenting style for the different aspects of health can be significantly impacted by the child's temperament (Aparicio et al., 2016; Bergmeier et al., 2014). This may be why we see both metrics having significant interactions with parental nutritional efficacy.

Limitations and Future Directions

There were several limitations with this study. First, this study was cross sectional which gave us information about the direction of effects but is not causal . There would be great benefit if future researchers were able to conduct longitudinal studies to examine the differential impact parental health efficacy has on children's health outcomes. Previous research suggests that there are developmental variations in the way in which these impacts occur (e.g., Cleland et al., 2011) and they should be studied in diverse youth. Another limitation in this study is the small sample size which may have been underpowered for a moderation analyses (Sheih, 2009). This study used BMI percentile as a measure of weight status, but it would have been both informative and helpful to add additional metrics to paint a full picture of physical health given the limitations with BMI/ BMI percentile in pediatric populations (Freedman & Sherry, 2009). Future researchers should include other metrics in addition to BMI/BMI percentile to measure health

outcomes. Finally, having only English-speaking participants limit the study by potentially creating a sample bias that is not reflective of the full population of interest. Future researchers should include participants with different language and cultural backgrounds as these can impact choices in food and views on exercise. In addition, a measure of nutrition or dietary quality would also be helpful to include given the associations between diet, temperament, and BMI (Bergmeier et al., 2014).

Overall, further research is needed on feeding practices of parents with high nutritional efficacy and child temperament in relation to child health outcomes. Future researchers should investigate the development of intuitive eating in childhood, parental feeding practices and parental health efficacy across different temperaments. This current study is also surprisingly one of the only studies to look at the relationship of parental health efficacy and temperament on childhood health outcomes in school aged children, further suggesting the need for continued research on health outcomes in diverse samples of school aged children.

Summary

In sum, while our 2 hypothesis were not supported, several of the current study's research questions showed interesting relationships such as, income and race were related to parent health efficacy and the temperament characteristic of surgency was related to lower BMI percentile. In addition, surgency and effortful control both interacted with parent nutrition efficacy to predict step count and BMI percentile, respectively. These results demonstrate the importance of social, familial, and individual characteristics in influencing child health outcomes (Harrison et al., 2011).

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