Is Family Sense of Coherence a Protective Factor against the Obesogenic Environment?**Abstract**

Despite greater risk for poor nutrition, inactivity, and overweight, some low-income children are able to maintain a healthy weight. We explore if a strong family sense of coherence (FSOC) acts as a protective factor against childhood obesity for low-income preschool children. Families with a strong FSOC view challenges as predictable, understandable, worthy of engaging and surmountable. Data were collected from 321 low-income mothers and their preschool children in five states between March 2011 and May 2013. FSOC was assessed using the FSOC Scale. A 16-item checklist was used to assess practicing healthy child behaviors (fruit and vegetable consumption and availability, physical activity, and family meals) and limiting unhealthy child behaviors (sweetened beverage and fast food consumption, energy dense snack availability, and screen time). Child body mass index (BMI) z-scores were calculated from measured height and weight. FSOC was significantly associated with practicing healthy child behaviors ($\beta = 0.32$, $p < .001$). We did not find a statistically significant association between FSOC and limiting unhealthy child behaviors or child BMI z-scores in fully adjusted models. Our results suggest the importance of family functioning in predicting health behaviors around food consumption and availability, physical activity, and family meals.

Keywords: childhood obesity; family sense of coherence; healthy behaviors; low-income families; preschool-aged children; resiliency

Abbreviations: FSOC, family sense of coherence; PHCB, practicing healthy child behaviors sub-scale; LUCB, limiting unhealthy child behaviors

Just under one in four two- to five-year-olds in the US are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Overweight during the preschool years is related to overweight later in life (Cunningham, Kramer, & Narayan, 2014; Singh, Mulder, Twisk, Van Mechelen, & Chinapaw, 2008) as well as poor physical health (Daniels et al., 2005) and low self-esteem (Griffiths, Parsons, & Hill, 2010) during childhood. Although there are biological, familial, and social determinants of obesity, low-income American children are at greater risk for obesity than their higher income counterparts for several reasons (Jo, 2014). Low-income children are less likely to have shared spaces (e.g. parks and bike paths) that promote physical activity in their communities (Gordon-Larsen, Nelson, Page, & Popkin, 2006; Powell, Slater, & Chaloupka, 2004). Energy dense foods that promote obesity are generally less expensive than healthier nutrient dense foods (Drewnowski, 2010). Low-income families also are more likely to experience high levels of stress and stressful events (Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005; Morrison Gutman, McLoyd, & Tokoyawa, 2005). Higher stress levels have been linked to poor eating behaviors and dietary patterns (Lumeng et al., 2014; Michels et al., 2012); low levels of physical activity (Lampard, Jurkowski, Lawson, & Davison, 2013); and increased television viewing (Li, Jurkowski, & Davison, 2013) in low-income samples. Additionally, increased cortisol levels are produced in response to stress and disrupted cortisol secretion has been associated with higher body mass index (BMI) for preschool-aged children (Miller et al., 2013).

Despite their increased risk for obesity, some low-income children are able to maintain a healthy weight (Centers for Disease Control and Prevention, 2013). However, it is unclear what promotes this resiliency (Sigman-Grant, Hayes, vanBrackle, & Fiese, 2015). Family

functioning, or how well the members of a family unit work together to provide a loving, supportive and developmentally appropriate home environment and ensure the family members' basic needs are met, may be an important factor. It has been suggested that when families struggle to manage daily routines, communicate effectively, and control child behaviors, children develop unhealthy eating and activity habits (Rhee, 2008). There is empirical evidence that children from poorly functioning families consume more sugar-sweetened beverages and potato chips and fewer home-prepared meals, fruits, and vegetables than children from better functioning families (A. Renzaho, Dau, Cyril, & Ayala, 2014; A. M. Renzaho, Kumanyika, & Tucker, 2011).

In particular, a family's sense of coherence (FSOC), or ability to cope with stressors and environmental challenges, may be important for low-income children's resilience to obesity. FSOC was first introduced by Antonovsky and Sourani (1988) who suggested that individual sense of coherence (SOC) could be applied to the family unit. SOC describes an individual's general outlook in terms of how comprehensible, meaningful, and manageable one sees the world and the stressors that he or she encounters (Antonovsky, 1996). An individual with a strong SOC will view stressful stimuli as predictable and understandable (comprehensible) and as challenges that are worthy of engaging (meaningful), as well as believe that he or she possesses or can acquire the resources to overcome stressful stimuli (manageable) (Antonovsky, 1996). Antonovsky (1987; 1993) suggested that a strong SOC is an important resource that allows an individual to cope with difficulties and maintain good health. FSOC describes how well a family unit is able to use its resources to overcome the challenges that it faces (Antonovsky & Sourani, 1988).

A strong FSOC may allow low-income families to practice healthy behaviors despite limited resources and stressful life events. Being able to manage stressful situations could allow for time and energy to be focused on healthy behaviors (e.g. physical activity, preparing healthy meals, and monitoring and limiting screen time) which could, in turn, reduce the likelihood of overweight. The extant literature does not directly explore the relationship between FSOC and child or adult health behaviors or obesity. However, there is evidence that a strong FSOC acts as a protective factor in a variety of contexts such as caring for a child with a disability (Lustig, 1999) and accessing resources after a personal crisis (Wickens & Greeff, 2005).

Additionally, there is evidence that an individual's sense of coherence (SOC) plays a role in his or her health. The relationship between SOC and general health has been well documented for both adults and adolescents (Eriksson & Lindstrom, 2006). Adults who have a stronger SOC are more likely to practice a range of healthy behaviors than those with a weaker SOC. Swan et al. (2015) report an association between strong SOC and high weekly consumption of fresh fruit, vegetables, fish, and whole grains in a sample of 703 Dutch adults. In a cross-sectional study of 4,991 Swedish adults, stronger SOC was associated with greater consumption of fruits or vegetables and lower consumption of saturated fat, sucrose, and sweets for women and alcohol for men (Lindmark, Stegmayr, Nilsson, Lindahl, & Johansson, 2005). Similarly, Wainwright and colleagues (2007) found that British adults who reported higher SOC also reported higher levels of physical activity, and fruit, vegetable, and fiber intake. Higher levels of SOC were associated also with more physical activity in a sample of 18 to 24 year old Finish university students (Kuuppelomäki & Utriainen, 2003) and healthier eating habits and a more active lifestyle (more

physical activity, recreation and sleep) in a sample of 521 Polish university students (Binkowska-Bury & Januszewicz, 2010).

Similar links between SOC and healthy behaviors were found using samples of adolescents. Stronger SOC was associated with consumption of nutritionally balanced lunches and healthy snack choices in a sample of 887 10- to 17-year-olds in eastern Finland (Tilkkonen, Suominen, Liukkonen, Poutanen, & Karhunen, 2014). In a study of 383 14- to 15-year-old Swedish students, stronger SOC was related to regular meal frequency and engaging in physical activity (Myrin & Lagerström, 2006). Although SOC and FSOC are distinct concepts, they are related. It is likely that they are positively correlated in that when FSOC is high SOC is likely to also be high and vice versa. In this way, the evidence indicating that a high SOC is related to practicing healthy behaviors and limiting unhealthy behaviors suggests that FSOC will also be associated with an individual practicing more healthy behaviors for him or herself.

There is some literature examining the relationship between a parent or caregiver's SOC and child health outcomes and health behaviors. Stronger parental SOC was associated with greater child intake of nutrient dense foods and lower intake of energy dense foods in a study of 772 Finish parents and their 10- to 11-year-old children (Ray, Suominen, & Roos, 2009). However, mother's SOC was not significantly associated with daily sugar intake in a sample of 664 15-year-old Brazilian mothers and their children (Freire, Hardy, & Sheiham, 2002). Using a sample of 1,332 five year old children and their caregivers in Guangzhou, Southern China, Qui, Wong, Lo, & Lin (2013) also failed to find a significant association between the caregiver's SOC and child's daily sugar intake when the child's primary caregiver was their mother or father, but did find a negative association when the caregiver was a grandparent. It is important to note the

ages of the children in each of these studies. Those that used samples of adolescent children (Ray, Suominen, & Roos, 2009 and Freire, Hardy, & Sheiham, 2002) maybe less relevant for the current study than Qui, Wong, Lo & Lin's (2013) study of five year olds. Adolescents have more control over the food they eat and may consume more of their meals away from their parents or caregivers than preschool-aged children. Thus parental SOC or FSOC may impact young children's food intake more directly than older children's food intake.

There are only a few studies that have examined the relationship between an individual's SOC and obesity and these studies do not present a clear picture. In a sample of 947 German adults, von Lengerke, Janssen, and John (2007) did not find a significant association between SOC and BMI when controlling for age and SES. However, Teraoka, et al. (2012) found that a stronger SOC was associated with a higher BMI in a sample of 511 Japanese adults after controlling for age and sex. These two studies used the same measure of SOC and both calculated BMI from measured height and weight. Moreover, one study examined the relationship between parental SOC and child overweight using a sample of 9,524 children aged 2-17 years old from Norway, Sweden, Finland, Iceland, and Denmark. This study failed to find a significant relationship between parental SOC and child overweight. (Groholt, Stigum, Nordhagen, & Kohler, 2003). However, child overweight was assessed by asking the children or their parents if the child had been overweight for three months or longer. Given the limited literature exploring the relationship between SOC and overweight or obesity, it is difficult to draw conclusions. Additionally, given the methodological weaknesses (i.e. parent-reported child weight) in the one study exploring parental SOC and child weight there is no empirical evidence to suggest how parental SOC (or by extension FSOC) and child weight might be related.

The present study explores FSOC as a protective factor against childhood obesity for low-income children. We are guided by a salutogenic approach to understanding childhood obesity that prioritizes identifying factors that allow individuals to move toward health and away from disease (Antonovsky, 1987; Antonovsky, 1993). As an initial step in understanding how FSOC may protect low-income children from childhood obesity, we explore three research questions: (1) Is a stronger FSOC associated with practicing healthy child behaviors (fruit and vegetable consumption and availability in the home, physical activity, and eating meals as a family)? (2) Is a stronger FSOC associated with limiting unhealthy child behaviors (sweetened beverage and fast food consumption, energy dense snack availability in the home, and screen time)? (3) Is FSOC negatively associated with child overweight?

We explored the relationship between FSOC and healthy and limiting unhealthy child behaviors as well as child BMI because there are several child behaviors that have been identified as important correlates of child weight status. Higher consumption of fruits (Lin & Morrison, 2002) and vegetables (Kepper et al., 2015) seems to reduce the risk for obesity and overweight among children. Sugar-sweetened beverage consumption, has been linked to obesity during the preschool years and, among girls, obesity throughout childhood and the early teen years (Kuhl, Clifford, & Stark, 2012). Young children who consume fast food have poorer diet quality than children who do not consume fast food (Bowman, Gortmaker, Ebbeling, Pereira, & Ludwig, 2004). Additionally, what is available in the home seems to positively impact consumption of fruits and vegetables (Wyse, Campbell, Nathan, & Wolfenden, 2011) as well as snacks with high fat and sugar content (Spurrier, Magarey, Golley, Curnow, & Sawyer, 2008). Frequency of family meals is also positively related to how often parents serve fruits and

vegetables (FitzPatrick, Edmunds, & Dennison, 2007) and children's nutritional health (Hammons & Fiese, 2011), and negatively related to children's BMI (Anderson & Whitaker, 2010).

How preschool children spend their time also has implications for weight status. More time spent watching television has been linked to increased energy consumption (Ford, Ward, & White, 2012) and increased risk of obesity (Twarog, Politis, Woods, Boles, & Daniel, 2015) in preschool-aged children. Similarly, overall screen time (television viewing and video game playing) has been positively associated with BMI (Sijtsma, Koller, Sauer, & Corpeleijn, 2014). Physical activity during the preschool years has been concurrently associated with adiposity during the preschool years (Janz et al., 2002) and may be associated with adiposity in later childhood and early adolescence (Janz et al., 2009).

Method

Data and Sample

Data for this study were drawn from a larger study of low-income mothers and their preschool-aged children ($n = 432$). Inclusion criteria required being 18 or older; having full-time custodial care for at least one 3- to 5-year-old child; being nonpregnant; speaking English fluently; and participating in one of the following government assistance programs, all of which require meeting an income standard, the most generous of which is 185 percent of the Federal poverty level: Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), free- or reduced-price school lunch, medical assistance, or Early Head Start or Head Start. The present study used a sub-sample of 321 participants who lived in households with two or more adults (individuals ≥ 18 years) as the FSOC measure has not been validated for use with single-

adult households. Of the 321 participants in our sample, 255 were living with their spouse or partner (among other adults). For the 66 participants who did not live with their spouse or partner, 50 lived with at least one parent or step-parent (among other adults), six lived with their adult child, four lived with an adult sibling or cousin, three lived with at least one friend or roommate, two lived with a grandparent, and one lived with her aunt, uncle, and adult cousins.

Participants were recruited from Head Start and Early Head Start programs, preschools, and WIC programs in Nevada, California, Connecticut, New Jersey, and Oklahoma. Recruitment occurred during family events, at check-in stations or in school common areas. Data were collected between March 2011 and May 2013 by trained interviewers at the same locations where participants were recruited. Interviewers read survey questions to participants and recorded their answers. Participants were instructed to consider their youngest 3- to 5-year-old child when responding. Produce bags, children's books, and jump ropes were offered as incentives. The appropriate university-based Institutional Review Boards approved this study.

Measures

Family Sense of Coherence. FSOC was measured using the Family Sense of Coherence Scale (Antonovsky & Sourani, 1988). This measure includes 26 semantic differential questions each with seven answer choices that are anchored by phrases describing each extreme. For example, participants were given the prompt "When the family faces a tough problem, the feeling is" and asked to rate their family from 1 to 7 where an answer of 1 would indicate "There's no hope of overcoming the difficulties" and 7 would indicate "We'll overcome it all." A FSOC score was created by taking the mean of the responses to the 26 items after reverse coding 14 items for which higher scores indicated weaker FSOC. Higher scores indicate stronger

FSOC. This measure has demonstrated adequate reliability and validity and was highly correlated with a measure of family adjustment (Antonovsky & Sourani, 1988). Cronbach's alpha for the current sample was 0.87.

We explored the concurrent validity of the FSOC scale by correlating it with the Family Economic Strain Scale, a measure of perceived economic strain (Hilton & Devall, 1997). The general association of the FSOC scale with the Family Economic Strain Scale was examined using the Spearman's rank correlation coefficient (Spearman's rho). We would expect a negative correlation between the FSOC scale and the Family Economic Strain Scale such that higher levels of FSOC would be associated with lower perceived economic strain. These two measures were negatively and significantly correlated (Spearman's rho= -0.42, $p < 0.0001$), providing evidence for the concurrent validity of the FSOC scale.

Healthy and Unhealthy Child Behaviors. Participants were asked to complete a 16-item checklist (Dickin, Lent, Lu, Sequeira, & Dollahite, 2012) designed to assess caregivers' and children's dietary intake, physical activity, and behaviors in the home environment (Table 1). Each question has five answer choices indicating the frequency with which a behavior is performed. The behavior checklist has demonstrated acceptable test-retest reliability and convergent validity with six established measures in samples of low-income parents (Dickin et al., 2012). As described below, participants were administered all 16 items, but only 9 were used in this study.

The current investigation uses two sub-scales, practicing healthy child behaviors (PHCB) and limiting unhealthy child behaviors (LUCB). Initially, an exploratory factor analysis of all 16 original items resulted in three factors (Table 1). Items with loadings of absolute value ≥ 3.0

were considered significant and assigned to the factor in which they had the highest loading (Guadagnoli & Velicer, 1988). The dairy consumption factor was removed because the eigenvalue was below one and only two items loaded on this factor. The item “How often do you let your child decide how much food to eat?” was removed because it did not load on any factor. The remaining two factors included 13 items concerning practicing healthy behaviors and limiting unhealthy behaviors.

Because child health and wellbeing were of interest, four items that measured *caregiver* behaviors (caregiver fruit, vegetable, and soda consumption and physical activity) were removed, resulting in 9 items that assess PHCB and LUCB. The PHCB sub-scale consists of 5 of the original 16 items: child fruit and vegetable consumption, physical activity, family meal frequency, and availability of fruits in the home. The LUCB sub-scale consists of 4 of the original 16 items: child soda, fast food, and snack food intake as well as television viewing. Removing the four caregiver items did not affect model adequacy as measured using Kaiser's Measure of Sampling Adequacy and reduced the residuals (difference between predicted and observed correlations) as measured using the Root Mean Square Off-Diagonal Residuals. Thus the 9 retained items seem to adequately account for the correlations among the original variables.

To further confirm our decision to remove the four items that measured *caregiver* behaviors (caregiver fruit, vegetable, and soda consumption and physical activity), we conducted two confirmatory factor analyses: one that included the caregiver items and one that did not. Both confirmatory factor analyses recognized the two factor structure for the items relating to healthy and unhealthy behaviors. However model fit was improved in all three fit classes (absolute, parsimony, and comparative) when the caregiver items were removed (Standardized

Root Mean Square Residual decreased from 0.066 when the caregiver items were included to 0.052 when the caregiver items were removed, the Root Mean Square Error of Approximation decreased from 0.089 (90% confidence intervals (CI):0.08, 0.10) to 0.061 (90% CI: 0.04, 0.08), and the Comparative Fit Index increased from 0.78 to 0.91).

Sub-scale scores were created by summing the items that made up each factor. For both sub-scales, higher scores indicate more healthy behaviors. In order to assess the internal consistency (reliability) of the items within each factor, the values of the Cronbach's alpha were evaluated. The Cronbach's alpha was 0.64 (raw and standardized) for the PHCB scale and 0.49 (raw) and 0.53 (standardized) for the LUCB. We also evaluated the change if an item was deleted. For each sub-scale, no items were deleted because the Cronbach's alpha did not substantially improve when deleting any items.

The Cronbach's alpha values are reasonable given the relatively small number of items within each sub-scale (≤ 5) and the observed variability of the responses in this low-income sample which inadvertently introduces measurement error. Deciding on an acceptable alpha level depends on the stage of the study (e.g., exploratory or diagnostic), what the scale is used for (e.g., research or to determine entry level grades), and the area of study (e.g., social science or medicine). This is a preliminary study in the area of health-related behavior and the items have relatively low inter-item correlations (inter-item correlations ranged from 0.11 to 0.50 for the PHCB sub-scale and from 0.15 to 0.36 for the LUCB sub-scale). These are all reasons to lower the alpha values (Streiner, 2003b; Tavakol & Dennick, 2011). Hence all alphas are below 0.7 (the general cutoff for acceptable reliability). The fact that each item within the subscales measures a different concept is a strength of the study because it allows the indexing of items

that carry a wider breadth of meaning. This creates heterogeneity and reduces unnecessary redundancy in the measured items, which is known to decrease inter-item correlations and alpha values (Streiner, 2003a). Moreover, since perfect tau-equivalence (linear related and differing by a constant) is impractical and rarely achieved, the raw Cronbach's alpha is considered a lower bound estimate of reliability (Cortina, 1993).

To assess the concurrent validity of the PHCB and LUCB sub-scales we correlated them with the Parenting Behavior Questionnaire-Head Start (PBQ-HS), a measure of parenting style (Coolahan, McWayne, Fantuzzo, & Grim, 2002). The PBQ-HS has three sub-scales describing parenting styles, active-responsive, active-restrictive, and passive-permissive. We would expect that more frequent child healthy behaviors (higher PHCB scores) and limiting of unhealthy behaviors (higher LUCB scores) would be associated with more parental responsiveness and less parental restrictiveness and permissiveness. As expected, the PHCB sub-scale was positively and significantly correlated with responsive parenting as measured by the PBQ-HS (Spearman's $\rho = 0.20$, $p < 0.0001$) and negatively and significantly correlated with restrictive parenting (Spearman's $\rho = -0.28$, $p < 0.0001$) and permissive parenting (Spearman's $\rho = -0.28$, $p < 0.0001$). The LUCB sub-scale was negatively and significantly associated with restrictive parenting (Spearman's $\rho = -0.25$, $p < 0.0001$), and permissive parenting (Spearman's $\rho = -0.34$, $p < 0.0001$). The LUCB sub-scale was not associated with responsive feeding (Spearman's $\rho = 0.05$, $p = 0.33$). We also assessed the correlation between the PHCB and LUCB sub-scales to ensure they were measuring distinct concepts. These two sub-scales were weakly correlated ($r = 0.22$, $p = 0.0003$) suggesting multicollinearity is not an issue.

Child BMI. Each child's height and weight were measured by a trained staff member or licensed medical personnel using a digital scale and stadiometer. Height was measured to the nearest 0.25" and weight was measured to the nearest 0.1lb. Child BMI was calculated as $\text{weight (lb)} / [\text{height (in)}]^2 \times 703$ and converted into a BMI z-score, a standardized score indicating the distance a child's BMI is from an age- and gender-specific mean set by the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2014). Weight status was determined using CDC's age and sex adjusted growth charts (Centers for Disease Control, 2011) as follows: (underweight < 5th percentile; healthy weight $\geq$ 5th percentile and < 85th percentile; overweight $\geq$ 85th percentile and < 95th percentile; and obese $\geq$ 95th percentile).

Control Variables. Models were adjusted for child's gender and age and caregiver's marital status, employment status, race/ethnicity, education level, and BMI as well as the number of children in the household and the state where the data were collected. We selected these control variables because child's gender, child's age, caregiver's marital status, employment status, race/ethnicity, education level, BMI, and the number of children in the household have been associated with child healthy or unhealthy behaviors and/or weight status in previous research. We controlled for the state where the data were collected to account for any systematic variance in how the survey was administered in the different locations. Caregiver BMI was calculated from measured height and weight as $\text{weight (lb)} / [\text{height (in)}]^2 \times 703$ (Centers for Disease Control, 2015) and used to classify mothers as underweight (BMI < 18.5), healthy weight (BMI 18.5 -24.9), overweight (BMI 25 - 29.9), and obese (BMI $\geq$ 30). All other control variables were reported by the mother. All analyses were performed using the Statistical Analysis Software (version 9.3, 2011, SAS Institute Inc.).

Data Analysis

To address the first and second research questions (Is a stronger FSOC associated with practicing healthy child behaviors? and Is a stronger FSOC associated with limiting unhealthy child behaviors?), differences in mean PHCB and LUCB scores across FSOC quartiles were tested using the Kruskal-Wallis test. Then ordinary least squares (OLS) regression models were estimated to determine the association of FSOC used as a continuous variable with PHCB and LUCB, each used as the outcome in a separate model. To address the third research question (Is FSOC negatively associated with child overweight?), mean child BMI z-scores were calculated for each quartile of FSOC. An OLS regression model then was estimated to determine the association of FSOC with BMI z-scores. We also categorized participants as under or healthy weight and overweight or obese and tested a logistic regression model to determine the association between FSOC and the two weight status categories. In addressing all three research questions we fit unadjusted models first and then models that were adjusted for the control variables.

Table 1

Summary of exploratory factor analysis results for behavior checklist using principal factor analysis estimation (n=321)

Item	Factor Loadings		
	Healthy Behaviors	Unhealthy Behaviors	Dairy Consumption
How often...			

does your child usually eat fruits?	0.70	0.04	0.12
does your child usually eat vegetables?	0.67	0.03	0.08
do you usually eat vegetables? ^a	0.65	0.13	-0.04
do you usually eat fruit? ^a	0.57	0.24	0.07
are fruits available at home for your child to eat?	0.43	0.13	0.06
does your child play actively for at least 60 minutes a day?	0.46	-0.14	-0.05
are you physically active for at least 30 minutes a day? ^a	0.32	0.04	-0.13
do you eat together with your child at least one meal a day?	0.31	0.11	-0.00
are high-fat or high-sugar snacks available at home for your child to eat?	0.14	0.54	-0.01
do you drink regular soda? ^a	-0.03	0.50	0.11
does your <u>child</u> drink regular soda, fruit drinks, Kool-Aid, Gatorade, or things such as Sunny Delight?	0.04	0.48	0.11
does your child usually eat take out, delivery, or fast foods?	0.26	0.38	0.02
does your child spend time watching TV, using the computer, or playing video games?	0.17	0.35	-0.03
do you use 1% milk, skim milk, or low-fat yogurt? ^b	0.01	0.14	0.69
does your <u>child</u> have 1% milk, skim milk, or low-fat	0.03	0.04	0.70

yogurt?^b

do you let your child decide how much food to eat? ^c	0.13	-0.16	-0.02
Eigenvalues	2.64	1.21	0.83
% of variance	59.14	27.07	18.61

Note: Factor loadings over .30 appear in bold.

^a item removed because it measures caregiver practices

^b item removed because factor's eigenvalue was below 1

^c item removed because it did not load on a factor

Results

Descriptive statistics are presented in Tables 2 and 3. As shown in Table 2 the mean FSOC score was 5.58 out of a possible 7. The mean PHCB score was 21.60 out of a possible 25 and the mean LUCB was 15.47 out of a possible 20. About one third of the children were overweight or obese. Table 3 displays the Spearman's rank correlations among the independent variable (FSOC), dependent variables (PHCB, LUCB, child BMI z-score, child weight status), and the control variables (child's gender and age; caregiver's marital status, employment status, race/ethnicity, education level, and BMI; and the number of children in the household). Table 3 indicates that most study variables are weakly and non-significantly correlated with correlations ranging from 0 to 0.31.

Table 2.

Descriptive statistics (n = 321 unless otherwise noted).

Variables	n (or M)	% (or SD)
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Maternal Characteristics

Marital status

Married	188	58.57
Living with a partner	67	20.87
Single, never married	41	12.77
Separated or divorced	25	7.79

Employment

Not employed	159	49.53
Employed full-time	96	29.91
Employed part-time	66	20.56

Race/ethnicity

Hispanic/Latino	154	47.98
NH White	75	23.36
NH African American/Black	48	14.95
Other	44	13.71

Education

High school degree or less	138	42.99
More than a high school degree	183	57.01

BMI (n = 314)

Underweight or normal weight	108	34.07
Overweight	82	25.87
Obese	127	40.06

Number of adults in the household (including participant)		
Two	252	78.50
Three	44	13.71
Four	18	5.61
Five	5	1.56
Six	2	0.62
Number of children in the household (including target child)	2.38	1.26
Child Characteristics		
Gender		
Male	170	52.96
Female	151	47.04
Age (in months)	52.62	8.67
BMI z-score (n = 303)	0.58	1.09
BMI (n=303)		
Underweight	9	2.94
Healthy weight	192	62.75
Overweight	62	20.26
Obese	43	14.05
FSOC (possible range: 1 – 7)	5.58	0.75
Behavior Checklist Practicing Healthy Scale (possible range: 5 – 25)	21.60	3.07
Behavior Checklist Limiting Unhealthy Scale (possible range: 4 – 20)	15.47	2.46

Note: NH = Non-Hispanic

Table 3.

Spearman's rank correlations among the independent variable, dependent variables, and control variables
(n=321)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Family Sense of Coherence	—													
2. Behavior Checklist Practicing Healthy Scale	0.31***	—												
3. Behavior Checklist Limiting Unhealthy Scale	0.10	0.22***	—											
4. Child BMI z-score	0.07	0.01	0.01	—										
5. Child BMI	0.09	0.05	-0.05	0.99***	—									
6. Marital status	-0.10	-0.12	-0.17**	-0.01	0.06	—								
7. Employment	-0.01	-0.16*	-0.06	-0.11	-0.09	0.13	—							
8. Race/ethnicity	-0.05	-0.03	0.05	0.25***	0.25**	0.03	0.06	—						
9. Education	-0.06	-0.09	-0.06	0.01	-0.00	0.20*	-0.11	0.01	—					
10. Parental BMI	0.01	-0.01	-0.15*	0.10	0.07	0.02	-0.10	-0.18	-0.09	—				
11. Number of adults in the household	-0.17**	-0.09	0.01	-0.12	-0.18	0.40***	-0.02	0.05	0.20**	-0.10	—			
12. Number of children in the household	-0.02	0.09	-0.02	-0.09	-0.18*	-0.37***	-0.09	-0.13*	-0.08	0.23**	-0.18**	—		
13. Child gender	-0.12	-0.02	0.02	0.04	0.06	-0.03	0.05	0.11	0.03	0.09	0.12	-0.07	—	
14. Child age	-0.02	-0.10	-0.03	0.07	0.15*	-0.01	0.01	0.02	-0.03	-0.03	0.00	-0.05	0.10	—

*p< .05. **p< .01. ***p< .001

Note. Categorical variables were coded as follows: Child BMI: 0=underweight or normal weight, 1=overweight or obese; Marital status: 1=married,

2=living with a partner, 3=separated or divorced, 4=single, never married; Employment: 1=homemaker or not employed, 2=employed full time, 3=employed part time; Race/ethnicity: 1=NH African American/Black, 2=NH White, 3=Hispanic/Latino, 4= Other; Education: 0=More than a high school degree, 1=High school degree or less; Parental BMI: 1=underweight or healthy weight, 2=overweight, 3=obese; Child gender: 0=male, 1=female. For categorical variables, the value of the correlation coefficient was obtained using polychoric correlation.

To begin to explore the association between FSOC and PHCB, LUCB, and BMI z-scores we created quartiles for the FSOC variable. The mean FSOC scores for each quartile were as follows: quartile 1, 4.52; quartile 2, 5.43; quartile 3, 5.89; and quartile 4, 6.41. Mean PHCB, LUCB and BMI z-scores across the quartiles of FSOC were calculated and are presented in Table 4. PHCB and LUCB both demonstrate a linear trend such that at higher levels of FSOC, more healthy behaviors are practiced and unhealthy behaviors limited. The differences were statistically significant for PHCB ($p < 0.0001$) but not LUCB ($p = 0.281$). Mean BMI z-scores across FSOC quartiles did not demonstrate a linear trend.

Table 4.

Mean practicing healthy child behaviors, limiting unhealthy child behaviors, and BMI z-scores across quartiles of family sense of coherence.

	Quartile 1 ^a	Quartile 2	Quartile 3	Quartile 4 ^b	P value*
Practicing Healthy Child behaviors	20.16	21.53	22.23	22.56	<0.0001
Limiting Unhealthy Child Behaviors	15.06	15.35	15.74	15.81	0.2813
BMI z-score	0.59	0.48	0.45	0.86	0.0567

*Kruskal-Wallis Test

^a Lowest level of FSOC scores

^b Highest level of FSOC scores

Table 5 presents the results from a fully adjusted OLS regression model estimating the relationship between FSOC and the PHCB sub-scale. A significant association was observed between FSOC and PHCB in an unadjusted model (standardized beta coefficient (β) = 0.33,

p<.001; results not shown) and in an adjusted model ($\beta = 0.32$, $p<.001$). Thus, each unit increase in mean FSOC is associated with an increase in the frequency of child healthy behaviors by 0.32 units (e.g., days per week of eating fruits) after considering child BMI, age, gender and family demographic characteristics.

There was a marginally significant association between FSOC and LUCB in an unadjusted model ($\beta = 0.11$, $p=.056$; results not shown). FSOC was not significantly associated with LUCB in a model that was adjusted for the control variables ($\beta = 0.07$, $p=.203$; results not shown). FSOC also was not associated with child BMI z-scores in an unadjusted ($\beta = 0.06$, $p=.272$) or adjusted model ($\beta = 0.07$, $p=.251$; results not shown). Nor was FSOC associated with child BMI when categorized into under or healthy weight and overweight or obese, in an unadjusted model (OR=1.5, 95% CI: 0.83, 1.59) or a fully adjusted model (OR=0.83, 95% CI: 0.58, 1.19; results not shown).

Table 5.

Association between Family Sense of Coherence and the Practicing Child Healthy Behavior Sub-Scale (OLS Regression).

Variable	<i>B</i>	<i>SE B</i>	β
Family Sense of Coherence	1.34	0.23	0.32***
Marital status			
Single, never married	-0.06	0.55	-0.01
Living with a partner	-0.02	0.42	-0.00
Separated or divorced	-0.51	0.64	-0.04

Married	Reference category		
Employment			
Not employed	0.15	0.40	0.02
Employed part-time	-0.69	0.48	-0.09
Employed full-time	Reference category		
Race/ethnicity			
Hispanic/Latino	-0.81	0.43	-0.13
NH African American/Black	-0.46	0.61	-0.05
Other	-0.46	0.58	-0.05
NH White	Reference category		
Education			
High school degree or less	-0.52	0.34	-0.08
More than a high school degree	Reference category		
BMI			
Underweight or healthy weight	Reference category		
Overweight	-0.05	0.44	-0.01
Obese	-0.46	0.40	-0.07
Number of children in the household	0.12	0.14	0.05
Child gender			
Female	0.20	0.33	0.03
Male	Reference category		

Child age (in months)	-0.03	0.02	-0.08
R ²	0.19		
F for change in R ²	3.50		

Note: NH = Non-Hispanic, *B*=beta coefficient, *SE* = standard error, β =standardized beta coefficient, categorical variables (marital status, employment, race/ethnicity, education, parental BMI, and child gender) were entered as dummy variables.

This model was adjusted for the state where the data were collected.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

This exploratory study examined the association between FSOC and practicing healthy and limiting unhealthy child behaviors that have been associated with childhood overweight as well as child BMI using a sample of low-income mothers and their preschool-aged children. Families that had a strong FSOC were more likely to practice healthy behaviors. This finding is supported by existing literature that suggests parents' sense of coherence promotes healthy behaviors in their children (Ray et al., 2009; Tilles-Tirkkonen et al., 2014). Low-income families with a strong FSOC may be better able to marshal the resources necessary to provide healthy foods and activities for their children despite having limited resources. A strong FSOC may mean that these families are better able to navigate through stressful situations leaving more time and energy for cooking meals at home, shopping for fresh produce, and eating meals together.

The relationship between FSOC and LUCB is less clear. In looking at mean LUCB scores across quartiles of FSOC, we found a non-significant linear trend that suggests families with a higher sense of coherence limit unhealthy behaviors more than families with a lower sense of coherence. We also found a marginally ($p=.056$) significant, but weak ($\beta = 0.11$), association

between FSOC and LUCB in an unadjusted OLS regression model. When the model was adjusted for the control variables, there was no longer a significant association between FSOC and LUCB ($p=0.20$) and the strength of the association was reduced ($\beta = 0.07$). These results suggest that more work is needed to fully understand the relationship between LUCB and FSOC. It would be useful to repeat our analyses with a larger sample to determine why we did not find strong evidence of a significant association between FSOC and LUCB. It may be that our sample size was too small to detect an effect in a fully adjusted model or there may be no association and our results from the unadjusted model suggest a relationship only because we have not accounted for the control variables.

It is noteworthy that the association between FSOC and PHCB was stronger than that between LUCB and FSOC. It may be that it is generally easier to perform or participate in a behavior (e.g. keep fruits and vegetables in the home, eat family meals) than it is to limit or stop a behavior (e.g. decrease consumption of snack foods or time spent watching television), especially when there are external pressures (e.g. advertisements for snack foods and fast food) to practice unhealthy behaviors (Birch, Parker, & Burns, 2011).

Our findings, which indicate strong FSOC is related to practicing healthy and limiting unhealthy child behaviors that have been linked to risk for overweight, suggest the importance of considering family functioning or family resilience when conceptualizing the home environment. Presently, the childhood obesity research that considers the home environment largely focuses on parenting practices (e.g. parental feeding practices, the availability of resources in the home (e.g. fresh fruits and vegetables, televisions and other screens, and spaces for physical activity), family activities (e.g. family meals), and demographic characteristics. Our findings indicate that FSOC

can help low-income families be resilient to the larger obesogenic environment (e.g. easy and inexpensive access to energy dense foods and lack of safe spaces for physical activity) and practice healthy behaviors despite limited resources.

We did not find evidence of an association between FSOC and child BMI z-scores. We hypothesized that FSOC would be positively associated with practicing healthy behaviors and limiting unhealthy behaviors in children, which in turn would lead to a lower likelihood of overweight. Our finding that FSOC is associated with practicing healthy behaviors, but not child BMI could indicate that it may take longer than three to five years to see the impact of FSOC on child BMI.

There are limitations that should be acknowledged. This is a cross-sectional study and therefore cannot determine directionality or causation. It is possible that instead of FSOC facilitating healthy child behaviors, practicing healthy child behaviors strengthens FSOC. We measured mothers' perceptions of FSOC, but it might be instructive to capture several family members' perceptions of FSOC. Additionally, FSOC and practicing healthy child behaviors and limiting unhealthy child behaviors were self-reported. We also removed seven questions from the original measure used to assess practicing healthy behaviors and limiting unhealthy behaviors. However, the removal of these items is justified by the overall focus of the paper and the results of exploratory and confirmatory factor analyses. Finally, this was a relatively small sample of low-income mothers that is not representative of all low-income mothers. However, it is diverse in terms of race/ethnicity and includes families from five states, and rural and urban areas.

The strengths of this study include examination of both healthy and unhealthy child behaviors and an objective measure of child BMI. The Family Sense of Coherence Scale is grounded in theory and showed high internal reliability in this sample. All models were adjusted for key socio-demographic variables. Finally, this study focuses on low-income mothers, a vulnerable subpopulation in need of practical means to improve their children's health behaviors and reduce the impact of obesogenic environments.

These findings suggest several directions for future work. This study should be replicated using a larger nationally representative dataset. Longitudinal data can be used to explore associations between FSOC during early childhood and BMI in later childhood or adolescence. Replicating this study with older children could explore if the association between FSOC and healthy behaviors persists beyond the preschool years as parents gradually lose some control of their children's health behaviors. Additionally, future research could explore how parental perception of or concern about child weight may alter the relationship between FSOC and practicing healthy or limiting unhealthy behaviors as not all parents recognize when their children are overweight (Carnell, Edwards, Croker, Boniface, & Wardle, 2005) or are concerned about obesity (Etelson, Brand, Patrick, & Shirali, 2003). Finally, interventions aimed at preventing childhood obesity could be designed to determine if increasing FSOC can promote healthy child behaviors and limit unhealthy child behaviors.

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