



Examining unanswered questions about the home environment and childhood obesity disparities using an incremental, mixed-methods, longitudinal study design: The *Family Matters* study



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ABSTRACT

There are disparities in the prevalence of childhood obesity for children from low-income and minority households. Mixed-methods studies that examine home environments in an in-depth manner are needed to identify potential mechanisms driving childhood obesity disparities that have not been examined in prior research. The *Family Matters* study aims to identify risk and protective factors for childhood obesity in low-income and minority households through a two-phased incremental, mixed-methods, and longitudinal approach. Individual, dyadic (i.e., parent/child; siblings), and familial factors that are associated with, or moderate associations with childhood obesity will be examined. Phase I includes in-home observations of diverse families ($n = 150$; 25 each of African American, American Indian, Hispanic/Latino, Hmong, Somali, and White families). In-home observations include: (1) an interactive observational family task; (2) ecological momentary assessment of parent stress, mood, and parenting practices; (3) child and parent accelerometry; (4) three 24-hour child dietary recalls; (5) home food inventory; (6) built environment audit; (7) anthropometry on all family members; (8) an online survey; and (9) a parent interview. Phase I data will be used for analyses and to inform development of a culturally appropriate survey for Phase II. The survey will be administered at two time points to diverse parents ($n = 1200$) of children ages 5–9. The main aim of the current paper is to describe the *Family Matters* complex study design and protocol and to report Phase I feasibility data for participant recruitment and study completion. Results from this comprehensive study will inform the development of culturally-tailored interventions to reduce childhood obesity disparities.

1. Introduction

While the prevalence of childhood obesity may have started to plateau for some groups of children [1–5], other groups such as children from low-income, minority, or immigrant households are experiencing disparities in childhood obesity [4–7]. Given the known health risks [8–14], societal burden [15], and healthcare costs [15] associated with childhood obesity, addressing childhood obesity disparities is of high importance.

Childhood obesity disparities may in part be linked to unanswered questions regarding the home environments of racially/ethnically and socioeconomically diverse children. Although prior research has identified some important factors within the home environment that are protective for childhood obesity risk, there are limitations and unanswered questions that exist. First, research has shown that frequent family meals [16–19], non-controlling parent feeding practices [20,21], healthful food availability/accessibility in the home [20], and authoritative parenting style [21–25] are associated with more healthful

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dietary intake (e.g., fruit/vegetables) [26–28], less consumption of sugar-sweetened drinks and fast food [29], and fewer weight control behaviors [30–33] in youth. However, many of the above findings have been inconsistent across studies with minority and low-income families [18,31,34,35]. Second, the majority of studies have assessed key familial variables such as parent stress or parent feeding practices as static variables however, there may be day-to-day changes in parent stress levels or fluctuations in parent feeding practices that require measurement of intraindividual (i.e., occurring within the individual) processes. Using innovative technologies such as, ecological momentary assessment (EMA) will help pinpoint within- and between-day fluctuations in parenting practices or parent stress levels to identify nuances within the home environment that amplify or exacerbate childhood obesity risk. Third, analyses typically have not included multiple family members. Dyadic and familial-level analyses may create a more refined picture of the home environment and allow for analyses that disentangle risk and protective factors for childhood obesity [36,37]. Fourth, many prior studies have been limited by cross-sectional designs, retrospective measures, and lack of objective measurements of dietary intake and physical activity [38]. These limitations may partially explain why childhood obesity interventions that draw from these designs have had limited success [39].

The *Family Matters* study was designed in direct response to these prior limitations in the field and in response to the NIH Strategic Plan for Obesity Research [40], which recommends research to identify common and unique risk and protective factors across and within racial/ethnic subgroups to inform the development of interventions to prevent childhood obesity and reduce childhood obesity disparities. The *Family Matters* study was specifically designed to: (a) examine in-depth the home environments of diverse families ($n = 150$) using innovative mixed-methodologies (e.g., EMA, video-recorded direct observations, qualitative interview) to identify novel risk and protective factors for childhood obesity, and (b) examine these factors longitudinally within a large diverse sample ($n = 1200$ African American, American Indian, Hispanic/Latino, Hmong, Somali, and White families) to identify potential explanatory mechanisms for childhood obesity disparities.

Given the unique nature of the *Family Matters* study design, and its potential utility for future research, the main aims of this paper are to: (1) provide a comprehensive overview of the complex study design and protocol and (2) report Phase I feasibility data for participant recruitment and study completion.

1.1. Theoretical framework

Family Systems Theory [41,42] is the theoretical framework guiding the study design, hypotheses, and analyses. Family Systems Theory recognizes multiple levels of influence on a child's weight and weight-related behaviors. Fig. 1 illustrates the multiple familial levels within the home environment that may reciprocally influence child health behaviors and weight status. The family environment is the most proximal level of influence on child health behaviors and includes key variables such as parental control/restriction of the food environment, family meals, weight talk/teasing, sibling and parental modeling of health behaviors, and familial beliefs and practices. These parent, sibling, and familial factors ultimately influence child eating behaviors, physical activity patterns, and weight status.

2. Methods

2.1. Design overview

Family Matters is a 5-year incremental (Phase I = 2014–2016; Phase II = 2017–2019), mixed-methods (e.g., video-recorded tasks, EMA, interviews, surveys), longitudinal study designed to identify novel risk and protective factors for childhood obesity in the home

environments of racially/ethnically and socioeconomically diverse children. Fig. 2 shows the timeline and accompanying tasks for each Phase of the study. Phase I of the study concluded in December 2016 and Phase II of the study began in January 2017.

In Phase I, a mixed-methods analysis of the home environments of 150 families with children ages 5–7 years old ($n = 25$ African American, American Indian, Hispanic/Latino, Hmong, Somali, and White families) was conducted to identify individual, dyadic, and familial risk and protective factors for childhood obesity. A ten-day in-home observation was conducted with each family, including two in-home visits and an eight-day direct observational period. In-home observation components included: (1) an interactive observational family task [43] using a family board game with activities around family meal planning, meal preparation, and family physical activity to measure family functioning and parenting practices; (2) EMA [44] surveys measuring parent stress, mood, parent feeding practices, food preparation, parent modeling of eating and physical activity, and child dietary intake, physical activity, and sedentary behaviors; (3) child and parent accelerometry; (4) three 24-hour child dietary recalls; (5) a home food inventory; (6) built environment block audit; (7) objectively measured height and weight on all family members; (8) a parent-completed online survey; and (9) a parent interview (see Table 1). A stratified random sampling design was used in Phase I. The sample was stratified by weight status and race/ethnicity to recruit overweight/obese (BMI $\geq 85\%$ ile) and non-overweight (BMI $> 5\%$ ile and $< 85\%$ ile) children within each of the six racial/ethnic categories to identify potential weight- or ethnic/race-specific home environment factors related to obesity risk. Thus, within each racial/ethnic group ($n = 25$ participants) approximately half (12 or 13) of the participants were non-overweight and approximately half were overweight/obese. Data from the in-home observations are currently being used for analytic purposes and for developing the survey for Phase II.

In Phase II, a different group of diverse parents of children ages 5–9 years old (total $n = 1200$) will be recruited. The sample will be stratified by race/ethnicity ($n = 200$ in each racial/ethnic group) only. The sample will not be stratified by weight status because it is expected that we will recruit a normal distribution of children across weight status categories. A survey, developed from the Phase I findings, will be administered to the 1200 parents/primary caregivers. Test-retest reliability analysis will be conducted with 120 parents (20 from each racial/ethnic group). Additionally, EMA will be revised from Phase I and utilized in about half ($n = 600$) of the Phase II participants (i.e., those who meet eligibility criteria of having three or more family meals per wk.). The survey and EMA will be administered at two time points, 18-months apart to a large diverse sample to identify potential risk and protective factors for childhood obesity. The University of Minnesota's Institutional Review Board Human Subjects Committee approved all protocols used in both phases of the *Family Matters* study.

2.2. Study recruitment and participant tracking

2.2.1. Eligibility criteria

Study inclusionary criteria for both study phases includes: children ages 5–7 (Phase I) and 5–9 (Phase II) years old with no medical problem precluding study participation (e.g., disease altering diet or physical activity, serious mental illness), a BMI $> 5\%$ th %ile [45] in the target child's electronic medical records (EMR) not more than three months old, speak English, Spanish, Hmong and/or Somali, live full-time with the parent completing the study, and parent or child not currently participating in a weight management program. Children between the ages of 5–9 years old were intentionally recruited for this study because developmentally they are becoming more responsible for decision making about dietary intake and physical activity behaviors as they start school, while their parents are simultaneously becoming less directly involved with their weight-related behaviors [46].

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