Can Information Enhanced with Nudges Mitigate the Rise of Childhood Obesity in the Global South?

October 2022

Pham Khanh Nam * Brandon J. Restrepo # Matthias Rieger ǂ + Natascha Wagner º

Abstract – We conducted a RCT to test whether updating nutrition information sets of parents along with nudges reduces excess body fat among primary schoolchildren in urban Vietnam. Parents of overweight or obese children were randomly offered a nutrition consultation that led to goal setting with soft commitment, BMI-for-age report card, and weight scale. After 6 months, the intervention reduced body fat, waist circumference, and the likelihood of being overweight or obese, which are partly explained by improvements in diets and diet-related parental perceptions. Anthropometric improvements are concentrated among girls—partly operating through achievement of dietary goals—and persisted after 22 months.

JEL Codes: I12, I15, I18

Keywords: Information, nudges, parents, children, overweight, obesity, Vietnam

---

ǂ Corresponding author: rieger@iss.nl * Pham Khanh Nam is Associate Professor Economics at the University of Economics Ho Chi Minh City, Vietnam. # Brandon J. Restrepo is a Research Economist at the USDA, Economic Research Service, Washington, DC. + Matthias Rieger is Associate Professor of Development Economics at The International Institute of Social Studies of Erasmus University Rotterdam, The Netherlands. º Natascha Wagner is Professor of Development Economics and Director of the Global Data Lab at Radboud University in Nijmegen, The Netherlands. **Acknowledgements:** We thank Dr. Do Thi Ngoc Diep and the HCMC Nutrition Center for helping with the design of the intervention and its implementation. We thank John Cawley and Eddy van Doorslaer for comments during earlier stages of this project, as well as participants at a workshop by the Rotterdam Global Health Initiative and at a Groningen University seminar. We received helpful comments from Joseph Cummins, participants at the 2021 ASHEcon and iHEA conferences, as well as discussants Hedieh Tajali and Marrit van den Berg. We would also like to thank Tom Hoang and Anouk Ide for comments and research assistance. This research project was initiated before Brandon J. Restrepo began his employment with USDA, Economic Research Service. Pham Khanh Nam was solely responsible for administering all surveys and collecting all data used in this study. The findings and conclusions in this publication are those of the authors and should not be construed to represent any official U.S. Department of Agriculture (USDA) or U.S. Government determination or policy. This research was partly supported by the USDA, Economic Research Service. Alphabetical ordering of authorship with the following contributions: Pham Khanh Nam: Conceptualization, Methodology, Investigation - data collection, Resources, Data curation, Software, Validation, Formal analysis, Writing - review & editing. Brandon J. Restrepo: Conceptualization, Methodology, Software, Validation, Formal analysis, Data curation, Writing – original draft, Writing - review & editing. Matthias Rieger: Conceptualization, Methodology, Software, Validation, Formal analysis, Data curation, Writing – original draft, Writing - review & editing, Visualization, Project administration, Funding acquisition. Natascha Wagner: Conceptualization, Methodology, Writing - review & editing, Funding acquisition. The study was approved by the Ethics Committee of the International Institute of Social Studies (ISS). We acknowledge internal funding from the ISS. The authors declare to have no conflicts of financial and non-financial interest. This study was pre-registered in the AEA Trial Registry as AEARCTR-0003780. The exploratory longer-term follow-up after completion of the AEA registered analysis was publicly pre-registered before fieldwork at aspredicted.org, #58638. See details in manuscript. An online appendix is available. The data used in this article along with replication codes are available at Mendeley Data: https://doi.org/10.17632/fymdsykkww.1

doi:10.3368/jhr.0821-11827R2

"It is crucial that lower income countries facing rapid dietary change learn from the lessons of higher income countries and try to direct the nutrition transitions in more healthy directions."

—Barry Popkin (1994, p.285)

1. Introduction

Childhood obesity is on the rise in lower income nations and may be one reason that the prevalence of chronic diseases is surging at a pace that is more rapid in developing countries (Kelishadi 2007). Since obesity during childhood raises the risk of a range of serious health conditions and can persist until adulthood (Ebbeling et al. 2002; Whitaker et al. 1997), childhood obesity puts substantial upward pressure on healthcare use and medical care costs (Anderson et al. 2003; Biener, Cawley, and Meyerhoefer 2020; Black, Hughes, and Jones 2018; Doherty et al. 2017; Kinge and Morris 2018). Many developing countries are also facing the unique challenge of tackling both undernutrition and overnutrition with healthcare sectors that have traditionally dealt with infectious diseases and not lifestyle-related chronic diseases (Hoffman 2001; Kelishadi 2007).

A prime example of a country that is battling the double burden of malnutrition while undergoing a rapid nutrition transition is Vietnam, which has witnessed an explosion in youth obesity rates in its urban areas, especially in Ho Chi Minh City (HCMC). The combined prevalence of overweight and obesity among HCMC schoolchildren (ages 6-18) was 12% in 2002, rose to 22% in 2009, and jumped again to 40-60% in 2014 (Mai et al. 2020a; Mai et al. 2020b). In 2016, almost 1 in 2 young HCMC primary schoolchildren (ages 7-9) was overweight or obese (Nam et al. 2020). Cost-effective policy actions to mitigate the rise of childhood obesity and obesity-related illness may help to reduce the costs of Vietnam's plan to provide universal healthcare coverage in a national single-payer healthcare system (Cheng 2014) as well as boost the country's future economic productivity and growth potential (Tremmel et al. 2017). Policy insights from the existing literature are, however, of limited use for lower income countries in the Global South since most obesity prevention/management and health economics studies use data from high-income countries (Ash et al. 2017; Cawley 2015; Das et al. 2013; Ells et al. 2018; Pitt, Goodman, and Hanson 2016; Hirvonen 2020; Wagstaff and Culyer 2012).[1]

We contribute to the literature with a randomized controlled trial (RCT) that studies the short- and longer-term responses of excess body fat among primary schoolchildren in HCMC to a nutrition-focused information intervention that is enhanced with behavioral nudges. The intervention targeted parents since they play a powerful role in shaping the eating behavior of young children (Savage, Fisher, and Birch 2007) and features data on a detailed set of anthropometric measurements and a wide variety of plausible mechanisms. Drawing on 2018 administrative data from six HCMC primary schools, our sampling frame was restricted to schoolchildren (ages 7-9) who were overweight or obese according to these pre-baseline school records. Our own baseline measurements taken in February 2019 indicated that 95% of the 727 schoolchildren in our sample were overweight or obese. Using a professional body composition analyzer, average body fat percentage at baseline was 35%, which is considered elevated based on cut-offs for children under the age of 9 (Freedman et al. 2009). These objective anthropometric measures are starkly at odds with the perceptions of parents concerning their child's baseline weight status, which 80% of parents considered as "healthy".[2]

In March 2019, half of the sampled children were selected at random and their parents were offered an opportunity to receive a nutrition consultation with a well-known HCMC nutrition center, which was designed to build on pre-existing parental knowledge with new or updated information about a healthy weight, diet, and lifestyle for children. To magnify the impacts of the nutrition and health information gained during the nutrition counseling session, parents were also offered personalized baseline child weight status information (BMI-for-age report card), equipment to monitor child weight over time (weight scale), and behavioral nudges (goal commitment form and SMS reminders of goals). Parents in the control group received a non-personalized pamphlet on healthy diets and recommended exercise levels for children.

After 6 months, our intervention succeeded in improving anthropometric status. By November 2019, the likelihood of being overweight or obese was reduced by 3 percentage points (pp) (or 3% relative to the control mean), average waist circumference fell by 0.6 centimeters (or 0.8%), and average body fat percentage dropped by 0.832pp (or 2%). The healthier shifts in anthropometric status are partly explained by improvements in diet-related parental perceptions and child diets. Treated parents were 8pp (or 24%) less likely to consider their child's diet as "healthy" and, consistent with this updating, treated children consumed 30% fewer frozen meals in the past month and 20% fewer soft drinks in the past week. By contrast, activity levels of treated children did not significantly change, which may be partly due to the nutritional focus of our intervention.[3] In a food choice experiment we conducted in schools without parents present, we find no evidence of healthier snacking behavior among treated children, which points to the importance of home-based parental margins of adjustment as mechanisms for the intervention's anthropometric improvements. A particularly concerning null funding that we uncover is that, despite high rates of overweight and obesity at baseline, treated parents did not significantly change their perceptions about the healthiness of their child's weight, which is in line with a qualitative literature supporting strong parental desires for overnourished children in Vietnam (Ehlert 2019).

Analysis of treatment heterogeneity by child sex reveals that improvements in anthropometric outcomes are concentrated among girls, which is partly explained by gender heterogeneity in the types of goals set and follow-through by parents. Treated parents of girls were significantly more likely by 5.4pp (or 6%) to commit to dietary goals and successfully brought about dietary improvements. Conversely, treated parents of boys were significantly more likely by 17pp (or 20%) to commit to activity goals, but failed to generate any activity improvements. These patterns are consistent with cultural norms in Asia for big and strong boys and slender girls as well as greater sociocultural pressure on girls to be thinner that motivates girls to better adhere to diet-related interventions (Kobes et al. 2018; Park 2017). We did not, however, find significant changes in treated parents' perceptions regarding the healthiness of their daughter's weights or diets. Since the diets and anthropometric status of treated girls improved, it is possible that the treated parents of girls made a greater effort to improve diets that they already perceived as "healthy" for the sake of health benefits that are unrelated to weight changes (e.g. healthier skin, teeth, and eyes).

In a nearly 2-year follow-up that is uncommon in childhood obesity interventions (Staniford, Breckon, and Copeland 2012), we find that our treatment package's impacts on the anthropometric status among girls were durable. In March 2021, about 22 months after the nutrition consultations, we find significant reductions in average BMI-for-age (6%), the likelihood of being overweight or obese (7%), and average body fat percentage (4%) among girls. The longer run average estimated effect on anthropometric outcomes of -0.16 standard deviations (SD) is within the 95% confidence interval (CI) of our 6-month follow-up average estimated effect (-0.19 SD), which points to the persistence of our intervention's impact among girls.

Although many developing countries still have low obesity rates among adults (WHO 2017), keeping the societal costs associated with obesity at bay calls for cost-effective obesity prevention and management strategies among youth prior to or at the onset of nutrition transitions. Our study suggests that, when coupled with interrelated behavioral devices, providing nutrition information to parents can bring about dietary and anthropometric improvements among young children. However, consistent with prior research (Kobes et al. 2018; Park 2017), achieving anthropometric improvements may be easier among girls. A cost-benefit analysis we perform reveals that our intervention generated a sizeable net benefit among girls.

2. Experimental Design

This section outlines our RCT, which involved nutrition consultations and interrelated treatment components at the parent/child level. The treatment package was randomized at the child level and targeted parents because of their impactful role in boosting healthy food choices (Charness et al. 2020). Parents in the control group received a non-personalized pamphlet about the importance of healthy eating behavior, an active lifestyle, and a healthy body weight for children. Our analysis follows the plans we laid out in the AEA Trial Registry (AEARCTR-0003780) and we acknowledge any deviations or exploratory analyses.

2.1 Intervention Package

Our partners at a well-known nutrition center in HCMC[4] asked us to improve upon and test the effect of a nutrition counseling service they provide to clients over the phone. We did not change the core content that focused on counseling parents of children with unhealthy weights (overweight or obese) on how to improve the diets, physical activity levels, and related lifestyle behaviors of their children. The intervention merely built on this pre-existing nutrition and health information service provided by nutrition experts. Our goal was to render the information provided by trained nutritionists as effective as possible by combining it with three interconnected behavioral devices: (i) a healthy lifestyle conversation, (ii) goal setting with soft commitment, and (iii) subsequent goal reminders.

<u>Healthy Lifestyle Conversation</u> - Rather than unidirectional information provision flowing from experts to parents, our sessions featured a more fluid nutrition-focused conversation, *"creating opportunities to discuss health behaviors, using open discovery questions, listening, reflecting and goal-setting"* (Lawrence et al. 2016, p.1). The conversation involved exploratory questions such as: *What do you know about a healthy weight? Why should children keep a healthy weight? Do you know if your child's weight is currently healthy?* This conversation centered around what constitutes a healthy weight status for children, actions to achieve a

healthy weight, and why an unhealthy weight is undesirable. The overall goal of the conversation was to provide the necessary information and motivation for parents to better understand and appreciate the importance of a healthy weight and to plan, if desired, effective actions to improve their child's weight status based on the nutritionist's recommendations.[5]

Goal Setting, Soft Commitment, and Reminders - At the end of the conversation, the nutritionists encouraged parents to set dietary or activity goals. These goals were written down and both parties signed an agreement (Online Appendix B). This amounts to a form of soft commitment or a psychologically natured commitment device, which taps into loss aversion and leverages self-image to overcome present bias (Liu 2019; Strecher et al. 1995; Kremer, Rao, and Schilbach 2019; Samek 2019). Following the nutrition consultations, we sent SMS text messages to remind parents of the specific goals they set with nutritionists (Online Appendix C). To complement the expert nutrition and healthy lifestyle advice, parents were also sent a personalized BMI-for-age report card for their child to clearly highlight baseline weight status and a weight scale to give them an easy way to monitor their child's weight over time at home.

2.2 Conceptual Considerations and Related Literature

Our study can be conceptualized within an economic model of weight choice following Philipson and Posner (2003) (see also Lakdawalla and Philipson 2009; Lakdawalla, Philipson, and Bhattacharya 2005). A parent's utility function U is determined by her child's body weight W, food intake F, non-food consumption C, as well as physical activity A — for simplicity abstracting from own food consumption and weight concerns. Utility is maximized subject to a budget constraint $pF + C = I$ where p is the price of food and I is income. Weight rises with more food consumption and falls with higher physical activity levels. Importantly, U is non-monotonic in W and in particular has an inverted U-shape with respect to W, i.e. the parent prefers weight gain (loss) for her child when weight is below (above) an "ideal weight" W_0.

Therefore, all else equal, $W > W_0$ would lead to a parent to change child diets and/or activity levels until W_0 is reached.

In our setting, prices and income are independent of treatment. The informational part of our intervention could potentially induce weight loss through the following channels: (i) improving information about a child's true weight W (BMI-for-age report card and weight scale); (ii) lowering the child's "ideal weight" W_0 in line with medically recommended weight (nutrition consultation and BMI-for-age report card); and (iii) receiving and following effective advice on how to achieve the child's target weight (nutrition consultation). The nudging part of the intervention includes goal setting with soft commitment to help overcome present bias and SMS reminders of desired goals help to reduce inattention.

Figure 1 further fixes ideas with a schematic that summarizes key elements of the intervention package and the potential channels through which anthropometric changes may occur. Information updates diet- and health-related knowledge and perceptions of parents, which, in turn, could lead to improvements in child diets or physical activity levels and ultimately child weight status. Nudges motivate parents to follow through with preferred lifestyle changes for their children. Of course, translating updated parental information sets into anthropometric improvements depends on the influence of parents over their child's energy intake and expenditure and a child's own behavior may reinforce or dampen parental actions. We investigate this possibility in a snack choice experiment among children while they were in school without parents present, which is motivated by the behavioral economics literature on information- and incentive-based approaches to improve children's own food choices (Angelucci et al. 2019; Belot, James, and Nolen 2016; Just and Price 2013; Lai, List, and Samek 2020; List and Samek 2015; Samek 2019). Importantly, any treatment effect on snack choice would operate via parents, so we expect any downstream effects on child behavior to be modest (see dashed arrow in Figure 1).

Figure 1 makes clear that, to generate a "big push" to achieve a healthier weight among overweight or obese children, we opted for a *combination* of four interrelated intervention components along with the nutrition consultations that operate through information (personalized baseline BMI-for-age report card and weight scale) and nudges (goal setting with soft commitment and SMS reminders of the goals set with nutritionists). In isolation, the treatment components may have limited impacts. For instance, although personalized BMI-for-age report cards were shown to improve knowledge of overweight status among parents and children in Mexico, they did not prove effective as a stand-alone tool to improve child weight status, which may be driven in part by a diminution in the impacts of information over time (Prina and Royer 2014).

SMS reminders and home weight scales reduce the chance that the impacts of the nutrition consultations and BMI-for-age report cards on health behaviors will dissipate over time. Including SMS reminders is motivated by studies showing that text messaging can support weight loss or weight gain prevention among adults who are overweight or obese (McGirr et al. 2020; Hernández-Reyes et al. 2020) and reinforces the goal-setting exercise with nutritionists. We include weight scales because they serve as a source of regular feedback that can be an effective aide for weight loss, especially as a part of behavioral weight loss interventions (Madigan et al. 2015; Steinberg et al. 2013). As parents use weight scales to assess the success of changes they make to their child's diets or activity levels, they may further improve or internalize their knowledge or perceptions about the healthiness of their child's behaviors and weight status (learning effect) and/or become more sensitive to them (salience effect). Furthermore, even in the absence of any improvement in knowledge or perceptions, parents are more likely to follow through with their commitments to improve the healthiness of their child's diets or activity levels when reminded of them by the SMS text messages (salience effect).

The combination of all four potentially weight-reducing components to tackle childhood obesity is also backed by meta-analytical studies showing that weight loss interventions involving diet, exercise, and behavioral components are more effective for children and adolescents (Salam et al. 2020) and adults (Johns et al. 2014) than approaches using one of the components alone. In particular, since we target parents of children, we follow meta-analytical studies showing that integrating soft commitment devices as a part of weight loss interventions can bring about anthropometric improvements among adults in the short run and possibly in the longer run (Coupe et al. 2019). Given the interconnectedness of the treatment components and expected modest (if any) singular effects, as well as our limited sample size, we did not attempt to isolate component-specific effects through different treatment arms.

2.3 Outcomes and Predictions

We now briefly summarize the pre-registered set of primary and secondary outcomes as well as their expected effects (Table 1). Within each family, we coded variables to move in the same hypothesized direction and also report average effect sizes.

Primary outcome family 1 collects anthropometric measures, all of which we hypothesized to decrease in response to the treatment: BMI-for-age z-score[6]; overweight: >1SD; obesity: >2SD; waist circumference[7]; and body fat percentage measured by a professional body composition analyzer (InBody 570). Body fat percentage is a more accurate measure of body fat than BMI and is rarely collected in health surveys and interventions in developing countries.

Primary outcome family 2 stems from a snack choice experiment that children participated in just before the anthropometric measurement at school (similar to List and Samek 2015; script reproduced in Online Appendix D). Our aim was to document any preference shifts for healthier snacks among children in the absence of parents. This outcome is a binary indicator based on a snack choice between a fruit (tangerine)[8] and an industrially processed, popular, as well as internationally and locally known cookie. We expected treated children to be less likely to choose the cookie than control children.

Primary outcome family 3 features a series of nutrition knowledge questions in the parental survey that built on an earlier descriptive survey (Nam et al. 2020) of one of this study's authors. In addition, we adapted select questions from the *National Health and Nutrition Examination Survey* (NHANES) and *Behavioral Risk Factor Surveillance System* (BRFSS).[9] For example, drawing from the 2007-08 NHANES, we asked parents to react to the statement: *"Some children are born to be fat and some thin; there is not much you can do to change this."* This was meant to capture a parent's perceived control over their child's body weight. We also quizzed parents on the grams of fruits and vegetables their child needs daily for good health, as well as the calories needed per day to maintain their child's current weight. The main aim was not to determine if parents were able to guess correctly *per se*, but rather to infer if they updated guesstimates in response to receiving the treatment. The survey responses by parents may suffer from social desirability bias and the treatment may have induced experimenter demand effects. Although recent studies point to small experimenter demand effects (see discussion by McKenzie 2018 and notably de Quidt et al. 2018), we rely on both the objective anthropometric data and survey data to interpret the success of the intervention.

Primary outcome family 4 collects children's consumption levels of various processed and healthy food items, as well as sugary drinks, which were based on self-reports of parents. We hypothesized a reduction in the consumption of unhealthy foods and beverages and increased consumption of fruits and vegetables.

The *secondary outcome families* are shown in the three bottom panels of Table 1 and cover potential mechanisms that are linked to the primary ones including diet- and weight-related parental perceptions, snack food expenditures, and physical activity. We hypothesized no clear direction for the treatment's effect on parental perceptions, a reduction in unhealthy food spending, and increased physical activity levels.

2.4 Determination of Sample Size

We powered our RCT to detect small effects in unconditional models given the difficulty of impacting dietary choices and weight outcomes in information interventions. Setting *Cohen's d* to 0.21, power to 0.8, and the significance level to 0.05 for a randomization at the person level, we determined that a total of 714 observations would be required.[10] We rounded up to 720 observations and in practice collected body fat percentage (height/weight) at baseline for 728 (727) children.[11,12] The inclusion of baseline covariates absorbs residual variation in the outcomes, so they are controlled for in the main regression analysis discussed below.

2.5 Sampling and Data Collection Activities

Seven schools[13] were conveniently picked from a list of 16 schools that were originally selected using a multistage clustering sampling method in a previous survey (Nam et al. 2020). All classes from grades 2 to 4 within a sampled school were chosen and then all children who were overweight or obese in all of those classes were sampled.

Figure 2 gives an overview of key data collection and intervention activities. We pretested the questionnaires/procedures in December 2018. We collected baseline data in February 2019 and the intervention began in March 2019. All treated parents were offered the treatment package (excluding SMS reminders) by May 2019 and SMS reminders were sent in August 2019. About 6 months after the baseline survey, in October/November 2019, we collected the first round of follow-up data.

After completion of the AEA-registered activities, we were encouraged by commentators on our first draft paper to test for longer term anthropometric effects. We were able to collect a second round of follow-up data in mid-March 2021, 16 months after the first follow-up round and 22 months after the nutrition counseling sessions with parents. We publicly registered this third round of data collection and related hypotheses on aspredicted.org.[14] We discuss findings from these data in a stand-alone section below.

3. Baseline Descriptive Statistics and Balance Checks

To fully understand the baseline situation, we describe the baseline data on our primary and secondary outcome families (Table 1).[15] To account for multiple hypothesis testing, we report false discovery rate (FDR) corrected q-values alongside p-values (Benjamini and Hochberg 1995; Anderson 2008).[16] The number of observations varies across outcomes because of either refusals to participate in the body measurements and the snack choice experiments or nonattendance at schools during these events. Also, parents did not always answer all the survey questions sent to their homes.

BMI z-scores based on the WHO growth charts indicate that children are on average 2.3 SD above the WHO standard. We exclusively sampled children who were overweight or obese as indicated by (pre-baseline) 2018 school records from the start of the school year so, as expected, our own measurements found that 95% of children were overweight or obese and 65% were obese. Average waist circumference was 72.9cm. To put this value in perspective, it is similar to the 72.9cm and 72.3cm reported for the 75th percentile of boys and girls aged 9 in the U.S. that was estimated by Fryar et al. (2012, p.22) for the period 2007-2010. Body fat percentage was on average 35% and broken down by gender was 35.6% for girls and 34.5% for boys. Freedman et al. (2009) consider values above 26% for boys and 34% for girls 5-9 years of age to be elevated. All anthropometric outcome indicators are economically and statistically similar between treatment and control at baseline (see p- and q-values reported in Columns 4 and 5).

The only behavioral outcome specific to children was measured in our school-based snack choice experiment. Overall, 64% of children picked the processed food (cookie) over the fruit (tangerine). The proportion of children who chose a cookie was just 1.2pp higher in the treatment group compared to the control group (p-value and q-value=0.74).

A set of four variables captures parental knowledge. Notably, 63% of parents strongly disagreed or disagreed with the statement "*Some children are born to be fat and some thin; there is not much you can do to change this*." Focusing on child consumption, the remaining knowledge variables asked about the estimated daily amounts of fruits and vegetables for good health and calories needed to maintain current weight, which are reported in Table 1 as used in the regression analysis (all inverse hyperbolic sine transformed to allow zeros). To ease interpretation, the average guesses in levels are 311g for fruits, 236g for vegetables, and 1092 calories for energy intake. Note that variables in this outcome family are well balanced.

Next, we consider six diet-related questions. We find that, in the past month, the average child consumed a combined 5 processed or prepared meals (fast-food, ready to eat, or frozen). And in the past week, the average child drank soft drinks (i.e. sugar sweetened beverages) on about 2 days, and consumed fruits and vegetables at home on about 4 days each. These variables are well balanced.

Parental perceptions about their child's diet and weight at baseline are stunning. A mere 30% of parents consider their child's diet as "healthy" (excellent or very good). Yet, almost 80% consider their child's weight as "healthy." The latter indicator is at stark odds with the largely unhealthy anthropometric situation at baseline, underlining one important attitudinal margin of adjustment at the parental level. While healthy diet perception is well balanced, healthy weight perception is not (6.2pp higher in treatment group, p-value=0.05). Although the multiple hypothesis testing adjustment for the two variables in the outcome family shows that the difference is borderline significant at the 10% level, our regression specification adjusts for this moderate imbalance at baseline.

Additional secondary outcome variables include food expenditures on sweet snacks, salty snacks, and soft drinks (all inverse hyperbolic sine transformed to allow zeros). When we sum these three variables (in levels) and divide them by total food expenditures per month (excl. alcoholic beverages), they account for a substantial 14% share at the median. Salty snacks and soft drink expenditure are well balanced at baseline. Sweet snack expenditure is imbalanced at the 10% level, but adjustment for multiple hypothesis testing suggests statistical balance (q-value=0.21). Although some parents recorded zero expenditure, others did not provide responses, which could also be interpreted as zero expenditure. As we explain in more detail later, we investigated and found no evidence that the treatment changed the likelihood of non-zero or non-missing answers for expenditures. Therefore, we focus on discussing the overall impact on expenditures (i.e. any extensive or intensive margins of adjustment).

Finally, we report child activity patterns. The average child spent 14.5 hours watching TV, playing video games, or on other electronic devices over the previous 7 days or about 2 hours per day. In comparison, American children aged 8-12 accumulate 4-6 hours of screen time per day (American Academy of Child & Adolescent Psychiatry 2020). In the past week, on average sample children were physically active for at least 20 minutes on 2.4 days and they walked/biked for at least 10 minutes on 2.2 days. All activity variables are well balanced.

In Table A4, we describe the demographic and socio-economic characteristics of our sample of children and their parents at baseline. The average age of children at baseline is 103 months (8.6 years) and nearly 6 in 10 (58%) of the children are male. Mothers are on average 38 years old and are 1.56m tall. Nearly 9 in 10 (88%) of the women in our sample work, which is comparable to *Labour Force Survey* estimates by ILO (2019) of national, urban, and female labor participation rates from 2019 (84.5% for age band 25-34 and 85.8% for age band 35-44). On average, families consist of 4.36 members and reside in 2.54 bedrooms. Nearly all respondents to our household survey were parents (96%). All variables are well balanced.

4. Analysis and Results

4.1 Empirical Strategy

As pre-registered, to estimate intention-to-treat effects, we perform linear regressions for all outcome variables:

$$y_i = \alpha + \beta_1 T_i + \beta_2 y_{i,0} + X'_{i,0}\gamma + \varepsilon_i, \qquad (1)$$

where y_i is one of our outcome variables for child i at follow-up; T_i is the individually randomized treatment indicator and β_1 is the true intention-to-treat effect; $y_{i,0}$ is the lagged value of the dependent variable; $X'_{i,0}$ is a vector of demographic and socio-economic characteristics at baseline[17]; and ε_i is the error term. We control for $y_{i,0}$ and $X'_{i,0}$ in order to absorb residual variance and improve the precision of treatment effect estimates.

We estimate equation 1 using the pooled sample of boys and girls as well as separately by child sex. Due to the individual-level randomization procedure, we estimate robust standard errors in all analyses. For every family of indicators, we calculate average effects using the control group's SD at follow-up for standardization (Kling et al. 2004), and q-values are always presented alongside p-values to account for multiple hypothesis testing (Benjamini and Hochberg 1995; Anderson 2008).

4.2 Treatment Components (Exploratory and Unregistered Analysis)

In order to better understand the estimated treatment effects in the subsequent sections, we present data on treatment components among treated parents for whom primary outcomes were available at follow-up. About 63.2% participated in the nutrition consultation, 62.9% set at least one goal with the nutritionist, 48.2% confirmed that they had received the BMI-for-age report card, and 84% reported having received the weight scale.[18] Among parents who set a goal, the average number of goals was 4, and 19.5% of goal-setting parents reported receiving SMS reminders about the goals they set. Treated parents were also asked about the helpfulness of the treatment components for either understanding the healthiness of their child's weight, encouraging dietary changes, or motivating activity changes. The vast majority of treated parents thought each treatment component was helpful for at least one of these reasons, with the breakdowns being 97.3% (nutrition consultation), 97.5% (BMI-for-age report card), 96.9% (weight scale), and 93.8% (SMS reminders).

We explored demand for treatment subcomponents of the intervention by regressing take-up of each treatment component on baseline characteristics (Table A5a): observables at baseline do not predict BMI-for-age report card, consultation, and scale take up. The number of commitments parents made is positively and strongly correlated with body fat percentage and snack choice at baseline. A one SD increase in body fat percentage (7.2% at baseline in the treated group) is associated with a 0.5 increase in the number of commitments (7.2*0.067). Similarly, the unhealthy choice of a cookie at baseline is correlated with an increase of 0.6. When we conduct this analysis by child sex, we find that the body fat percentage and snack choice effects are driven by boys and girls, respectively (Table A5b). The overall and gender-specific results suggest that parental demand for soft commitment devices may help to overcome lifestyle-related self-control problems, which we now move to further investigate.

About 83% of goal-setting parents committed to improving activity levels while 96% committed to improving child diets (Table A6).[19,20] Homing in on this sample of parents who set at least one goal, regressions involving either an indicator for committing to any diet-improving goal or any activity-improving goal uncover important gender differences. Controlling for baseline characteristics, we find that parents of boys were significantly more likely by 16.7pp—or 20% relative to the mean—to commit to improving activity levels (p-value=0.01), while parents of girls were significantly more likely by 5.4pp—or 6% relative to the mean—to commit to improving child diets (p-value=0.08).

4.3 Anthropometric Outcomes and Snack Choice Experiment

Table 2 summarizes the treatment package's impacts on anthropometric outcomes from linear regression models conditional on the lagged dependent variable and the set of demographic and socio-economic covariates.[21] In the pooled sample of boys and girls, although Column 1 suggests that the treatment reduced BMI-for-age by 0.036 SD, the estimate is not statistically significant. The likelihood of being overweight or obese was reduced by 3.0pp, which is significant at the 5% level (Column 2), but there is no significant change in the likelihood of being obese (Column 3).[22] Column 4 indicates a 0.61cm reduction in waist circumference that is significant at the 10% level. Likewise, body fat percentage was reduced by 0.832pp and the p- and q-values support a highly significant effect.[23,24] It is not surprising that the body fat percentage model yields the most precisely estimated reduction as this outcome was measured by a professional body composition analyzer via bioelectrical impedance analysis. Column 6 of Table 2 presents the average impact across columns in a seemingly unrelated regression (SUR) framework using standardized outcomes. Across the board, anthropometric indicators were lowered by a statistically significant 0.073 SD. Although these anthropometric improvements are modest, they do point to the success of the intervention.

Table 2 also presents findings by child sex. Despite boys having higher obesity rates than girls (compare control means for boys versus girls), the estimated effects of the intervention are concentrated among girls. Apart from the obesity model, all point estimates among girls are negative, larger in magnitude, and significant based on p- and q-values. Although the average effect for boys is very small (0.003 SD) and insignificant, it is much larger among girls (-0.185) and significant at the 1% level. When compared with control means, the average effect among girls is driven by significant 6%, 6%, 1%, and 5% reductions in BMI-for-age, likelihood of being overweight or obese, waist circumference, and body fat percentage, respectively.

Although the intervention targeted parents, there may be downstream effects on child behavior that we investigated with a snack choice experiment. Table 2 suggests that the treatment lowered the likelihood of picking the unhealthy snack (i.e. the cookie) by almost 5pp (Column 7). Although this amounts to a non-trivial 10% reduction relative to the control mean, it is statistically insignificant (p-value=0.17).[25] We acknowledge power issues to detect a small improvement in child behavior.[26] Table 2 also documents homogenous (economically and statistically so) effects on snack choices across boys and girls. In sum, this is suggestive evidence that the intervention is likely to have operated primarily via changes in home-based, parent-directed child behavior changes rather than in-school child behavior changes, although we cannot rule out modest effect sizes and unobserved channels.

We subject our main analysis to two robustness checks and perform a complementary treatment analysis. First, to address the possible concern that our results may be sensitive to allowing arbitrary correlation of observations among classmates, we instead clustered standard errors at the class level in an exploratory analysis and found that they were very similar to those in Table 2 (Table A8). Second, we investigated the possibility that treatment spillovers caused attenuation bias through contact among treated and control schoolchildren or parents. As we detail in Online Appendix H and show in Tables A9-A11, our main results and conclusions hold firm to various attempts to adjust for possible treatment spillover effects. Finally, to complement our intention-to-treat analysis, we correlated a "treatment intensity" index—i.e. a simple sum of all treatment components—with the anthropometric outcomes and find results that are consistent with our main analysis and conclusions from the overall and gender-specific samples (Online Appendix I and Table A12).

4.4 Children's Food Consumption and Household Food Expenditures

Table 3 provides evidence of dietary changes that partly explain the anthropometric improvements documented in Table 2 and are in line with the vast majority of treated parents committing to dietary goals during the goal-setting exercise. Consider first the average effect where we coded dietary variables to reflect reductions in unhealthy foods (such as processed and ready-to-eat meals and soft drinks, Columns 1-4). Columns 5 and 6 enter negatively into the average effect calculation as they look at effects on healthy foods. We find an overall improvement in food intake of almost 0.1 SD that is significant at the 5% level.

When considering sub-indicators, as expected, we find that point estimates are negative in the case of unhealthy foods and positive in the case of healthy foods, which further supports the notion that overall dietary behavior moved in a healthier direction as a result of the treatment. However, most of these individual estimated effects are insignificant. Reductions in the consumption of frozen meals and soft drinks are significant at the 10% level but q-values=0.3 suggest otherwise. Economically speaking though, these reductions are meaningful. The number of frozen meals in the past 30 days decreased by about 30% and the consumption of soft drinks in the past 7 days dropped by about 20%. The reductions in fast-food meals and ready-to-eat grocery store meals relative to sample means are smaller (11% and 10%, respectively) and insignificant using p- and q-values. The improvements in fruit and vegetable consumption are smaller still (5% and 6%, respectively) and also insignificant.

Results by gender reveal heterogeneity that is consistent with parents of girls being more likely to commit to dietary goals and the anthropometric impacts being concentrated among girls. The average effect on girls is almost twice the size of the one on boys and is significant at the 5% level. Of note among the sub-indicators is frozen meals/pizzas in the past 30 days, which fell by a sizeable 60% among girls and p- and q-values are well below the 1% threshold.

To complement the consumption variables, we also analyze snack food expenditures (Table A13a, Panel C). Spending on these unhealthy foods also appear to have moved in a healthier direction, but the estimated effects are insignificant and small in magnitude.[27] Spending on sweet snacks, salty snacks, and soft drinks fell by an insignificant 2%, 6%, and 2%, respectively. Likewise, the average effect suggests a small and insignificant reduction of 0.08 SD. When broken down by gender, we also find small and insignificant estimated effects of the treatment on snack food expenditures (Table A13b).

4.5 Diet- and Weight-Related Perceptions and Knowledge of Parents

We find that parental perceptions concerning a healthy diet significantly changed in the overall sample (Column 1 of Table 4), which helps to explain the overall dietary improvements we detected in Table 3. Treated parents are 8.3pp less likely to consider their child's diet as healthy. The estimated effect is significant at the 5% level according to p- and q-values and is also a meaningful reduction of 24% relative to the control group mean (34% of control parents consider their child's diet to be healthy). By contrast, Column 2 reveals the most striking null finding of our analysis: an insignificant reduction of 4pp in parental perceptions concerning a healthy weight. About 74% of control parents consider their child's weight as healthy, so the insignificant effect amounts to a mere 5% reduction relative to the control mean. Despite all anthropometric indicators painting an unhealthy baseline situation and the provision of information to better understand what constitutes a healthy weight, treated parents do not seem to have updated weight-related perceptions. As we discuss later, this may be attributable to strong social norms and desires for overfed and chubby children that have been well-documented in the qualitative literature in Vietnam (Ehlert 2019). The significant average effect in Column 3 (-0.134 SD) is thus driven by changes in healthy diet perceptions rather than healthy weight perceptions.

When we split results by gender, we find quantitatively similar patterns, but they are statistically weaker. Diet-related perceptions are on average very similar in control-group girls and boys: 34% (35%) of parents perceive their son's (daughter's) diet as healthy. The estimated effect of the treatment on the likelihood of parents considering their child's diet as healthy is marginally significant among boys (-9pp or 26%) but is rendered insignificant when accounting for multiple hypothesis testing (q-value=0.12). The estimated effect is smaller among girls (-5.6pp or 16%), but it is statistically indistinguishable from the estimated effect among boys (p-value=0.64). Estimated effects on weight-related perceptions are much smaller relative to control means and insignificant in both sub-samples, as was observed in the pooled sample. Overall, the intervention improved diet- and weight-related parental perceptions by a similar 0.13 SD in boys and girls (Column 3), but the average effect is only significant among boys (at the 10% level) and is driven by diet-related perceptions. In sum, given the nontrivial estimated effect sizes relative to sample means, there is suggestive evidence that the treatment improved diet-related perceptions among parents of boys and girls.

We also examined effects on knowledge-related variables such as whether the treatment induced parents to think that overweight status is not a given or to update their guesstimates of recommended intakes of fruits and vegetables and calories needed to maintain current weight. None of these indicators was significantly impacted, both overall and by child sex, as best summarized by very small and insignificant average effects in the last column of Tables A15a and A15b.[28] We also explored alternative indicator specifications that reflect WHO recommendations on daily fruit/vegetable intake and arrived at similar conclusions.[29] Therefore, a change in parental knowledge itself is unlikely to have brought about the anthropometric improvements documented in Table 2.

4.6 Children's Sedentary and Physical Activity Levels

In the pooled sample, the estimated effects on screen- and exercise-related time use are all insignificant and small in magnitude relative to the control group means (Table A16a). A very small average effect (0.034 SD in the full model shown in Panel C) rules out a possible activity-related channel for the anthropometric changes documented in Table 2, which are therefore driven by reduced energy intake rather than increased energy expenditure. Moreover, even though parents of boys were significantly more likely to commit to activity-related goals, they did not succeed in following through with their preferred activity-related margins of adjustment. Indeed, when broken down by gender, all estimated effects of the treatment on physical activity measures are insignificant and smaller among boys than among girls (Table A16b). Taken together, these results suggest that physical activity may be a particularly challenging margin of adjustment to achieve anthropometric improvements in Vietnam, which is one of the least physically active countries in the world (Vuong et al. 2018).

5. Exploring Longer Term Effects

Our analysis thus far has shown that our intervention yielded anthropometric benefits for girls within a time horizon of 6 months. About 16 months after the first follow-up measurement and 22 months after the nutrition counseling sessions with parents, we collected a third round of anthropometric data in mid-March 2021 (see Figure 2 for the timeline). In the pre-registration of the extension, we asked whether there are longer term impacts of the nutrition-focused information intervention and hypothesized that the longer-term effects would be (i) quantitatively and statistically smaller than the short-term effects and (ii) larger and more persistent for girls than for boys. Our empirical approach is the same as before.

We managed to collect a third round of anthropometric data for the majority of children, but for a very simple reason, 41% of children could not be assessed. Out of a total of 293 missing children, 289 are missing due to "aging out" of primary school and transferring to another school. Children aged around 11 moved on to secondary schools scattered across the city and it would have been too costly and difficult for us to track them down and get timely research-related access to assess them in their new schools, especially during the COVID-19 pandemic. Fortunately, the proportion of missing data is statistically similar for treatment (40%) and control (41%) groups (p-value=0.753). The likelihood of missing measurement is indeed largely explained by age eligibility for a school transfer (Table A17).[30] Notably, treatment is unpredictive of attrition, both in the full and gender-specific sub-samples. We adjust for the age-related attrition by expanding the control vector in equation 1 to include birth month-year fixed effects.

Table 5 reports longer term effects for the full sample and by child sex. All individual and average effects are insignificant in the full sample. A different picture emerges when we split the sample by child sex. Treatment effects among boys tend to be small and insignificant. There is a positive effect on BMI-for-age, but this does not survive adjustment for multiple hypothesis testing and is not echoed when analyzing the superior measure of body fat.[31]

Consistent with the shorter run follow-up analysis, girls benefit from the intervention in the longer run. We document significant reductions in BMI-for-age (-0.11 units or 6%), the likelihood of being overweight or obese (-6.4pp or 7%), and body fat percentage (-1.52pp or 4%). These effects sum up to a significant average effect of -0.158 SD. Recall that at first follow-up, we found an average effect of -0.185 SD (95% CI [-0.286; -0.084]) (Table 2, Column 6). We also ran first follow-up models on the more comparable reduced sample of girls for whom a second follow up is available (N=179 instead of N=285), which revealed an average effect of -0.175 SD at first follow-up (95% CI [-0.293; -0.056]). The longer run average effect decreased only slightly and is within the previous 95% confidence bands, suggesting that sustained anthropometric improvements can be achieved for young girls with our mixed, complementary treatment package.

6. Discussion and Conclusions

We designed and tested the anthropometric impacts of a behaviorally enhanced nutrition counseling program targeted at parents of primary schoolchildren who were overweight or obese in urban Vietnam, where diets are undergoing dramatic changes amidst a rapid nutrition transition. We document improvements in a host of anthropometric indicators following receipt of our treatment package, which operated through updated parental perceptions regarding the quality of child diets and a corresponding shift away from the consumption of unhealthy foods.

Anthropometric benefits were concentrated among girls and persisted after almost 2 years, pointing to strong child gender differences in the response to our nutrition-focused intervention. The gender heterogeneity is partly explained by successful follow-through among treated parents of girls with their desired dietary adjustments and unsuccessful follow-through with preferred exercise adjustments among treated parents of boys.

Our anthropometric results are consistent with those of a meta-synthesis of prior interventions aimed at preventing and reducing overweight and obesity among children and adolescents (Kobes et al. 2018). Among girls, we found that the treatment package reduced average BMI z-scores by 0.126 (Table 2), which amounts to a standardized mean difference of -0.21 (-0.126/0.605). The estimated effect on boys was insignificant and very close to zero (0.040=0.031/0.780). Pooling results from several meta-analytical studies, Kobes et al. (2018, p.1074) report a standardized mean difference in BMI z-scores of −0.11 [−0.17; −0.06] among girls. The corresponding estimated effect among boys (−0.09 [−0.18; 0.01]) was smaller and insignificant as was the case in our study.[32]

Compared to previous intervention efforts among children, our study fared better in terms of impact on BMI-for-age and fared similarly when it comes to gender patterns. Kobes et al. (2018, p.1073) discuss evidence that sociocultural pressure to be thinner may be larger among girls, which offers an additional potential explanation for the gender heterogeneity that we found in response to our intervention. A systematic review on parental perceptions of child weight status by Park (2017) finds that Asian parents are more likely to underestimate their son's weight than their daughter's weight, which likely reflects cultural norms in Asia for big and strong boys and slender girls. In line with this hypothesis, we found that treatment effects on child diets were sizeable and significant among girls but not boys. Our survey questions cannot shed light on gender differences in parental, societal, or child expectations for body type or whether there were unintended consequences of the treatment (e.g., body image concerns), so future research into these possible effects in similar information interventions is warranted.[33]

In the Vietnamese context, Ehlert (2019, p.120) notes that maternal opinions on child weight are *"in sharp contrast to the official public obesity discourse fostering the healthy child."* There seems to be a widespread desire for overnourished children in urban areas, which may be linked to Vietnam's history of child undernutrition, hunger, and deprivation during times of war and its recent rapid economic catch-up. Based on qualitative interviews with parents and experts in Vietnam, Ehlert (2019, p.119) cites an editor of a women's magazine who summarizes the thinking of many Vietnamese parents: *"The standard of a healthy child in our country is that of the fat child. When two mothers come together, they just care about how many kgs the child has. They don't care whether they [the children] are healthy or sick. Just how much food [the child eats] or how tall it is."* We found that weight-related parental perceptions in Vietnam are sticky, with no evidence in the overall and gender-specific samples that our intervention resulted in treated parents significantly updating perceptions of what constitutes a healthy weight. This finding is particularly alarming given that nearly all sampled children were at least overweight at baseline, and the vast majority were obese. Anthropometric improvements were driven instead by updated parental perceptions concerning a healthy diet and corresponding improvements in the quality of child diets.

It is interesting to compare this aspect of the intervention to other information-based interventions. Unlike in our study, Prina and Royer (2014) provided BMI report cards to parents in Mexico, which led to improved parental knowledge and perceptions about their child's weight status. Anthropometric measures did not, however, respond to the BMI report cards – again unlike in our study.[34] These contrasting findings may be taken to suggest that cultural context and the stage of the nutrition transition matter when it comes to diet- and weight-related norms and perceptions. Our study also moved beyond a singular focus with a multifaceted information intervention that coupled BMI-for-age report cards with weight scales and behavioral nudges. When combined, they may prove more effective in bringing about weight and dietary improvements than BMI report cards alone, which is consistent with emerging evidence on the usefulness of integrating soft commitment devices into diet- and weight-related behavioral interventions (Coupe et al. 2019; Samek 2019).

Obesity prevention must start at early ages given the strong association between childhood and adult obesity (Simmonds et al. 2016). Many countries may be facing an impending adult obesity epidemic. In 2016, among the 191 nations with obesity data, 74 countries had childhood obesity rates in excess of 10% (WHO 2017). Vietnam currently has the lowest adult obesity rate in the world (2% in 2016 according to WHO 2017),[35] but strong social norms conducive to childhood obesity have not been updated to reflect the health imperatives and recent dynamics among urban youth. Our findings are relevant to other countries undergoing nutrition transitions, some of which also display similar norms. For instance, focus group discussions conducted among mothers of Asian Indian schoolchildren revealed that it is common for mothers to state *"[a] child with chubby cheeks is healthy, not fat"* and that *"[m]ost of the obesity in children is baby fat, which would eventually go away*" (Gupta et al. 2012, p.57). In China, Wu et al. (2009 p.19) also point to a concerning *"lack of health knowledge on obesity, and traditional social attitudes towards body fatness."*

We conclude with an analysis of whether providing information enhanced with behavioral nudges is a cost-effective approach to mitigate the rise of childhood obesity in countries like Vietnam that are in the midst of a rapid nutrition transition. In 2019, we spent about €12,500 on the intervention package targeted at 360 children.[36] At a cost of about €35 per child, our intervention resulted in an average 0.832%-point reduction in body fat percentage after a period of 6 months (Table 2). Biener et al. (2020) estimated that, among U.S. children, an additional unit of BMI raises annual medical care costs by $82 (in 2019 dollars) or €74. Applying this estimate and recognizing that BMI and body fat are strongly correlated among children (Deurenberg et al. 1991), we find that our intervention may hold the potential to reduce yearly medical care spending in urban Vietnam by about €22 euros per child (0.832*(0.354)*€74).[37] Overall, then, our intervention resulted in a *net cost* of €13 euros per child (€22 - €35),[38] but this masks important heterogeneity since anthropometric improvements were concentrated among girls. Recall that we find that our intervention was followed by an average 1.712pp reduction in body fat percentage among girls after 6 months.[39] Considering only girls now, the potential reduction in annual medical care spending is much larger at €44 euros per girl (1.712*(0.348)*€74).[40] With a sizeable *net benefit* of €9 per girl (€44 - €35), this cost-benefit exercise suggests that scaling up the intervention to cover the estimated 117,402 overweight and obese girls currently attending primary schools in HCMC could potentially generate over €5 million in cost savings (or €1.1 million in total net benefits) per year for Vietnam's single-payer healthcare system.[41]

In Vietnam, the prevalence of overweight and obesity is higher among boys (Mai et al. 2020a; Mai et al. 2020b; Nam et al. 2020), so it is important for future research to identify interventions that can cost-effectively improve anthropometric status among boys. We found that parents prefer exercise adjustments for their sons. Given that our multifaceted nutrition-focused intervention had no impacts on the activity levels of boys (or girls), activity-focused interventions may hold greater promise to achieve healthier anthropometric status among boys. However, this may be a challenging goal in physically inactive countries like Vietnam (Vuong et al. 2018) and may require a combination of activity-focused information with financial incentives to lower the opportunity cost of exercise (Fricke et al. 2018; Marcus, Siedler, and Ziebarth 2022).

References

Aguilar Cordero, María José, Alberto Ortegón Piñero, Laura Baena García, Jessica Pamela Noack Segovia, María Cristina Levet Hernández, and Antonio Manuel Sánchez López. 2015. "[Rebound Effect of Intervention Programs to Reduce Overweight and Obesity in Children and Adolescents: Systematic Review.]" [In Spanish] *Nutricion Hospitalaria* 32(6):2508-2517.

Almond, Douglas, Ajin Lee, and Amy Ellen Schwartz. 2016. "Impacts of Classifying Students As Overweight." *Proceedings of the National Academy of Sciences* 113(13):3488-3491.

American Academy of Child & Adolescent Psychiatry 2020. "Screen Time and Children." Available at: https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Children-And-Watching-TV-054.aspx [Accessed 19 November 2020]

Anderson, Michael L. 2008. "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association* 103(484):1481-1495.

Anderson, Patricia M., Kristin F. Butcher, and Philip B. Levine. 2003. "Economic Perspectives on Childhood Obesity." *Economic Perspectives* 27(3):30-48.

Angelucci, Manuela, Silvia Prina, Heather Royer, and Anya Samek. 2019. "Incentives and Unintended Consequences: Spillover Effects in Food Choice." *American Economic Journal: Economic Policy* 11(4):66-95.

Ash, Tayla, Alen Agaronov, Ta'Loria Young, Alyssa Aftosmes-Tobio, and Kirsten K. Davison. 2017. "Family-based Childhood Obesity Prevention Interventions: A Systematic Review and Quantitative Content Analysis." *International Journal of Behavioral Nutrition and Physical Activity* 14(113):1-12.

Belot, Michèle, Jonathan James, and Patrick Nolen. 2016. "Incentives and Children's Dietary Choices: A Field Experiment in Primary Schools." *Journal of Health Economics* 50:213-229.

Benjamini, Yoav, and Yosef Hochberg. 1995. "Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing." *Journal of the Royal Statistical Society. Series B (Methodological)* 57(1):289-300.

Biener, Adam, John Cawley, and Chad Meyerhoefer. 2020. "The Medical Care Costs of Obesity and Severe Obesity in Youth: An Instrumental Variables Approach." *Health Economics* 29(5):624-639.

Black, Nicole, Robert Hughes, and Andrew M. Jones. 2018. "The Health Care Costs of Childhood Obesity in Australia: An Instrumental Variables Approach." *Economics and Human Biology* 31:1-13.

Cawley, John 2015. "An Economy of Scales: A Selective Review of Obesity's Economic Causes, Consequences, and Solutions." *Journal of Health Economics* 43:244-268.

Charness, Gary, Ramón Cobo-Reyes, Erik Eyster, Gabriel Katz, Ángela Sánchez, and Matthias Sutter. 2020. "Improving Healthy Eating in Children: Experimental Evidence." *IZA Working Paper* No.13999.

Cheng, Tsung-Mei. 2014. "Vietnam's Health Care System Emphasizes Prevention and Pursues Universal Coverage." *Health Affairs* 33(11):2057-2063.

Coupe, Nia, Sarah Peters, Sarah Rhodes, and Sarah Cotterill. 2019. "The Effect of Commitment-Making on Weight Loss and Behaviour Change in Adults with Obesity/Overweight: A Systematic Review." *BMC Public Health* 19(816):1-16.

Das, Jishnu, Quy-Toan Do, Karen Shaines, and Sowmya Srikant. 2013. "US and Them: The Geography of Academic Research." *Journal of Development Economics* 105:112-130.

de Quidt, Jonathan, Johannes Haushofer, and Christopher Roth. 2018. "Measuring and Bounding Experimenter Demand." *American Economic Review* 108(11):3266-3302.

Deurenberg, Paul, Jan A. Weststrate, and Jaap C. Seidell. 1991. "Body Mass Index as a Measure of Body Fatness: Age- and Sex-specific Prediction Formulas." *British Journal of Nutritio*n 65:105-114.

Doherty, Edel, Michelle Queally, John Cullinan, and Paddy Gillespie. 2017. "The Impact of Childhood Overweight and Obesity on Healthcare Utilization." *Economics and Human Biology* 27(Part A):84-92.

Ebbeling, Cara B., Dorota B. Pawlak, and David S. Ludwig. 2002. "Childhood Obesity: Public-Health Crisis, Common Sense Cure." *The Lancet* 360(9331):473-482.

Ehlert, Judith. 2019. "Obesity, Biopower, and Embodiment of Caring: Foodwork and Maternal Ambivalences in Ho Chi Minh City." In *Food Anxiety in Globalising Vietnam*, eds. Ehlert, Judith, and Nora Katharina Faltmann, 105-136. Singapore: Palgrave MacMillan.

Ells, Louisa J., Karen Rees, Tamara Brown, Emma Mead, Lena Al-Khudairy, Liane Azevedo, Grant J. McGeechan, Louise Baur, Emma Loveman, Heather Clements, Pura Rayco-Solon, Nathalie Farpour-Lambert, and Alessandro Demaio. 2018. "Interventions for Treating Children and Adolescents with Overweight and Obesity: An Overview of Cochrane Reviews." *International Journal of Obesity* 42(11):1823-1833.

Freedman, David S., Jack Wang, John C. Thornton, Zuguo Mei, Aviva B. Sopher, Richard N. Jr Pierson, William H. Dietz, and Mary Horlick. 2009. "Classification of Body Fatness by Body Mass Index–for-Age Categories Among Children." *Archives of Pediatrics & Adolescent Medicine* 163(9):805-811.

Fricke, Hans, Michael Lechner, and Andreas Steinmayr. 2018. "The Effects of Incentives to Exercise on Student Performance in College." *Economics of Education Review* 66:14-39.

Fryar, Cheryl D., Qiuping Gu, and Cynthia L. Ogden. 2012. "Anthropometric Reference Data for Children and Adults: United States, 2007–2010, National Center for Health Statistics." *Vital Health Statistics*, 11(252):1-48.

Gupta, Nidhi, Kashish Goel, Priyali Shah, and Anoop Misra. 2012. "Childhood Obesity in Developing Countries: Epidemiology, Determinants, and Prevention." *Endocrine Reviews* 33(1):48-70.

Heckman, James, Rodrigo Pinto, and Peter Savelyev. 2013. "Understanding the Mechanisms through which an Influential Early Childhood Program Boosted Adult Outcomes." *American Economic Review* 103(6):2052–2086.

Hernández-Reyes, Alberto, Fernando Cámara-Martos, Guillermo Molina Recio, Rafael Molina-Luque, Manuel Romero-Saldaña, and Rafael Moreno Rojas. 2020. "Push Notifications from a Mobile App to Improve the Body Composition of Overweight or Obese Women: Randomized Controlled Trial." *JMIR mHealth and uHealth* 8(2):e13747.

Hirvonen, Kalle. 2020. "This is US: Geography of Evidence in Top Health Economics Journals." *Health Economics* 29(10):1316-1323.

Hoffman, Daniel J. 2001. "Obesity in Developing Countries: Causes and Implications." *Food Nutrition and Agriculture* 28:35-44.

International Labour Organization (ILO). 2019. "Vietnam Labor Force Survey 2019." ILOSTAT explorer, available at: https://www.ilo.org/shinyapps/bulkexplorer13/?lang=en&segment=indicator&id=EAP_DWAP_SEX_AGE_GEO_RT_A [Accessed 27 August 2020]

Johns, David J., Jamie Hartmann-Boyce, Susan A. Jebb, Paul Aveyard, and Behavioural Weight Management Review Group. 2014. "Diet or Exercise Interventions vs Combined Behavioral Weight Management Programs: A Systematic Review and Meta-Analysis of Direct Comparisons." *Journal of the Academy of Nutrition and Dietetics* 114(10):1557–1568.

Just, David R., and Joseph Price. 2013. "Using Incentives to Encourage Healthy Eating in Children." *Journal of Human Resources* 48(4):855-872.

Kelishadi, Roya. 2007. "Childhood Overweight, Obesity, and the Metabolic Syndrome in Developing Countries." *Epidemiologic Reviews* 29:62-76.

Kinge, Jonas M., and Stephen Morris. 2018. "The Impact of Childhood Obesity on Health and Health Service Use." *Health Services Research* 53(3):1621-1643.

Kling, Jeffrey R., Jeffrey B. Liebman, Lawrence F. Katz, and Lisa Sanbonmatsu. 2004. "Moving to Opportunity and Tranquility: Neighborhood Effects on Adult Economic Self-sufficiency and Health from a Randomized Housing Voucher Experiment." *HKS Working Paper* RWP04-035.

Kobes, Annita, Tina Kretschmer, Greetje Timmerman, and Pauline Schreuder. 2018. "Interventions Aimed at Preventing and Reducing Overweight/Obesity among Children and Adolescents: A Meta-Synthesis." *Obesity Reviews* 19(8):1065-1079.

Kremer, Michael, Gautam Rao, and Frank Schilbach. 2019. "Behavioral Development Economics." In *Handbook of Behavioral Economics - Foundations and Applications*, eds. B.

Douglas Bernheim, Stefano DellaVigna, and David Laibson, 2:345-458. North Holland: Elsevier.

Lai, Chien-Yu, John A. List, and Anya Samek. 2020. “Got milk? Using Nudges to Reduce Consumption of Added Sugar.” *American Journal of Agricultural Economics* 102:154-168.

Lakdawalla, Darius, Tomas Philipson, and Jay Bhattacharya. 2005. “Welfare-Enhancing Technological Change and the Growth of Obesity.” *The American Economic Review* 95(2):253-257.

Lakdawalla, Darius, and Tomas Philipson. 2009. “The Growth of Obesity and Technological Change.” *Economics and Human Biology* 7(3):283-293.

Lawlor, Margaret-Anne, and Andrea Prothero. 2011. “Pester Power – A Battle of Wills between Children and their Parents.” *Journal of Marketing Management* 27(5-6):561-581.

Lawrence, Wendy, Christina Black, Tannaze Tinati, Sue Cradock, Rufia Begum, Megan Jarman, Anna Pease, Barrie Margetts, Jenny Davies, Hazel Inskip, Cyrus Cooper, Janis Baird, and Mary Barker. 2016. “'Making Every Contact Count': Evaluation of the Impact of an Intervention to Train Health and Social Care Practitioners in Skills to Support Health Behaviour Change.” *Journal of Health Psychology* 21(2):138-151.

List, John A., and Anya Samek, A. S. 2015. “The Behavioralist as Nutritionist: Leveraging Behavioral Economics to Improve Child Food Choice and Consumption.” *Journal of Health Economics* 39:135-135.

Liu, Yiming. 2019. “Effort Provision under Present Bias: Optimal Goal-Setting as a Commitment device.” *Mimeo,* available at: https://www.yimingliuecon.com/uploads/1/2/2/7/122790501/goal_setting__1_.pdf [Accessed 19 November 2020]

Madigan, Claire D., Amanda J. Daley, Amanda L. Lewis, Paul Aveyard, and Kate Jolly. 2015. “Is Self-Weighing an Effective Tool for Weight Loss: A Systematic Literature Review and Meta-Analysis.” *International Journal of Behavioral Nutrition and Physical Activity* 12(104):1-11.

Mai, Thi My Thien, D. Gallegos, L. Jones, Q.C. Tran, T. Tran, and J.C. van der Pols. 2020a. “The Utility of Anthropometric Indicators to Identify Cardiovascular Risk Factors in Vietnamese Children.” *British Journal of Nutrition* 123(9):1043-1055.

Mai, Thi My Thien, Ngoc Oanh Pham, Thi Minh Hanh Tran, Peter Baker, Danielle Gallegos, Thi Ngoc Diep Do, Jolieke C. van der Pols, and Susan J. Jordan. 2020b. “The Double Burden of Malnutrition in Vietnamese School-Aged Children and Adolescents: A Rapid Shift over a Decade in Ho Chi Minh City.” *European Journal of Clinical Nutrition* 74(10):1448-1456.

Marcus, Jan, Thomas Siedler, and Nicolas R. Zierbarth. 2022. “The Long-Run Effects of Sports Club Vouchers for Primary School Children.” *American Economic Journal: Economic Policy* 14(3): 128-165.

McGirr, Caroline, Ciara Rooney, Dunla Gallagher, Stephan U. Dombrowski, Annie S. Anderson, Christopher R. Cardwell, Caroline Free, Pat Hoddinott, Valerie A. Holmes, Emma McIntosh, Camilla Somers, Jayne V. Woodside, Ian S. Young, Frank Kee, and Michelle C. McKinley. 2020. "Text Messaging to Help Women with Overweight or Obesity Lose Weight after Childbirth: The Intervention Adaptation and SMS Feasibility RCT." *Public Health Research* 8(4).

McKenzie, David. 2018. "More on Experimenter Demand Effects." Available at: https://blogs.worldbank.org/impactevaluations/more-experimenter-demand-effects [Accessed 19 July 2021]

Nam, Pham Khanh, A. Sepehri, T.M. Le, and V.T. Tran. 2020. "Correlates of Body Mass Index among Primary School Children in Ho Chi Minh City, Vietnam." *Public Health* 181:65-72.

Park, So Hyun. 2017. "Asian Parents' Perception of Child Weight Status: A Systematic Review." *Journal of Child and Family Studies* 26(9):2363-2373.

Philipson, Thomas J., and Richard A. Posner. 2003. "The Long-run Growth in Obesity as a Function of Technological Change." *Perspectives in Biology and Medicine* 46(3):S87-S107.

Pitt, Catherine, Catherine Goodman, and Kara Hanson. 2016. "Economic Evaluation in Global Perspective: A Bibliometric Analysis of the Recent Literature." *Health Economics* 25(1):9-28.

Popkin, Barry M. 1994. "The Nutrition Transition in Low-income Countries: An Emerging Crisis." *Nutrition Reviews* 52(9):285-98.

Prina, Silvia, and Heather Royer. 2014. "The Importance of Parental Knowledge: Evidence from Weight Report Cards in Mexico." *Journal of Health Economics* 37:232-247.

Salam, Rehana A., Zahra A. Padhani, Jai K. Das, Amina Y. Shaikh, Zahra Hoodbhoy, Sarah Masroor Jeelani, Zohra S. Lassi, and Zulfiqar A. Bhutta. 2020. "Effects of Lifestyle Modification Interventions to Prevent and Manage Child and Adolescent Obesity: A Systematic Review and Meta-Analysis." *Nutrients* 12(8):2208.

Samek, Anya. 2019. "Gifts and Goals: Behavioral Nudges to Improve Child Food Choice at School." *Journal of Economic Behavior & Organization* 164:1-12.

Savage, Jennifer S., Jennifer O. Fisher, and Leann L. Birch. 2007. "Parental Influence on Eating Behavior: Conception to Adolescence." *Journal of Law, Medicine and Ethics* 35(1):22-34.

Simmonds, M., A. Llewellyn, C.G. Owen, and N. Woolacott. 2016. "Predicting Adult Obesity from Childhood Obesity: A Systematic Review and Meta-analysis." *Obesity Reviews* 17(2):95-107.

Staniford, Leanne J., Jeff D. Breckon, and Robert J. Copeland. 2012. "Treatment of Childhood Obesity: A Systematic Review." *Journal of Child and Family Studies* 21:545-564.

Steinberg, Dori M., Deborah F. Tate, Gary G. Bennett, Susan Ennett, Carmen Samuel-Hodge, and Dianne S. Warda. 2013. “The Efficacy of a Daily Self-Weighing Weight Loss Intervention using Smart Scales and E-mail.” *Obesity* 21(9):1789-1797.

Strecher, Victor J., Gerard H. Seijts, Gerjo J. Kok, Gary P. Latham, Russell Glasgow, Brenda DeVellis, Ree M. Meertens, and David W. Bulger. 1995. “Goal Setting as a Strategy for Health Behavior Change.” *Health Education Quarterly* 22(2):190-200.

Tremmel, Maximilian, Ulf-G. Gerdtham, Peter M. Nilsson, and Sanjib Saha. 2017. “Economic Burden of Obesity: A Systematic Literature Review.” *International Journal of Environmental Research and Public Health* 14(4):1-18.

Vidmar, Suzanna I., Tim J. Cole, and Huiqi Pan. 2004. “Standardizing Anthropometric Measures in Children and Adolescents with New Functions for egen.” *Stata Journal* 4(1):50-55.

Vuong, Quan-Hoang, Anh-Duc Hoang, Thu-Trang Vuong, Viet-Phuong La, Hong Kong T.Nguyen, and Manh-Tung Ho. 2018. “Factors Associated with the Regularity of Physical Exercises as a Means of Improving the Public Health System in Vietnam.” *Sustainability* 10(11):1-15.

Wagstaff, Adam, and Anthony J. Culyer. 2012. “Four Decades of Health Economics Through a Bibliometric Lens.” *Journal of Health Economics* 31(2):406-439.

Whitaker, Robert C., Jeffrey A. Wright, Margaret S. Pepe, Kristy D. Seidel, and William H. Dietz. 1997. “Predicting Obesity in Young Adulthood from Childhood and Parental Obesity.” *New England Journal of Medicine* 337(13):869-873.

World Health Organization (WHO). 2017. “Global Health Observatory Data Repository.” Available at: https://apps.who.int/gho/data/view.main.REGION2480A?lang=en [Accessed 19 November 2020]

Wu, Yangfeng, Rachel Huxley, Ming Li, and Jun Ma. 2009. “The Growing Burden of Overweight and Obesity in Contemporary China.” *CVD Prevention and Control* 4(1):19-26.

Table 1: Baseline balance

			Reg. Effect	N	(1) Overall	(2) Control	(3) Treatment	(4) P-value	(5) Q-value
Primary outcomes families	*(1)*	BMI z-score	-	727	2.319	2.319	2.318	0.99	0.99
		Overweight or obese	-	727	0.945	0.948	0.942	0.74	0.99
		Obese	-	727	0.651	0.67	0.631	0.27	0.99
		Waist (in cm)	-	725	72.867	72.781	72.953	0.75	0.99
		Body fat (in %)	-	728	34.954	34.935	34.974	0.94	0.99
	(2)	Snack choice (cookie=1, fruit=0)	-	726	0.638	0.632	0.644	0.74	0.74
	(3)	Children are born to be fat (strongly disagree or disagree=1, otherwise=0)	+	679	0.633	0.628	0.639	0.78	0.99
		Vegetables needed each day (in g, log)	+	496	5.162	5.13	5.194	0.64	0.99
		Fruits needed each day (in g, log)	+	498	4.978	4.953	5.004	0.67	0.99
		Calories needed each day (log)	-	362	6.321	6.32	6.323	0.99	0.99
	(4)	*Past 30 days, nr. of:*							
		Meals in "western style" fast-food or pizza place	-	677	1.498	1.555	1.438	0.46	0.69
		Ready to eat food meals from grocery store	-	677	2.641	2.406	2.886	0.18	0.54
		Frozen meals/pizzas	-	674	0.849	0.858	0.839	0.92	0.92
		*Past 7 days, nr. of days (days at home **plus** days outside excl. school):*							
		Consumed soft drinks	-	677	1.835	1.714	1.961	0.12	0.54
		Consumed fruit	+	677	3.984	3.971	3.997	0.91	0.92
		Consumed green vegetables	+	676	4.417	4.306	4.533	0.34	0.68
Secondary outcomes families	*(1)*	Perceived healthiness of child's diet (excellent or very good=1, otherwise=0)	~	680	0.296	0.294	0.297	0.92	0.92
		Perceived healthiness of child's current weight (healthy=1, no=0)	~	680	0.791	0.761	0.823	0.05	0.10
	(2)	*Past 30 days, spending on (log):*							
		Sweet snacks	-	556	0.482	0.447	0.519	0.07	0.21
		Salty snacks	-	552	0.352	0.342	0.362	0.59	0.84
		Soft drinks	-	549	0.284	0.288	0.28	0.84	0.84
	(3)	*Past 7 days, nr. of:*							
		Hours TV, video games, other electronic devices	-	678	14.493	14.703	14.274	0.78	0.84
		Days physically active for a total of at least 20 minutes	+	679	2.389	2.294	2.488	0.24	0.72
		Days walking/biking for at least 10 minutes	+	674	2.223	2.239	2.205	0.84	0.84

Note: Q-values by family of indicators as indicated by horizontal dividers. "Reg. Effect" means effect direction registered in AEA RCT Registry.

Table 2: Anthropometrics and snack choice

	(1) BMI z-score	(2) Overweight or obese	(3) Obese	(4) Waist (in cm)	(5) Body fat (in %)	(6) Average effect (1 to 5)	(7) Snack choice (cookie=1, fruit=0)
Overall							
Control mean	*2.28*	*0.96*	*0.64*	*75.43*	*35.93*		*0.46*
Treatment	-0.036	-0.030**	0.018	-0.613*	-0.832***	-0.073**	-0.049
	(0.027)	(0.015)	(0.025)	(0.327)	(0.278)	(0.033)	(0.036)
Q-value	0.22	0.10	0.47	0.10	0.02		
N	675	675	675	676	678		677
Boys							
Control mean	*2.50*	*0.98*	*0.74*	*77.07*	*35.85*		*0.53*
Treatment	0.031	-0.011	0.047	-0.162	-0.200	0.003	-0.045
	(0.039)	(0.014)	(0.032)	(0.429)	(0.401)	(0.046)	(0.048)
Q-value	0.71	0.71	0.71	0.71	0.71		
N	390	390	390	392	393		392
Girls							
Control mean	*1.95*	*0.92*	*0.50*	*73.01*	*36.04*		*0.37*
Treatment	-0.126***	-0.058*	-0.034	-1.065**	-1.712***	-0.185***	-0.050
	(0.036)	(0.030)	(0.040)	(0.530)	(0.375)	(0.052)	(0.054)
Q-value	0.00	0.07	0.41	0.07	0.00		
N	285	285	285	284	285		285

Note: *** p<0.01, ** p<0.05, * p<0.1. OLS estimates. Robust standard errors in brackets below estimates. All covariates, reduced sample. Q-values are calculated over columns 1 to 5 as preregistered.

Table 3: Diet

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Past 30 days			Past 7 days			
	Meals in "western style" fast-food or pizza place	Ready to eat food meals from grocery store	Frozen meals/pizzas	Consumed soft drinks	Consumed fruit	Consumed green vegetables	Average effect (in SD)
Overall							
Control mean	*1.29*	*3.13*	*0.68*	*1.73*	*4.05*	*4.83*	
Treatment	-0.143	-0.308	-0.212*	-0.343*	0.216	0.296	-0.098**
	(0.140)	(0.359)	(0.128)	(0.189)	(0.281)	(0.339)	(0.040)
Q-value	0.44	0.44	0.30	0.30	0.44	0.44	
N	621	612	605	394	354	338	
Boys							
Control mean	*1.29*	*3.20*	*0.63*	*1.74*	*3.99*	*4.89*	
Treatment	-0.260	-0.424	-0.021	-0.294	0.149	-0.085	-0.065
	(0.201)	(0.458)	(0.200)	(0.267)	(0.345)	(0.462)	(0.051)
Q-value	0.71	0.71	0.92	0.71	0.92	0.92	
N	356	353	349	228	205	190	
Girls							
Control mean	*1.30*	*3.02*	*0.77*	*1.72*	*4.12*	*4.74*	
Treatment	-0.012	-0.163	-0.462***	-0.409	0.218	0.571	-0.124**
	(0.205)	(0.591)	(0.160)	(0.276)	(0.491)	(0.514)	(0.062)
Q-value	0.95	0.94	0.02	0.42	0.94	0.54	
N	265	259	256	166	149	148	

Note: Effects in columns 5 and 6 enter negatively into the average effect calculation. *** p<0.01, ** p<0.05, * p<0.1. OLS estimates. Robust standard errors in brackets below estimates. All covariates, reduced sample. Q-values are calculated over columns 1 to 6 as preregistered.

Table 4: Perceptions

	(1) Perceived healthiness of child's diet (excellent or very good=1, otherwise=0)	(2) Perceived healthiness of child's current weight (healthy=1, no=0)	(3) Average effect (in SD)
Overall			
Control mean	*0.34*	*0.74*	
Treatment	-0.083**	-0.039	-0.132**
	(0.036)	(0.034)	(0.054)
Q-value	0.04	0.24	
N	634	637	
Boys			
Control mean	*0.34*	*0.75*	
Treatment	-0.090*	-0.028	-0.126*
	(0.047)	(0.045)	(0.072)
Q-value	0.12	0.54	
N	363	366	
Girls			
Control mean	*0.35*	*0.74*	
Treatment	-0.056	-0.059	-0.125
	(0.057)	(0.051)	(0.084)
Q-value	0.33	0.33	
N	271	271	

Note: *** p<0.01, ** p<0.05, * p<0.1. OLS estimates. Robust standard errors in brackets below estimates. All covariates, reduced sample. Q-values are calculated over columns 1 to 2 as preregistered.

Table 5: Anthropometrics (longer term, second follow-up)

	(1) BMI z-score	(2) Overweight or obese	(3) Obese	(4) Waist (in cm)	(5) Body fat (in %)	(6) Average effect (in SD)
Overall						
Control mean	*2.21*	*0.95*	*0.63*	*79.62*	*36.83*	
Treatment	0.034	0.004	0.044	-0.217	-0.175	0.020
	(0.038)	(0.018)	(0.038)	(0.495)	(0.418)	(0.047)
Q-value	0.83	0.83	0.83	0.83	0.83	
N	420	420	420	419	421	
Boys						
Control mean	*2.43*	*0.95*	*0.77*	*81.56*	*37.41*	
Treatment	0.099**	0.036	0.032	0.265	0.390	0.095
	(0.049)	(0.023)	(0.041)	(0.630)	(0.557)	(0.058)
Q-value	0.23	0.30	0.61	0.68	0.61	
N	240	240	240	240	241	
Girls						
Control mean	*1.87*	*0.96*	*0.41*	*76.53*	*35.91*	
Treatment	-0.105*	-0.064**	0.083	-1.229	-1.518**	-0.158**
	(0.056)	(0.028)	(0.066)	(0.812)	(0.638)	(0.073)
Q-value	0.10	0.06	0.21	0.17	0.06	
N	180	180	180	179	180	

Note: *** p<0.01, ** p<0.05, * p<0.1. OLS estimates. Robust standard errors in brackets below estimates. All covariates, reduced sample. Q-values are calculated over columns 1 to 5 as preregistered.

Figure 1: Schematic of key intervention activities

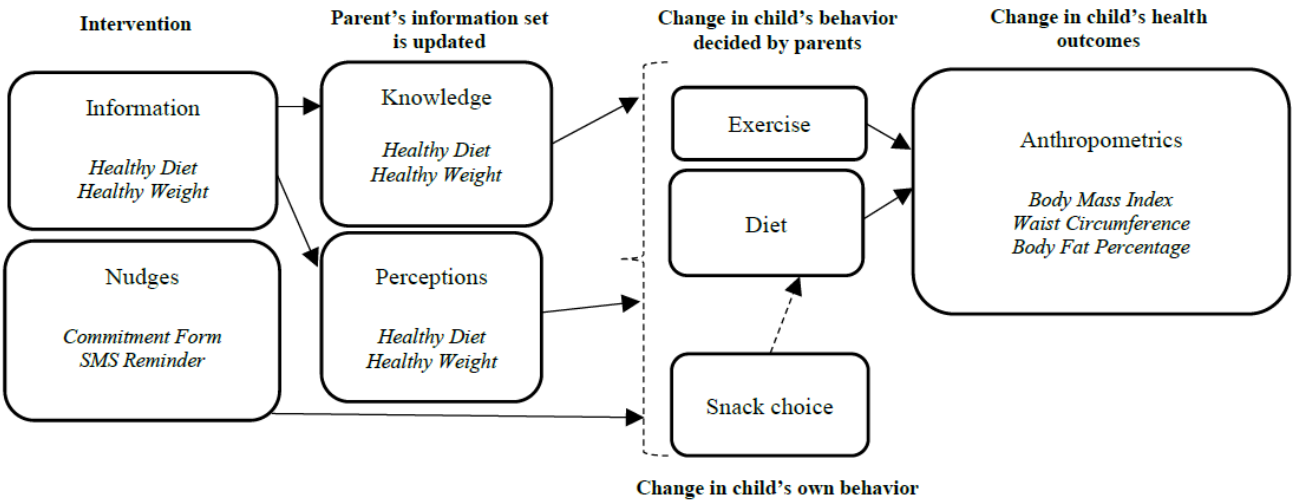
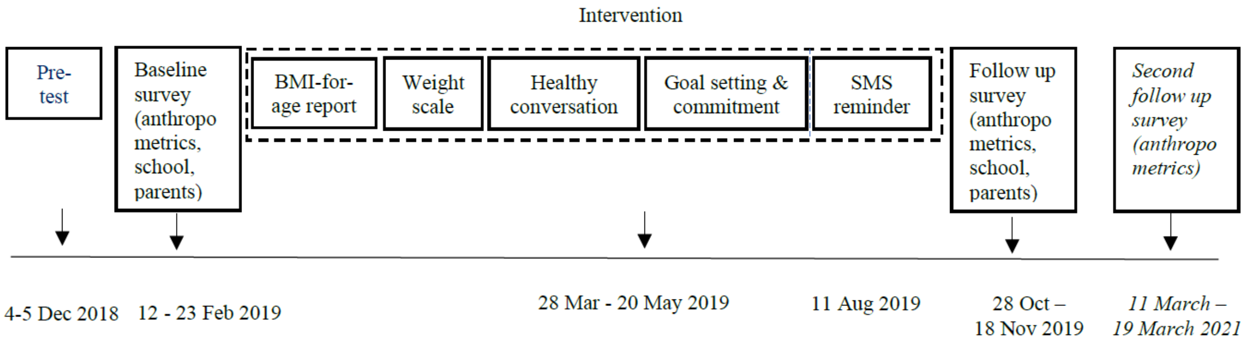


Figure 2: Timeline of data collection and intervention activities



Note: Activities until November 2019 in the timeline were registered in the AEA trial registry. Planned dates of the study, intervention, and first follow-up survey deviated from actual dates due to unforeseen practical/logistical reasons. The trial registry status was changed to "completed" on 27 September 2020 after a first draft of the paper was completed. The *italicized* part or second follow-up survey was done after completion of the AEA-registered activities and analysis. We publicly registered this second follow-up and research hypothesis/questions on 10 March 2021 on aspredicted.org.

Notes

---

[1] See Online Appendix A for an expanded background and review of the related literature.
[2] Risk factors for obesity at baseline also raise concerns (e.g., nontrivial household spending on unhealthy foods, high screen time, and low physical activity levels).
[3] Exercise improvement in Vietnam may also be particularly difficult to achieve since average physical activity levels in Vietnam are well below the global average (Vuong et al. 2018).
[4] The Nutrition Center of HCMC conducts research, informs the nutrition policies of the HCMC government, and provides nutrition services. It is the biggest nutrition center in the South of Vietnam and has been under the HCMC Center for Disease Control since May 2019.
[5] Example recommendations include encouraging more playtime after school, walking instead of taking the bus to school, reducing sugary drink consumption, and eating out less at western-style restaurants.
[6] We used the *zanthro* package in Stata by Vidmar, Cole and Pan (2004) to calculate BMI-for-age and overweight/obesity indicators based on WHO's 2006 child growth standards.
[7] Note that although we pre-registered measured sagittal abdominal diameter (SAD), we decided not to move forward with SAD measurement after consultation with our nutrition and data collection experts. Waist circumference covers this closely associated anthropometric measure and measurement time per child was already deemed to be lengthy by the experts.
[8] We initially planned and pre-registered slices of mango. For logistical reasons, a tangerine was used as the healthy snack.
[9] NHANES questionnaires are available at: https://www.ers.usda.gov/topics/food-choices-health/food-consumption-demand/flexible-consumer-behavior-survey/ and BRFSS questionnaires are available at: https://www.cdc.gov/brfss/questionnaires/index.htm [Both accessed May 25 2017].
[10] We performed the calculation in R-Cran 3.1.2 using library(pwr) and command pwr.t.test(d = 0.21, sig.level = 0.05, power = 0.8).
[11] An additional 80 children were also pre-registered from one "pure control" school for an exploratory analysis, but in practice we ended up with 100 children. We discuss this special sample in detail in the robustness section below, where we carefully investigate and find no evidence of treatment spillovers that could otherwise have caused attenuation of treatment effects.
[12] The analysis sample is smaller due to random missingness or attrition as we detail in Online Appendix E.
[13] This includes six schools chosen for the intervention and one "pure control" school. There were no school-specific nutrition programs in place at the time of the study that may confound our experiment. In Vietnam, educational and nutrition programs need approval by the Department of Education and are centrally planned and managed. Across HCMC schools, a milk program started in 2019, which was targeted at kindergarten and first graders. For these younger children, milk had to be augmented with 21 micronutrients as per government mandate. That said, our intervention was individually randomized, and the milk program therefore does not impact the internal validity of our findings.
[14] "Can information enhanced with nudges mitigate childhood overweight?" (#58638), registered publicly 10 March 2021, one day before data collection began in schools and is available at https://aspredicted.org/me386.pdf.
[15] See Online Appendix E for a discussion of an analysis of missing data and attrition that is summarized in Tables A1-A3. We find no evidence of systematic missingness or attrition in our data. As pre-registered, given that baseline data missingness is well balanced by treatment

status and attrition is below 10%, we make no adjustments that would be required in the case of substantial and systematic missingness.

[16] We use the Stata do-file by Michael L. Anderson, available at http://are.berkeley.edu/~mlanderson/downloads/fdr_qvalues.do.zip [Accessed May 25 2017].

[17] These include child (age in months, gender), parental (survey respondent relationship to child, education, age, work status, height), and household (family size, home ownership, number of bedrooms) variables. We have a few missing observations for some of these demographic and socio-economic variables, which are however well balanced between treated and control units (tests reported in replication do-file). We impute missing observations with the sample mean and account for this imputation with a missing observation dummy for each variable.

[18] While we study a treatment "package", the different sub-components were administered at different times and in the case of weight scales and report cards may have been received by different household members. They were simply sent to homes, but the survey may have been answered by a parent unaware that a scale or card had arrived some time ago. Unfortunately, we do not have data on who exactly received or did not receive or possibly rejected these items.

[19] Dietary goals include increasing intake of fruits and vegetables, drinking more water and unsweetened milk, increasing food portions in healthier forms (boiled, steamed, or in cooked soups), not giving children sweets (cake, candy, ice cream, and soft drinks), not letting children eat after 9pm, cutting back on fatty foods and sugar, and limiting fried and fast foods.

[20] Activity goals include encouraging children to get one or more hours of exercise per day, encouraging children to be more active, and limiting screen time to less than two hours per day.

[21] For brevity, we do not discuss results from linear regression models that feature only a constant, a treatment dummy, and no additional regressors. However, see Table A7 for results from unconditional models and Online Appendix F for a brief discussion. We unsystematically miss a few observations for the lagged dependent variable (Table A1). Therefore, unconditional models are performed on the full sample and the reduced sample for which information on lagged dependent variables and the set of baseline demographic and socio-economic covariates is available.

[22] In Online Appendix G, we estimate quantile regressions for the continuous anthropometric outcomes, but find no clear patterns across the BMI-for-age, body fat percentage, and waist circumference distributions.

[23] To account for time-invariant unobserved heterogeneity at the school level, we also re-ran the Table 2 specifications with school fixed effects. Findings are nearly identical and available upon request and documented in the replication do-file.

[24] A rough calculation converts this amount into weight units. In the control group, average body weight is 43.44kg and body fat is 35.93% or 15.61kg; a 0.832% fat reduction amounts to 130g or almost one-third of a pound.

[25] The effect becomes marginally significant in some specifications that we explored (unregistered analysis). For instance, processed snack choice and overweight/obesity status at baseline are positively and negatively correlated, respectively, with snack choice at follow up. These baseline variables together explain 13% of the variation in snack choice. If we control for snack choice and overweight/obesity status at baseline, the treatment effect of -5.9pp is marginally significant (p-value=0.10).

[26] The *Cohen's h* is about 0.05, while we were powered (without covariates) for 0.21. We would have required an infeasible 6,280 observations in this effect range.

[27] As shown in Table A14 and discussed in Online Appendix J, we find no evidence that the treatment brought about changes in the "extensive margin" of reporting (i.e. the likelihood of reporting missing or zero expenditure). Similarly, at baseline, we find that such non or zero

answers to the survey are very well balanced at conventional levels (results are available upon request and documented in the replication do-file).

[28] Note that the average effect reflects an improvement in knowledge. The variable concerning calorie knowledge in column 4 has been reverse coded to that effect.

[29] A conference discussant suggested that we use the typical WHO recommendation of 400g vegetable and fruit intake per day (adult equivalent). We find that 70% of control parents gave a much lower amount (<100g) or no answer at all to the combined fruit/vegetable intake question at first follow-up. In the treatment group, the proportion was not statistically different. Likewise, conditional on answering the question, 21% of control parents reported at least 400g and in the treatment group the proportion was statistically indistinguishable.

[30] The cutoff birthdate is 1 Jan to 31 Dec. Schools started the year on 1 September.

[31] Previous intervention studies among youth have reported rebound patterns characterized by an initial BMI decrease followed by subsequent overshooting (e.g., see systematic review by Aguilar Cordero et al. 2015). However, this is not a compelling story here because our shorter run follow-up analysis did not show any beneficial anthropometric effects among boys and the longer run follow-up analysis does not show a consistent harmful effect across anthropometric measures.

[32] The estimated effect when boys and girls were pooled was −0.12 [−0.16; −0.08], see Kobes et al. (2018, p.1074).

[33] Another related avenue for future research is to investigate whether there are differences in how information-based interventions impact externalizing behaviors that matter for parent-child food choice interactions specifically (Lawlor and Prothero 2011) and health behaviors more generally (Heckman et al. 2013).

[34] Within a higher-income context, Almond, Lee, and Schwartz (2016) estimated the effect of BMI report cards on the BMI of schoolchildren in New York City and found that overweight categorization led to a modest impact on subsequent BMI among females but not males – a gender pattern that aligns well with our findings – although they were unable to determine whether BMI knowledge or perception changes among parents drove these results.

[35] In an unregistered and exploratory analysis, we estimated small and insignificant effects of our intervention on self-reported parental BMI and overweight/obesity status, which is unsurprising given the information provided to parents concerned their children.

[36] About 7,000 euros went to the entire nutrition counseling program (including follow-up SMS reminders) and the remainder went to equipment costs.

[37] Using our baseline data, we estimated the following relationship between BMI and body fat percentage (BF%): $BMI = 0.354BF\% + 0.359 * AGE\_YR + 0.965 * BOY + 5.95$. The partial derivative with respect to $BF\%$ is 0.354, i.e., holding AGE_YR and BOY constant, a 1pp rise in $BF\%$ increases BMI by 0.354. For simplicity, in our calculation, we use the approximation $BMI = 0.354BF\%$, so a 0.832%-point drop is expected to reduce BMI by 0.295 units. Note that our cost-benefit analysis relies on the assumption that the weight-expenditure relationship in the U.S. and HCMC is the same. While we cannot test this assumption due to a lack of comparable data for Vietnam, it is noteworthy that studies using Australian, Irish, and English data have also found evidence to support a positive causal impact of childhood obesity on healthcare use and costs (Black, Hughes, and Jones 2018; Doherty et al. 2017; Kinge and Morris 2018).

[38] We do not include other costs we incurred in these calculations (e.g., baseline and follow-up surveys) since they cover both treated and control groups and note that the intervention has benefits that go well beyond anthropometric improvements (e.g. an evidence base for a citywide or even nationwide risk factor surveillance system).

[39] We use the shorter run body fat estimate since it applies to our broader sample; however, our conclusions of a sizeable net benefit among girls holds firm when applying the slightly smaller longer run body fat estimate.

[40] Using our baseline data for girls, the regression used for the *BMI-BF%* relationship is as follows: $BMI = 0.348BF\% + 0.470*AGE\_YR + 5.21$. We use the approximation $BMI = 0.348BF\%$.

[41] According to the 2019 *Vietnam Population and Housing Census* (available at: https://www.gso.gov.vn/en/data-and-statistics/2020/11/completed-results-of-the-2019-viet-nam-population-and-housing-census/, accessed May 25 2017), there were 291,321 girls attending primary school in 2019. Applying our intervention's cost-savings estimate to the estimated share of primary school girls who are overweight or obese (40.3% according to Nam et al. (2020)) suggests that our intervention may hold the potential to unlock €5,165,704 (€44 euros×0.403×291,321) in annual cost savings for Vietnam's healthcare system.