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Investigating Within-day and Longitudinal Effects of Maternal Stress on Children's Physical Activity, Dietary Intake, and Body Composition: Protocol for the MATCH Study

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Abstract

Parental stress is an understudied factor that may compromise parenting practices related to children's dietary intake, physical activity, and obesity. However, studies examining these associations have been subject to methodological limitations, including cross-sectional designs, retrospective measures, a lack of stress biomarkers, and the tendency to overlook momentary etiologic processes occurring within each day. This paper describes the recruitment, data collection, and data analytic protocols for the MATCH (Mothers And Their Children's Health) study, a longitudinal investigation using novel real-time data capture strategies to examine within-day associations of maternal stress with children's physical activity and dietary intake, and how these effects contribute to children's obesity risk. In the MATCH study, 200 mothers and their 8 to 12 year-old children are participating in 6 semi-annual assessment waves across 3 years. At each wave, measures for mother-child dyads include: (a) real-time Ecological Momentary Assessment (EMA) of self-reported daily psychosocial stressors (e.g., work at a job, family demands), feeling stressed, perceived stress, parenting practices, dietary intake, and physical activity with time and location stamps; (b) diurnal salivary cortisol patterns, accelerometer-monitored physical activity, and 24-hour dietary recalls; (c) retrospective questionnaires of sociodemographic, cultural, family, and neighborhood covariates; and (d) height, weight, and waist circumference. Putative within-day and longitudinal effects of maternal stress on children's dietary intake, physical activity, and body composition will be tested through multilevel modeling and latent growth curve models, respectively. The results will inform interventions that help mothers reduce the negative effects of stress on weight-related parenting practices and children's obesity risk.

Keywords

obesity; psychosocial stress; physical activity; dietary intake; children

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Introduction

The prevalence of childhood overweight and obesity has increased dramatically over the past thirty years,¹ and both of these conditions are associated with serious health risks from childhood onward including metabolic and cardiovascular disorders.²⁻⁵ Parents are thought to have a significant influence over the energy balance-related behaviors of their children, including physical activity and dietary intake.⁶⁻⁸ However, results from family-focused obesity trials emphasizing parental education and skills training have been limited and inconsistent.^{9,10} Parental stress is an understudied, yet theoretically-relevant, factor that may compromise effective family functioning, emotional dynamics, and practices related to health – all of which, in turn, may increase risk of overweight and obesity in children. As maternal employment rates have risen dramatically in the past few decades,¹¹ the struggle to balance work and family demands can elevate psychological stress,^{12,13} which may lead to heightened obesity risk.^{14,15} To date, only a few known studies have directly examined the relation between parental stress and obesity risk in children. Koch et al.¹⁶ found that parent-reported stressful life events, worries, and overall stress were associated with greater risk of obesity in children. Stenhammar et al.¹⁷ found that maternal but not paternal reports of family stress were related to increased risk of overweight in young children. Moens et al.¹⁸ found that families with overweight children experience more parenting stress. In addition, Lytle et al.¹⁹ found that parental stress was positively related to children's BMI z-score for overweight parents only.

Research in this area is limited by cross-sectional research designs, retrospective measures, the failure to assess stress biomarkers such as cortisol, and a lack of measurement of children's dietary intake and physical activity. Past studies focus on how parents' usual or average levels of stress—retrospectively summarized over the past few weeks—relate to children's obesity risk.^{16,17,20} However, the effects of parental stress on children's behaviors may operate on a shorter time frame. Levels of parental stress may vary across the day, and this within-day variation in parental stress may be associated with within-day variation in children's activity and food intake. For instance, a mother may be stressed when coming home from work at 4pm on a given day, which compromises her ability to prepare a healthy dinner for her children or encourage them to be physically active. The failure to account for within-day variation by previous studies in this area is akin to committing an ecological fallacy in epidemiological research.²¹ These gaps have left a relatively unrefined picture of the mechanisms underlying, amplifying, and buffering the parental stress-child obesity link, and have hampered the translation of findings into successful parent-focused programs to prevent and treat child obesity.

To address these limitations, the Mothers And Their Children's Health (MATCH) study is testing whether the putative effects of parental stress on children's physical activity and behaviors operate through within-day processes that contribute to children's long-term obesity risk over time (See Figure 1). The within-day component of the model proposes that elevated maternal stressful states at any given point in the day (a) compromise subsequent weight-related parenting behaviors (i.e., limiting, monitoring, modeling, encouragement of children's physical activity and dietary intake) and (b) elevate children's stressful states, which in turn, will both lead to less healthy dietary intake and physical activity practices by

children at a subsequent point in the day. The model suggests that these within-day effects may be moderated by social-ecological factors including sociodemographics, culture, family characteristics, and neighborhood context (e.g., food insecurity, family rules, acculturation, and access to parks and fast food restaurants). Preliminary results from the pilot component and recruitment progress to date will be presented to address issues of feasibility, compliance, and user satisfaction.

Methods

Design Overview

The current study uses a longitudinal, observational, dyadic, case-crossover design^{22,23} in a sample of mother-child pairs. In case-crossover designs, a dyad serves as their own control to assess the within-day effects of immediate antecedents on a repeatedly-measured dependent variable.²² A total of 200 mothers and their 8 to 12 year-old children (N = 400 total) are participating in 6 semi-annual assessment waves across 3 years. The study protocol was approved by the Institutional Review Board at the University of Southern California.

Participants

Participants include ethnically-diverse mothers and children living in the greater Los Angeles metropolitan area. Children are currently being recruited from public elementary schools based on the following inclusion criteria: (1) child is in the 4th or 5th grade, (2) 50% of child's custody resides with the mother, and (3) both mother and child are able to read English or Spanish. Exclusion criteria for mother or child are: (1) currently taking medications for thyroid function or psychological conditions such as depression, anxiety, mood disorders, and ADHD (including psychotropic medications, antidepressants, and stimulants), (2) health issues that limit physical activity, (3) enrolled in special education programs (3) currently using oral or inhalant corticosteroids for asthma, (4) pregnancy, (5) child classified as underweight by a BMI percentile < 5% adjusted for sex and age, which is approximately equivalent to a z-score of -2.0 for BMI and (6) mothers who work more than two weekday evenings (between the hours of 5-9pm) per week or more than 8 hours on any weekend day. Inclusion and exclusion criteria are assessed by research staff during the phone screening process. The race/ethnicity breakdown is expected to be 61% Hispanic, 17% African-American, 14% White, 3% Asian/Pacific Islander, and 6% other. Based on norms in recruitment schools, approximately 68% of students are expected to be eligible for free or reduced price meals.

Several issues were considered in establishing inclusion and exclusion criteria. This study will focus on children ages 8-12 years old at baseline because this period, known as late adiposity rebound, shows rapidly accelerating BMI and increased risk for obesity-related disorders that starts in childhood and may continue across the life course.²⁴⁻²⁶ Although fathers play an increasing role in children's health, this study focuses on mothers because women in dual-earner couples report taking greater responsibility for child care than their male partners.^{27,28} Requiring that at least 50% child custody resides with the mother will increase monitoring time spent together during the 7 days of assessment in naturalistic settings. Due to budgetary restraints, the EMA and paper-and-pencil survey materials are

only available in English and Spanish. Individuals who use psychotropic or corticosteroid medication, or are pregnant are excluded because these substances and conditions may interfere with salivary cortisol secretion, making these data uninterpretable. Children enrolled in special education programs will be excluded given the potential for reduced understanding of the assent and questionnaire process.

Recruitment and tracking—Mothers and children are recruited through informational flyers and in-person research staff visits to public elementary schools and community events. The longitudinal tracking plan involves: (1) obtaining home and cell phone numbers, e-mail addresses, and contacts of friends, parents, and relatives; (2) using Facebook and online tracking services (e.g., PeopleFinder.com) to locate families; and (3) sending study newsletters and birthday/holiday cards. Home data collections will be arranged for families who move out of the district in subsequent years.

Procedures

Each parent-child pair is on their own assessment schedule, depending on time of enrollment. Assessments take place during the fall (mid-Aug. through mid-Dec.) and spring (Jan. through May) to avoid data collection during the summer months and winter holiday when mother and children may have unusual patterns of physical activity and dietary intake. To limit equipment costs and reduce staff burden, assessments are performed on a rolling basis over the 10-12 weeks in the fall and spring (approximately 15-20 mother-child pairs per week). Interested families are called by phone to be screened for eligibility and scheduled for the first assessment, which includes in-person parental consent and child assent.

At each assessment wave, participants attend a 90-minute data collection session held on a weekday evening at a local school or recreation center. During these sessions, they complete the paper-and-pencil surveys and anthropometric assessments, and they receive mobile phone, saliva, and accelerometer instructions. Over the next 7 days, mothers and children proceed through a daily EMA and saliva measurement schedule. Assessments take place in the natural environment, and participants are asked to proceed with their daily routines as normal. Each member of the dyad receives random EMA prompts across 7 days. Both mothers and children give 4 salivary cortisol samples per day on the first 4 of the days with EMA prompting (including 2 weekdays and 2 weekend days to represent different patterns of stress that may occur on these days). On 2 of the 4 saliva collection days, (one weekday and one weekend day) children also complete 24-hour diet recalls by phone interview. Salivary cortisol and 24-hour dietary recall assessments will only be made on a subset of the total days of monitoring within each wave due to the costs of and potential participant burden introduced by these measures. Children wear an accelerometer across all 7 days. Thus, we have 2 days per wave with overlapping data to test within-day hypotheses about the relationships of maternal and child stress (from EMA and cortisol), parenting practices (from EMA), and children's dietary intake (from the 24-hour recall). Furthermore, we have 4 days per wave with overlapping data to test within-day hypotheses about the relationships of maternal stress (from EMA and cortisol), parenting practices (from EMA), and children's physical activity (from EMA and accelerometer). On all 7 days of each wave, we have

overlapping data to test relationships about EMA-reported stress, dietary intake, and physical activity.

Research staff members contact families by phone twice during the monitoring week to encourage compliance and address technical issues. Participants return the equipment and saliva samples, and receive compensation during a 30-minute follow-up session at the end of the 7 days. Data uploading and device resetting take place on site for immediate turn-around to a new sub-cohort that same evening. Additional equipment is available for distribution in case of no-shows among those scheduled to return equipment. Mother-child dyads are given \$200 for each complete assessment wave. If the dyad completes less than 70% of the prompted EMA surveys or saliva collections, has fewer than 4 days of valid accelerometer data (> 10 hours per day), or fewer than one 24-hour dietary recall; both members of the dyad are asked to redo that data collection wave.

Measures

Table 1 lists the sources of the independent variables, mediators, moderators, and dependent variables used to test the conceptual model. Measures are collected from mothers and children during each of the 6 assessment waves. All questionnaire items are available in English and Spanish (mothers only). Table 2 shows the schedule for EMA and salivary cortisol assessment on weekend days and weekdays.

Ecological momentary assessment—EMA data are collected through a custom software application (app) for smartphones running the Android operating system (Google USA, Inc.) EMA data from smartphones is wirelessly uploaded after each entry and stored on an internet-accessible server, where investigators can monitor compliance. Mothers and children who own Android smartphones download the EMA app at intake and complete the EMA surveys directly from their personal phones. Participants without a compatible mobile phone are loaned a MotoG (Motorola, USA) smartphone without a data plan and are instructed to connect to their home wireless Internet. If a wireless connection is not available at home, EMA data are downloaded directly from the phone when it is returned to the researchers at the end of the data collection wave. Upon being prompted by the app with chimes and/or vibration, participants are instructed to stop their current activity and complete a short EMA survey on the touch screen of the phone. This process requires about 2-3 min. If no entry is made, the application emits up to two reminder signals at 3-min intervals. After this point, the EMA program becomes inaccessible until the next recording opportunity. Participants are instructed to ignore signals that occur during an incompatible activity (e.g., driving, sleeping, bathing). During the pilot study, mothers completed 8 EMA surveys per day (on weekdays and weekends). However, the number of weekday EMA prompts for mothers was reduced to limit potential participant burden. In the current protocol, EMA surveys are prompted 7 times per day on weekend days and 3 times per day on weekdays (during non-school time) (see Table 1). EMA prompts are linked between mothers and children, so that both occur within a 1-hour window. Mothers are randomly prompted during the first half of each window and children during the second half of each window to prevent any contamination effects from completing surveys at the same time. Mothers also complete an additional unpaired late evening EMA survey prompt each day.

Soliciting 7 or more EMA entries per day is acceptable for EMA studies with children and adults.²⁹⁻³²

EMA items assess perceived stress, stressful events, exposure to stressors, positive and negative affect, weight-related parenting practices for mothers only, dietary intake and physical activity behaviors, and social contexts (see Tables 3 and 4). Sample screen shots are shown in Figure 2. *Perceived stress* at the current moment is assessed using 2 items (i.e., Mothers- ability to handle demands, deal with things; Children-ability to manage things, things are working out) from the Perceived Stress Scale (PSS)³³ Whether any *stressful events* have occurred in the past 2 hours is assessed with a yes/no response. In mothers, *exposure to stressors* over the past 2 hours is assessed using items adapted from the daily hassles scale by Bolger and colleagues³⁴ addressing work, home, and family domains. For children, *exposure to stressors* over the past two hours is measured using items modified from a scale developed by Parfenoff and colleagues³⁵ addressing peer, family, school, and general domains. Mothers are also asked whether *they have spent any time together with their child* over the past 2 hours. If so, then the EMA app follows a branching sequence of up to 12 items assessing *weight-related parenting practices* (e.g., encouragement, monitoring, limiting), taken from the Parenting Strategies for Eating and Activity Scale (PEAS).

EMA items assessing *physical activity and dietary intake* ask whether over the past 2 hours mothers and children have engaged in any screen time (i.e., TV/videos/video games) or exercise/sports, and/or consumed fruit/vegetables, pastries/sweets, soda/energy drinks, chips/fries, and fast food. For each of these items that is endorsed, mothers and children receive a follow-up question assessing who (if anyone) was with them while they were doing it (e.g., mother, siblings, friends) to assess *parental modeling* (another weight-related parenting practice). The EMA measures also assess potential covariates related to stress, parenting practices, physical activity and dietary intake—including *positive and negative affect*,³⁶⁻³⁹ and *other time demands* (e.g., ran errands, went shopping, took children to lessons/classes/activities, did housework/chores/cooking, worked for a job, or took care of an infant/toddler). For mothers, the last EMA survey of each day additionally asks about *perceived barriers* to cooking and preparing healthy food for the family and taking children to a place to be physically active (e.g., not enough time, feeling too tired/ stressed, being ill that day, or taking time off or missing work that day).

A number of methodological considerations were made when designing the EMA protocol to balance the benefits of data richness with the drawbacks of potential participant burden and demand characteristics. Reduced-item EMA subscales are used instead of the full scales in order to limit survey fatigue. We also use a random subscale inclusion strategy, so that only 60% of *weight-related parenting practices* items are included in each EMA survey to further reduce response burden. Also, EMA surveys are prompted at random times within preset intervals (i.e., hybrid signal-interval contingent sampling schedule) to prevent anticipatory effects, such as pausing or changing current behavior in anticipation of a survey prompt at a known time.⁴⁰ Despite the use of repeated measures, reactivity is generally low with EMA procedures.⁴¹ Furthermore, we will combine EMA with more widely validated

measures of physical activity (i.e., accelerometer) and dietary intake (i.e., 24-hour recall) to minimize the weakness of using either instrument on its own.

Salivary cortisol assessments—Salivary cortisol assessments provide an indicator of diurnal activity of the hypothalamic-pituitary-adrenal (HPA) axis, a neuroendocrine axis responsive to stress experience. Cortisol typically peaks shortly after waking in the morning and declines throughout the day. Slower rates of decline across the day are hypothesized to reflect greater activation of the stress system. Saliva is collected with the Salivette device (Sarstedt, Inc.), which is a small, cotton dental sponge. Participants are asked to very gently chew and roll the sponge around their mouths for 2 minutes. This strategy has been used in many daily experience studies with participant-administered collection in natural environments among children and adults.⁴²⁻⁴⁷ Participants are automatically prompted by the mobile phone application to provide samples upon waking (and before getting out of bed), 30 min after waking, between 3:30-4:40pm, and right before bedtime (see Figure 3). These 4 collection times permit assessment of within-day effects of key components of the diurnal cortisol rhythm (i.e., morning awakening response, slope of decline across day, total area under the curve, as well as levels at specific times of the day). To avoid contamination, saliva collections are made before breakfast and dinner. During the pilot study, participants were asked to record on a paper log the date, time, and whether any dietary eating, drinking (not water), toothbrushing, smoking or exercising had occurred in the prior 30 minutes. To improve data quality and completeness, a change was made to the protocol so that participants are currently asked to write this information directly on the saliva tube itself. Saliva collections with reported eating, drinking (not water), toothbrushing, smoking or exercise in the previous 30 min will be excluded from statistical analyses. Participants store collected saliva samples in their home refrigerator as soon as possible after collection. At the end of the 7-day period, samples are frozen at -80C until they can be assayed in batch. Cortisol is assayed in duplicate with commercial chemiluminescence immunoassay (CLIA; IBL International, Hamburg, Germany), which has a lower detection limit of .005 ug/dL and intra- and inter-assay coefficients in the range of 3.0 - 4.1% (IBL International).

Accelerometer monitoring—The Actigraph, Inc. GT3X model accelerometer is used for measurement of physical activity and sedentary behavior across the 7 days of each data collection wave. This device has been used extensively in large-scale studies of physical activity.^{48,49} The Actigraph is worn on the right hip, attached to an adjustable belt, all times except sleeping, bathing, or swimming. The device is set to collect body movement data in activity counts units for each 30-sec epoch. Meterplus software (Santech, San Diego, CA) is used to identify periods of non-wear (> 60 continuous minutes of zero activity counts) and valid days (at least 10 hours of wear). Accelerometer recordings are time-stamped in order to be linked with EMA and salivary cortisol data. Cut-points for moderate-to-vigorous physical activity (MVPA) and sedentary activity (SA) are consistent with studies of national surveillance data^{50,51} using age-specific thresholds for children generated from the Freedson prediction equation equivalent to 4 METs.⁵¹⁻⁵⁶ SA is defined as <100 counts per minute.^{57,58}

Dietary assessment—Dietary intakes for children are assessed using 24-hour dietary recalls. The 24-hour dietary recalls will be collected using Nutrition Data System for Research (NDSR), a computer-based software application that facilitates the collection of recalls in a standardized fashion.⁵⁹ Dietary intake data gathered by interview is governed by a multiple-pass interview approach.⁶⁰ Five distinct passes provide multiple opportunities for the participant to recall food intake. The first pass involves obtaining from the participant a listing of all foods and beverages consumed in the previous 24 hours. This listing is reviewed with the participant for completeness and correctness (second pass). The interviewer then collects detailed information about each reported food and beverage, including the amount consumed and method of preparation (third pass). In the optional fourth pass, the interviewer then probes for commonly forgotten foods. Finally, the detailed information is reviewed for completeness and correctness (fifth pass). Interviews last up to 30 min each.

The 24-hour dietary recalls are collected from children with assistance from mothers. Trained research staff members conduct the 24-hour dietary recalls by phone—a method shown to provide valid estimates of nutritional intake when compared with direct observation.^{61,62} Children are asked to recall what they ate during the course of the most recent complete 24-hour period (midnight to midnight). The dietary recall days include two days: one weekend day and one weekday. The child is the primary respondent but is assisted by the mother who will join the call via speaker phone or by a second phone to help answer any questions the child may not be able to answer. Interviewers attempt to call up to 3 times between 7pm and 8pm on the designated interview day. If participants cannot be reached by 8pm, another saliva collection day will be selected to complete the missed dietary assessment. Calls are attempted through the remainder of the 7-day monitoring period in order to obtain 2 complete 24-hour dietary recalls per wave. Dietary intake data are recorded per eating occasion with a time stamp for within-day analyses. For ancillary analyses, usual daily dietary intake can also be calculated by adding daily totals and dividing by the number of days. Primary outcomes are: fat (g), total sugar (g), sweetened beverages (servings), and fruit and vegetables (cups), each adjusted for total energy intake (kcal).

Anthropometric assessments—Height and weight are measured in duplicate using an electronically calibrated digital scale (Tanita WB-110A) and professional stadiometer (PE- AIM-101) to the nearest 0.1 kg and 0.1 cm, respectively. Body mass index (BMI; kg/m²) and CDC age and gender-specific BMI z-scores are determined using EpiInfo 2005, Version 3.2 (CDC, Atlanta, GA). Waist circumference is measured in triplicate and recorded to the nearest 0.1 cm. Values for waist circumference will be referenced against age- and gender-adjusted percentiles for children in the United States.⁶³ Alternative measures of body fat were considered (e.g., DXA) but were ruled out due to feasibility and cost issues.

Retrospective questionnaires—In addition to EMA and cortisol measures of stress states, retrospective measures of usual or chronic stress are used because they may capture unique elements of the stress construct that may contribute differently to long-term processes. Mothers complete two paper-and pencil retrospective measures of chronic stress: (1) perceived stress in the past month (10-item Perceived Stress Scale)⁶⁴ and (2) stressful

life events in the past 6 months (13-item version of the Stressful Life Events Questionnaire).^{65,66} Mothers also complete measures of sociodemographic, cultural, family, and neighborhood contextual factors to test a potential moderators and confounders of the association between maternal stress, dietary intake, and physical activity (see Figure 1). Children complete a retrospective measure of usual or chronic stress (21-item Stress in Children scale⁶⁷) and stressful events (40-item Child and Adolescent Survey of Experiences^{68,69}). The 3 Day Physical Activity Recall instrument⁷⁰⁻⁷² is also used in addition to the accelerometer because it can capture water-based sports and bicycling, which the accelerometer cannot.

Location monitoring and Geographic Information System (GIS) mapping—

Objective neighborhood environmental context data will also be tested as potential moderators and covariates of the associations between maternal stress and children's dietary intake, physical activity, and obesity. Using smartphone location finding features (e.g., cell tower triangulation, Wi-fi networks, and GPS), smartphones record real-time geographical location data. The EMA application wakes up once every minute to search for and electronically record time and latitude/longitude data. Using GIS mapping with available datasets; access to parks, green cover, open space, crime, traffic volume, fast food and healthy food outlets will be assessed for each location coordinate. Additionally, participants' home addresses will be geocoded. Surrounding each home address, 1-km road network buffers will be created and neighborhood summary values for the above GIS-derived environmental context indicators will be developed.

Data Integration

EMA, accelerometer, cortisol, and 24-hour dietary recall data will be imported into Stata (version 13.1). Date- and time-stamps will be used to match all records within each mother-child pair to create a long data file (i.e., each row represents an EMA prompting window). To examine within-day effects, maternal stress variables (EMA-reported and salivary cortisol) measured during any given prompting window T_n will be matched to (1) *mediators*: maternal parenting practices (EMA-reported) and child stress (EMA-reported and salivary cortisol) measured during the same prompting window T_n (concurrent effects) and subsequent window T_{n+1} (prospective effects); and (2) *outcomes*: child physical activity and dietary intake (EMA-reported) measured during the same window time T_n (concurrent effects) or subsequent windows T_{n+1} and T_{n+2} (prospective effects) (See Figure 4). Maternal stress, parenting practices, and child stress during any given EMA prompting or saliva collection window T_n will also be matched to children's MVPA and SA (measured by accelerometer), and dietary intake (measured by 24-hour recall) in the ± 15 min, +30 min, +60 min, +90 min, +120 min, or +240 min (to capture concurrent and prospective effects). Day- and person-level mean scores at each wave for indicators of stress, parenting practices, physical activity, and dietary intake will be added to the dataset to test intermediate and long-term effects.

Statistical Analyses

Overview—Prior to analysis, data will be screened for distributional assumptions (e.g., normality, outliers, multicollinearity) and subjected to arithmetic transformations to adjust

for non-normally distributed data.⁷³ Within waves, an analysis of missing salivary cortisol, accelerometer, and 24-hour dietary intake recall data will be conducted.^{74,75} If data are determined to be missing at random (MAR), missing EMA data will be imputed using REALCOM-IMPUTE, a multilevel multiple imputation software that is available to researchers for use with MLwiN or Stata. REALCOM-IMPUTE allows for level-1 and level-2 explanatory variables when specifying an MI model and uses Markov Chain Monte Carlo (MCMC) estimation to impute missing values.⁷⁶ Attrition propensity scores will be computed based on the estimated probability of dropout for each participant and used to adjust the analyses.⁷⁷ Factor analyses will examine the factor structures of measures. Principal components analysis will create a stress index based on the EMA indicators (i.e., perceived stress, stressful events, and stressor exposure).

Within-day effects—To test the within-day effects of maternal stress, a series of random-effect regression models (RRM) (Eq. 1a and 2) and generalized linear mixed models (GLMM) (Eq. 1b and 2) will be conducted using SAS. RRM is used to analyze multilevel data (level-1: repeated measure, level-2: individual subject), allowing for varying measurement schedules.⁷⁸ GLMM is used for non-normal dependent variables, accounting for multilevel data structure and incorporating random effects. Between-subject (BS, level-2) and within-subject (WS, level-1) versions of the main time-varying predictors will be generated. This approach permits the distinction between the level-1 and level-2 effect of a time-varying predictor.⁷⁹

$$\text{Level 1: } y_{ti} = \beta_{0i} + \beta_{1i}(MSW_{ti}) + \dots + \beta_{ki}X_{ti} + e_{ti} \quad (\text{for continuous outcome}) \quad (\text{Eq. 1a})$$

$$\text{Level 1: } P(y_{ti}|x) = e^{(\beta_{0i} + \beta_{1i}(MSW_{ti}) + \dots + \beta_{ki}X_{ti})} \quad (\text{for dichotomous outcome}) \quad (\text{Eq. 1b})$$

$$\begin{aligned} \text{Level- 2: } \beta_{0i} &= \gamma_{00} + \gamma_{01}MSB_i + \gamma_{02}Boy_i + \dots + u_{0i} \\ \beta_{1i} &= \gamma_{10} + \gamma_{11}MSB_i + \gamma_{12}Boy_i + \dots + u_{1i} \\ \beta_{ki} &= \gamma_{k0} + \gamma_{k1}MSB_i + \gamma_{k2}Boy_i + \dots + u_{ki} \end{aligned} \quad (\text{Eq. 2})$$

where the subscript i indicates individual and the subscript t indicates occasion or time with k time-varying covariates. Equation 1a and b respectively predict the probability of a child's behavior at T_{n+1} measured continuously and dichotomously. When the dependent variable is binary, residual variance (“ e_{ti} ”) cannot be estimated for Eq 1b; rather it is assumed to be $\pi^2/3$. Other Level-1 predictors (i.e., $\beta_{ki}X_{ti}$) might include relevant time-varying predictors, such as negative affect or time of day. Relevant level-2 covariates will be included in the model such as child sex and mother BMI. The intercepts and slopes, β_{ki} , will be allowed to vary across subjects, u_{ki} . We will conduct sensitivity analyses to determine the most appropriate temporal matching scheme for EMA data (concurrent versus prospective) and short-term windows for accelerometer and 24-hour dietary data (± 15 min, +30 min, +60 min, +90 min, +120 min, +240 min) to examine within day effects. Additional analyses will also examine day-level effects by entering daily averages for the proposed predictors and outcomes in the models described above. In addition to the linear multilevel modeling approach presented above, ancillary analyses will explore the use of Bayesian hierarchical statistical modeling approaches,⁸⁰ which may be able to better account for uncertainty in

sampling design, model specification, parameters of the specified model, and initial and boundary conditions in ecological data.

Mediation and moderation—Mediators will be included in the models, and a product of coefficients⁸¹ will estimate the within-day indirect effect of maternal stress on children's physical activity through weight-related parenting practices and children's stress in single path models and multiple path models involving both mediators. Confidence intervals and Sobel tests will be used to determine the magnitude and statistical significance of mediation effects.^{81, 82} Models will also explore potential moderators through single-level interactions (e.g., access to fast food at level-1 by maternal stress and level-1) and cross-level interaction interactions (e.g., parenting style at level-2 by maternal stress at level-1). Separate sets of models will be tested for each moderator. Exploratory analyses will also examine whether these variables moderate the effects of maternal stress on the mediators and moderated mediation.

Long-term effects—Latent Growth Curve Models (LGCs) in Mplus⁸³ will be used to test the long-term effects of maternal stress on children's physical activity, dietary intake, and obesity outcomes. LGCs estimate initial status (intercept) and growth (slope) factors by taking into account the multi-level data structure.⁸⁴⁻⁸⁶ Model fit will be evaluated with Chi-square (χ^2), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). Parallel process LGCs will test the effects of initial status (intercept_{stress}) and change (slope_{stress}) in maternal stress on the rate of change in children's physical activity, sedentary behaviors, dietary intake, BMI z-score, and waist circumference (slope_{outcomes}) across waves 1-6.⁸⁷ To reveal at which specific wave maternal stress has the greatest effect on the proposed child outcomes (e.g., physical activity, dietary intake, BMI z-score), a series of cross-lagged models will be developed to examine autoregressive paths, as LGC is unable to address this question.⁸⁸ Supplemental analyses will also consider whether the intercept_{stress} and slope_{stress} are related to slope_{adiposity} after controlling for slopes of physical activity and dietary intake, which may indicate the role of non-behavioral pathways linking stress and obesity.⁸⁹⁻⁹¹ Models will include the covariates of child sex, age, SES, and ethnicity; time spent together; and mothers' BMI. Other variables associated ($p < .10$) with outcomes will be included as covariates.

Sample Size Estimation

Within-day effects—The number of level-1 data points (i.e., EMA prompts and saliva assessments) is considered to be the unit of analysis for testing the within-day effects, assuming non-randomly varying slopes. The estimated slopes range from .57 ($r = .26$, $\sigma_x = .40$ and $\sigma_y = .88$) to 1.04 ($r = .19$, $\sigma_x = .40$ and $\sigma_y = .96$). The sample sizes required to achieve statistical power of .8 for this range of slopes were determined using G*Power (V3.0) software.⁹² Linear bivariate regressions were applied with 5% of Type I error rate and two-sided tests. A sample of 144 level-1 units will provide sufficient power to detect a slope of 0.5. To achieve this number at level-1, at least $N = 36$ mother-child dyads (level-2) would be needed to have sufficient power to detect the within-day effects during any given assessment wave after taking into account planned (up to 40%) and unplanned (up to 30%) missing data. With randomly-varying slopes, the required level-1 sample size may be upwardly adjusted

based on ICCs.⁹³ However, the planned level-2 sample size of 140 mother-child dyads (after attrition) is expected to be sufficient to handle these adjustments.

Long-term effects—The number of level-2 mother-child dyads is considered to be the primary unit of analysis for tests of the long-term effects. Effect sizes were calculated based upon previous studies,¹⁶⁻¹⁹ which have found standardized regression coefficients $|\beta|$ ranging from .07 to .66. Power was computed using 1000 Monte Carlo simulated data sets and reflects the proportion of effects from LGCM with $p < 0.05$.⁹⁴ A sample of 140 (after taking into account up to 30% attrition) will provide .79 power to detect an effect size as small as $|\beta| = .15$. Although this sample size is modest, it surpasses the $N = 100$ that is preferred for growth curve modeling, and statistical power is bolstered by the repeated observations over 6 waves.⁹⁵

Results to Date

The goal of this paper was to describe the study protocol. The study procedures were piloted tested for feasibility and user acceptability in a sample of 12 mother-child dyads. Results from the pilot test indicated that 75% of parents and children felt that the mobile phone EMA app were easy or very easy to use, and 17% of mothers and 25% of children reported that responding to the EMA surveys required too much of their time. On average, mothers responded to 80% (range = 60%-95%) and children responded to 69% (range = 25%-100%) of the EMA survey prompts. Mothers and children gave 100% and 95% (63%-100%) of the saliva samples requested, respectively. Twenty-five percent of saliva samples given by mothers and 26% given by children did not have a valid date and time reported. Approximately 75% of the 24-hour dietary recalls interviews were completed during the 4 target days (Thurs-Sun), and 91% occurred sometime within the 7-day assessment period. Although dietary intake data collected outside the 7-day window cannot be matched the EMA data for within-day analysis, it can be used to estimate usual dietary intake for ancillary analyses. Mothers and children had a mean of 5.17 (SD = 1.80) and 4.92 (SD = 1.16) valid days of accelerometer wear, respectively. Ninety-two percent of mothers and children had at least 4 valid accelerometer days. None of the phones were lost, stolen, or broken during the pilot study. EMA compliance did not differ by time of day, day of the week, or chronological day in the study. EMA, accelerometer, and saliva compliance rates were not associated with age, sex, income, race/ethnicity, or BMI for mothers or children.

Participant recruitment and data collection for the first wave is currently ongoing. A total of 166 (out of 200) mother-child dyads have been enrolled to date. A flow diagram showing participant progress through the recruitment, screening, and enrollment processes is shown in Figure 5. To date, a total of 453 mother-child dyads expressed initial interest in participating in the study by returning completed information sheets with contact information. Of these, 107 could not be reached by phone, 35 asked to be called back at a later time, 22 declined to be involved in the study, and 289 mother-child dyads were screened by phone for eligibility. Among those screened for eligible, 72 were not eligible (e.g., mother or child uses corticosteroid medication for asthma or medication for Attention Deficit Hyperactivity Disorder, mother works on nights or weekends, mother pregnant). Among the 217 mother-child dyads eligible to participate, 13 have a pending appointment,

33 did not show up for their initial data collection appointment, and 5 declined to participate. To date, 166 mother-child dyads have been consented and enrolled in the study.

Discussion

Existing studies examining the relation between parental stress and child obesity have used retrospective measures of stress, relied on cross-sectional study designs, and ignored within-day processes and intraindividual variation. These limitations have led to an unrefined picture of the mechanisms underlying, amplifying, and exacerbating the link between parental stress and children's obesity risk. To address these gaps, the MATCH study is testing a novel conceptual model purporting that the effects of parental stress on children's physical activity and dietary intake operate through within-day processes that contribute to children's long-term obesity risk in an accumulated manner over time. Applying a within-day approach permits a refined examination of psychosocial-behavioral transactions that affect childhood obesity risk on a moment-by-moment basis as they actually occur (e.g., increased maternal stress occurring at work may cause poorer parenting practices later that evening).

Overall, pilot study results generally support the feasibility and acceptability of the procedures and measures. However, a few modifications to the study protocol were been made to reduce participant burden, and improve compliance and data quality. Pilot data indicated that 17% of mothers felt that responding to the EMA surveys required too much of their time. Therefore, a decision was made to eliminate EMA prompts for mothers that occurred during the day on weekdays (7am-3pm). This decision was based on the fact that children are at school during this time—therefore limiting the putative effects of mothers' weight-related parenting behaviors (e.g., encouraging children's healthy dietary intake and physical activity, restricting children's unhealthy dietary intake and sedentary activity). Children's dietary intake and physical activity levels during the day on weekdays are expected to be more closely tied to school policies and programming than direct parental influence. Therefore, EMA prompting during this period was eliminated from mothers to reduce potential participant burden. In addition, a change was made to the saliva collection protocol. Pilot data indicated that 25% of saliva samples given by mothers and 26% given by children did not have a valid date and time reported. Therefore, we decided to ask participants to write this information directly on the tube itself instead of on a separate paper log. It is expected that this change will improve data quality and completeness because it no longer requires participants to carry a separate log.

Prior work in this area typically assesses stress and parenting practices using standard retrospective questionnaires, which may be prone to recall errors^{96,97} and cannot capture intraindividual variability.⁹⁸ The current study addressed these methodological weaknesses through EMA of mothers' and children's stress, and maternal parenting practices during the course of their daily lives integrated with accelerometry-based indices of physical activity and time-linked 24-hour dietary recalls. The real-time EMA methodology capitalizes upon recent advances in mobile phone technology.^{99,100} Mobile phones have become affordable, easy to use, and quite ubiquitous. An estimated 68% of adults worldwide own a mobile phone,¹⁰¹ and they have been widely adopted across socioeconomic groups and in

developing countries.^{102,103} Thus, the EMA application (“app”) and protocol developed in the proposed study will have the potential to be integrated into existing or new large-scale cohort studies of mother-child dyads. Previous EMA-based studies of dietary intake and physical activity have been conducted in children and adults separately.^{104,105} However, this is the first known study to employ EMA in parents and children at the same time to examine the cross-over effects of parental factors on children's physical activity and dietary intake. It will enhance knowledge of how EMA can be employed in parent-child dyads in combination with other types of real-time behavioral and biological measures (i.e., accelerometers and salivary cortisol assessments) in a synchronized fashion to capture short-term effects of parental factors on children's behavior. These advancements could have broad impact on advancing the ecological validity of methodologies for the fields of developmental psychology and health behavior research.

The current study will help to generate more definitive conclusions about the directionality of the association between maternal stress and child obesity. Through its hybrid design, it will be able to differentiate effects that primarily operate within-dyads from effects that operate between-dyads. It will also identify key mediating and moderating mechanisms of these relationships that can form the basis of clinic- and community-based interventions. Overall, results will determine the optimal timing for the incorporation of maternal stress reduction and buffering strategies into family-focused campaigns and programs to prevent and treat childhood obesity. Given the increasing numbers of mothers working outside the home and risks of chronic health conditions elevated by childhood obesity, the results from this study could have a broad-spanning impact on public health.

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Note. Darkened solid lines represent model's hypothesized pathways. + = positive relation between two variables; - = inverse relation between two variables.

Figure 1.

Model of Within-day and Long-term Effects of Maternal Stress on Children's Eating, Activity, and Obesity Risk

Mother’s EMA

Child’s EMA

Figure 2.
Sample Screen Images from Mother’ and Child's Ecological Momentary Assessment (EMA)
Items

Figure 3. Sample Data from Mother-Child Dyad Showing Decline in Cortisol Concentration Across the Day Linked with Weekend Ecological Momentary Assessment (EMA) Prompts.

Note: Time_n refers to any given EMA prompt. Time_{n+1} refers to the next EMA prompt about 2 hours after the EMA prompt at Time_n.

Time_{n+2} refers to the subsequent EMA prompt about 4 hours after the EMA prompt at Time_n.

Figure 4.
Within-day Hypotheses for Concurrent and Time-lagged Effects Measured through
Ecological Momentary Assessment (EMA)

Figure 5.
Flow Diagram of Participant Progress through Study Recruitment, Screening, and Enrollment

Table 1

Measures to Assess Model Constructs

Model	Construct	Measures
Independent Variable	Maternal Stress (M)	EMA and paper questionnaire
Mediator	Weight-related Parenting Practices (M)	Salivary cortisol
Mediator	Child Stress (C)	EMA
		EMA
Moderators	Sociodemographic, Cultural, Family Environment Factors (M)	Salivary cortisol
Moderators	Neighborhood Context (M and C)	Paper questionnaire
Dependent Variable	Physical Activity and Sedentary Behavior (C)	Location monitoring/GIS
		EMA and paper questionnaire
Dependent Variable	Dietary Intake (C)	Accelerometer
		EMA
Dependent Variable	Obesity Risk (C)	24-hour dietary recall
		BMI z-score
		Waist circumference

Note: (M) Mother completes assessment; (C) Child completes assessment; (EMA) Ecological Momentary Assessment; (GIS) Geographic Information Systems.

Table 2

EMA and Salivary Cortisol Daily Measurement Schedule

	Weekend days	Weekdays
Waking	Saliva	Saliva
Waking (+ 30 min)	Saliva	Saliva
7:00am - 8:00am	EMA	No assessment
9:00am - 10:00am	EMA	No assessment
11:00am - 12:00pm	EMA	No assessment
1:00pm - 2:00pm	EMA	No assessment
3:00pm - 4:00pm	EMA	EMA
3:30pm - 4:30pm	Saliva	Saliva
5:00pm - 6:00pm	EMA	EMA
7:00pm - 8:00pm	EMA	EMA
9:00pm - 9:30pm (mothers only)	EMA	EMA
Bedtime	Saliva	Saliva

Note: No assessments were conducted during school hours on weekdays because mothers and their children are typically not together during this time.

Table 3

MATCH Ecological Momentary Assessment (EMA) Items (Mother)

Variable (Subscale)	Item	Response Options	Format	Timing	Frequency
(A) Positive and Negative affect	Right before the phone went off, how (HAPPY, FRUSTRATED/ANGRY, STRESSED, CALM/RELAXED, SAD DEPRESSED) were you feeling?	Not at all A little Quite a bit Extremely	Separate screen for each mood item	Every Prompt	100%
(B) Perceived Stress	1. How certain do you feel that you can deal with all the things that you have to do RIGHT NOW? 2. How confident do you feel about your ability to handle all of the demands on you RIGHT NOW?	Not at all A little Quite a bit Extremely	Separate screen for each item	Every Prompt	100%
(C) Stressful events	Since waking up this morning (Over the last 2 HOURS), has anything STRESSFUL happened to you?	Yes No		Every Prompt	100%
(D) Daily hassles/stressors	Since waking up this morning (Over the last 2 HOURS) which of these things caused you stress? (check all)	Work at home Work at a job Demands made by your family Tension with a coworker Tension with a spouse Tension with your children Something else None of these things		Every Prompt	100%
(E.1) Eating and Activity Behavior	Since waking up this morning (Over the last 2 HOURS), which of these things have you done? (check all)	TV, VIDEOS or VIDEO GAMES EXERCISE or SPORTS Eaten CHIPS or FRIES Eaten PASTRIES or SWEETS Eaten FAST FOOD Eaten FRUITS or VEGETABLES Drank SODA or ENERGY DRINKS (not counting diet) None of these things		Every Prompt	100%
(E.2) Parental Modeling	Was ANYONE with you when you were (watching TV, VIDEOS or VIDEO GAMES; Doing EXERCISE OR SPORTS, Eating CHIPS or FRIES, Eating PASTRIES or SWEETS, Eating FAST FOOD, Eating FRUITS or VEGETABLES, Drinking SODA or SOFT DRINKS)? (check all)	No (alone) My child Spouse/Romantic partner Other		Every Prompt	100% Follow-up sequence to occur for each response selected in Section E.1
(F) Time Spent with Child	Since waking up this morning (Over the last 2 HOURS), have you spent time WITH YOUR CHILD (together in the same location)?	No (Note: skip to Section N) Yes		Every Prompt	100%

Variable (Subscale)	Item	Response Options	Format	Timing	Frequency
(G.1) Permission-Sedentary behavior	Since waking up this morning (Over the last 2 HOURS), has your child ASKED to watch TV or VIDEOS or play VIDEO GAMES?	Yes, and I allowed it (<i>go to G.2</i>) Yes, and my spouse/partner allowed it (<i>go to G.2</i>) Yes, but I/we did NOT allow it (<i>skip G.2</i>) No, but did so WITHOUT my permission (<i>go to G.2</i>) No, has not asked (<i>skip G.2</i>)		Every Prompt	60%
(G.2) Limiting-Sedentary behavior	Since waking up this morning (Over the last 2 HOURS), have you tried to LIMIT your child's TV or VIDEO OR VIDEO GAME time?	No Yes		Every Prompt	60%
(H.1) Encouraging - Physical Activity	Since waking up this morning (Over the last 2 HOURS), have you ENCOURAGED your child to BE PHYSICALLY ACTIVE?	No Yes		Every Prompt	60%
(H.2) Encouraging - Physical Activity	Since waking up this morning (Over the last 2 HOURS), have you TAKEN your child to a place to BE PHYSICALLY ACTIVE?	No Yes		Every Prompt	60%
(I.1) Permission-Junk Food intake	Since waking up this morning (Over the last 2 hours), has your CHILD asked to eat any CHIPS, FRIES, PASTRIES, SWEETS, OR CANDY?	Yes, and I allowed it (<i>go to I.2</i>) Yes, and my spouse/partner allowed it (<i>go to I.2</i>) Yes, but I/we did NOT allow it (<i>skip I.2</i>) No, but did so WITHOUT my permission (<i>go to I.2</i>) No, has not asked (<i>skip I.2</i>)		Every Prompt	60%
(I.2) Limiting-Junk Food intake	Since waking up this morning (Over the last 2 hours), have you tried to LIMIT the amount of CHIPS, FRIES, PASTRIES, SWEETS, OR CANDY your child ate?			Every Prompt	60%
(J.1) Permission - Fast food intake	Since waking up this morning (Over the last 2 HOURS), has your CHILD asked to eat at a FAST FOOD restaurant	Yes, and I allowed it (<i>go to J.2</i>) Yes, and my spouse/partner allowed it (<i>go to J.2</i>) Yes, but I/we did NOT allow it (<i>skip J.2</i>) No, but did so WITHOUT my permission (<i>go to J.2</i>) No, has not asked (<i>skip J.2</i>)		Every Prompt	60%
(J.2) Limiting-Fast food intake	Since waking up this morning (Over the last 2 HOURS), did you try to CONTROL what type of food your child ordered at the FAST FOOD restaurant?	No Yes		Every Prompt	60%
(K.1) Encouragement - Fruit and vegetable intake	Since waking up this morning (Over the last 2 HOURS), have you ENCOURAGED your child to eat any FRESH FRUITS OR VEGETABLES?	No Yes		Every Prompt	60%
(K.2) Preparation-Fruit and vegetable intake	Since waking up this morning (Over the last 2 HOURS), have you COOKED OR PREPARED any FRESH FRUITS OR VEGETABLES for your child to eat?	No Yes		Every Prompt	60%

Variable (Subscale)	Item	Response Options	Format	Timing	Frequency
(L.1) Permission-Soda intake	Since waking up this morning (Over the last 2 HOURS), has your CHILD asked to have diet or regular SODA, SOFT DRINKS, OR SPORTS/ENERGY DRINKS?	Yes, and I allowed it (<i>go to L.2</i>) Yes, and my spouse/partner allowed it (<i>go to L.2</i>) Yes, but I/we did NOT allow it (<i>skip L.2</i>) No, but did so WITHOUT my permission (<i>go to L.2</i>) No, has not asked (<i>skip L.2</i>)		Every Prompt	60%
(L.2) Limiting-Soda intake	Since waking up this morning (Over the last 2 HOURS), have you tried to LIMIT the amount of diet or regular SODA, SOFT DRINKS, OR SPORTS/ENERGY DRINKS your child drank?	No Yes		Every Prompt	60%
(M) Family Rules	Since waking up this morning (Over the last 2 HOURS), which have happened? (check all)	Eaten a meal together as a family. Child watched TV/videos while eating. Child ate a meal in the car. Let my child watch TV/videos as a reward Gave my child food as a reward		Every Prompt	60%
(N) Time Use	Since waking up this morning (Over the last 2 HOURS), which have you done? (check all)	Errands/shopping Took children to lessons/classes/activities Housework/chores/cooking Work for a job Took care of an infant/toddler None of these		Every Prompt	100%
(O) Social Context	Who were you with just before the phone went off? (Choose all that apply)	Spouse Your child (in this study) Your child(ren) (not in this study) Other family members (nephews, cousins, aunts) Friend(s) Coworkers Other types of acquaintances People you don't know I was alone		Every Prompt	100%
(P) Perceived barriers (eating)	Thinking about today, did any of the following things make it difficult to cook/prepare healthy food or snacks for your child? (choose all)	Not enough TIME Feeling TOO TIRED Feeling TOO STRESSED None of the above		9-9:30pm prompt only	100%
(Q) Perceived barriers (physical activity)	Thinking about today, did any of the following things make it difficult to take your child to a place to exercise? (choose all)	Not enough TIME Feeling TOO TIRED Feeling TOO STRESSED None of the above		9-9:30pm prompt only	100%
(R) Sick Day/Illness	Were you sick or ill today?	No Yes		9-9:30pm prompt only	100%
(S) Time off from work	Did you miss work or take time off from work today?	No Yes		9-9:30pm prompt only	100%

Table 4

MATCH Ecological Momentary Assessment (EMA) Items (Child)

Variable	Items	Response Options	Format	Timing	Frequency
(A) Positive and Negative affect	Right before the phone went off, how (HAPPY, JOYFUL, STRESSED, MAD, SAD) were you feeling?	Not at all A little Quite a bit Extremely	Separate screen for each mood item	Every Prompt	100%
(B) Perceived Stress	1. I can manage with all the things I have to do RIGHT NOW 2. Things are working out as I have planned RIGHT NOW	No Yes	Separate screen for each item	Every Prompt	100%
(C) Stressful events	Since waking up this morning (Over the last 2 HOURS), has anything STRESSFUL happened to you?	Yes No		Every Prompt	100%
(D) Daily hassles/stressors	Since waking up this morning (Over the last 2 HOURS), which of these things caused you stress? (check all)	Having a lot of homework to do Not doing well at something Being teased by someone Arguing with someone Arguing with your parents Having too many things to do None of these things		Every Prompt	100%
(E) Eating and Activity Behavior	Since waking up this morning (Over the last 2 HOURS), which of these things have you done? (check all)	TV, VIDEOS or VIDEO GAMES EXERCISE or SPORTS Eaten CHIPS or FRIES Eaten PASTRIES or SWEETS Eaten FAST FOOD Eaten FRUITS or VEGETABLES Drank SODA or ENERGY DRINKS (not counting diet) None of these things		Every Prompt	100%
(F) Social Context	Who were you with just before the phone went off? (Choose all that apply)	Mom Dad Sister(s) or brother(s) Other family members (cousins, uncles) Friend(s) Classmates People you don't know I was alone		Every Prompt	100%
(G) Sick Day/Illness	Were you sick or ill today?	Yes No		7:30-8pm prompt only	100%
(H) Absent from school	Were you absent from or did you miss school today?	Yes No		7:30-8pm prompt on weekdays only	100%