

**Healthy menu changes and healthy meal promotions in restaurants: evaluating consumer responses and industry trends over the past decade**

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## ABSTRACT

In recent years, as parents have become more time-constrained, and American families acquire much more of their food away from home, the health of our next generation depends on having more nutritious food offerings in restaurants. Children's meals from restaurants are higher in calories, saturated fat, sodium, and added sugars than meals prepared at home. Restaurant meals are also prevalent in the diets of American children, with 34% of children estimated to eat fast food meals on a given day. Recent changes in the prevalence of healthy side and beverage options on children's restaurant menus have been noted, but trends in the availability of healthy sides and beverages over time are poorly understood. While some evidence suggests that the nutritional quality of children's meal orders improves after healthy menu changes, there is a limited understanding of the differences in how children respond to healthy children's menus. Moreover, it is unclear if promotional campaigns aimed at improving the quality of children's meal orders will also positively impact what their parents order either via priming or parents' desire to serve as a role model. The objective of this dissertation was to evaluate 1) meal orders after a healthier children's menu change within a regional restaurant chain, 2) parent orders in a national quick-service restaurant after the implementation of a community campaign aimed at promoting healthier orders for their children, and 3) healthy side and beverage menu changes across a sample of national restaurant chains from 2004 to 2015.

In Aim 1, we utilized latent class analysis to evaluate individual differences in the patterns of child meal orders from a regional restaurant chain with a new, healthier children's menu. Linear mixed models were used to evaluate differences in the calorie content of orders in each class. We uncovered six distinct classes of ordering patterns. Most orders (57.9%) were in classes that were consistent with the healthier menu and were more likely to meet calorie recommendations. Ordering patterns comprised of less healthy items also emerged, and included individuals who made substitutions for healthier items or added less healthy items to their meals.

Aim 2 evaluated using a randomized controlled design the potential spillover effects of a community campaign aimed at promoting healthier orders for children. Difference-in-differences analyses were conducted to evaluate differences in the calories of parent orders overall ( $n=1533$ ) and by subgroups specific to the campaign's intended audience. We found no significant differences in the change in calories ordered by parents from before to after the campaign in the intervention community compared to the control in all analyses.

Aim 3 described the availability on the menu of healthy sides and beverages over the past 11 years in a subset of quick service restaurants (QSRs) at the national level, along with co-occurring policy trends. The percentage of meal bundles with healthy sides increased from 25.0 to 82.5% between 2004 and 2015; meals bundles with healthy beverages increased from 50.0 to 75.0% during that same time. Healthy menu changes coincided with periods of high policy activity and occurred initially in the largest QSR chains in or prior to 2004.

This research indicates side and beverage options on the leading QSR menus have become healthier over time. Yet the potential for differential responses to healthier menus suggests the need to consider which children are ordering these items and in which contexts. The absence of spillover from the campaign aimed at improving children's menu orders indicates that to also influence parent orders, strategies that explicitly ask them to consider their own ordering habits as part of interventions targeting children's meals in restaurants may need to be considered. Future research and interventions should examine multiple levels of influence on the nutrition quality of children's restaurant meals.

## Table of Contents

Acknowledgements .....	2
Abstract .....	3
List of Tables .....	6
List of Figures.....	7
Chapter 1: Introduction .....	8
Statement of the Problem Studied and Its Significance .....	8
Chapter 2: Review of the Literature .....	11
Overview.....	11
Factors Influencing Healthy Menu Changes in the Restaurant Setting .....	13
Factors Influencing What Children Order in Restaurants .....	15
Conclusions.....	17
Chapter 3: Methods .....	19
Aim 1: Silver Diner healthy children’s menu change, dataset, and analyses .....	22
Aim 2: <i>You’re the Mom</i> campaign, dataset, and analyses .....	26
Aim 3: Technomic’s MenuMonitor dataset and analyses .....	31
Chapter 4: Ordering Patterns Following the Implementation of a Healthier Children’s Restaurant Menu: A Latent Class Analysis .....	36
Abstract .....	38
Introduction .....	39
Methods.....	41
Results .....	45
Discussion.....	47
Chapter 5: Evaluating spillover effects on parent orders from a campaign aimed at empowering moms to select healthier restaurant meals for their children.....	59
Abstract .....	60
Introduction .....	62
Methods.....	64
Results .....	69
Discussion.....	70
Chapter 6: Healthy sides and beverages on children’s menus between 2004 and 2015: a descriptive analysis of industry trends and concurrent policy efforts .....	82
Abstract .....	83
Introduction .....	84
Methods.....	86
Results .....	90
Discussion.....	91
Chapter 7: Summary and Discussion .....	102
Appendix 1 Silver Diner’s Healthier Kid’s Menu .....	147

Appendix 2 Recruitment materials and surveys for the evaluation of the <i>You're the Mom</i> campaign.....	148
2A. Recruitment script for data collection before and after the campaign was implemented (PRE) .....	149
2B. Recruitment script for data collection before and after the campaign was implemented (POST).....	151
2C. Survey for the control and intervention community before the campaign was implemented (PRE) .....	152
2D. Survey for the control community after the campaign was implemented (POST) .....	155
2E. Survey for the intervention community after the campaign was implemented (POST) .....	159
Appendix 3 Chapter 6 Supplementary Figures .....	164
Supplementary Figure 6 1 A) The average percentage of meal bundles with non-fruit or vegetable (non-FV) sides included by default (S1A) and B) the average percentage of meal bundles with a sugary drink included by default (S1B).....	164
Supplementary Table 6 1 Nutrition-related policy efforts that were omitted from this analysis because they did not legislate menus or menu offerings.....	165

## **LIST OF TABLES**

### **Chapter 4**

Table 4 1 Criteria to Assess Model Fit for Latent Class Analysis Model .....	37
Table 4.2 Class Membership and Conditional Item-Response Probabilities for Six Latent Classes of Children's Ordering Patterns.....	53
Table 4 3 Top Five A La Carte Side Items added to Orders, by Menu Section (Breakfast, Non-breakfast Entrees).....	54
Table 4 4. Top Five Side Substitution Items included in Orders by Menu Section (Breakfast, Non-Breakfast Entrées) .....	55
Table 4 5 The Percentage of Orders that Met or Exceeded Calorie Recommendations in Each Ordering Class .....	56

### **Chapter 5**

Table 5 1 Demographic and select behavioral characteristics of parents and children at baseline and follow up.....	76
Table 5 2 Difference in differences estimates of the impact of the <i>You're the Mom</i> campaign on calories ordered for all parents (All Parents, Intent to Treat) .....	78
Table 5 3 Difference in differences estimates of the impact of the <i>You're the Mom</i> campaign on calories ordered for moms (Moms Only, Intent to Treat) .....	79
Table 5 4 Difference in differences estimates of the impact of the <i>You're the Mom</i> campaign on calories ordered among those moms who were exposed to the campaign (Moms Only).....	80
Table 5 5 Priority population difference in differences estimates of the impact of the <i>You're the Mom</i> campaign on calories ordered.....	81

### **Chapter 6**

Table 6 1 Average number of á la carte and bundled healthy and non-healthy side and beverage offerings in 2004 and 2015 .....	97
--	----

### **Appendix**

Supplementary Table 6 1 Nutrition-related policy efforts that were omitted from this analysis because they did not legislate menus or menu offerings.....	165
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## **LIST OF FIGURES**

### **Chapter 3**

Figure 3 1 Conceptual Model .....	19
-----------------------------------	----

### **Chapter 4**

Figure 4 1 Average total calorie content of meal orders in each of the six ordering classes. .	57
Figure 4 2 The distribution of orders that met or exceeded calorie recommendations (based on the total meal being $\leq 600$ calories) for each ordering class. ....	58

### **Chapter 5**

Figure 5 1 An example advertisement from the You're the Mom campaign. ....	75
Figure 5 2. Differences in calories ordered between parents at baseline and follow up in the two communities. ....	77

### **Chapter 6**

Figure 6 1 The average percentage of meal bundles with fruit or vegetable sides included as a side option and the average percentage of meal bundles with fruit or vegetable sides included as a side option weighted by each restaurant's relative contribution to the system wide sales each year (A). The average percentage of meal bundles with non-sugary beverages included as a beverage option and the average percentage of meal bundles with non-sugary beverages included as a beverage option weighted by each restaurant's relative contribution to the system wide sales each year (B). ....	98
Figure 6 2 The average percentage of meal bundles with a fruit or non-fried vegetable sides included by default (A) and the average percentage of meal bundles with a non-sugary drink included by default (B). ....	99
Figure 6 3 A timeline and histogram of policy efforts and healthy menu changes between 2003 and 2013. ....	100

### **Appendix**

Supplementary Figure 6 1 The average percentage of meal bundles with non-fruit or vegetable (non-FV) sides included by default (S1A) and the average percentage of meal bundles with a sugary drink included by default (S1B). ....	164
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## CHAPTER 1. INTRODUCTION

### Statement of the Problem Studied and Its Significance

Frequent restaurant meals are a reality for many US families, but are also associated with poor overall diet quality and excess weight gain in children<sup>1-5</sup>. According to the most recent National Health and Nutrition Examination survey, approximately one third of US children (about 25.3 million individuals) consume meals from quick service restaurants (QSRs) every day<sup>6</sup>. Eating meals outside of the home is associated with higher intakes of calories, sugar, saturated fat, and sodium<sup>3,7,8</sup>; a higher likelihood of following a Western dietary pattern characterized by higher intakes of refined grains, added sugars, and processed meats<sup>9</sup>; and with larger longitudinal increases in BMIz-score among children and adolescents<sup>4</sup>. High frequencies of dining out are especially prevalent among low-income and African American youth<sup>8-10</sup>, populations that are also at higher risk for obesity, cardiovascular disease, and other diet-related chronic diseases compared to higher income and Non-Hispanic White youth<sup>11</sup>. Given that many families have constraints that make dining out a necessity<sup>12</sup>, it is important to gain a better understanding of factors that can improve the quality of children's restaurant meals.

Evidence suggests that changing restaurant menus to be more in line with nutrition recommendations can impact the quality of child meal orders<sup>13-15</sup>. Recent literature on food away from home demonstrates that there have been some improvements in the nutrition quality of adult and children's menu items over the last 17 years<sup>16-23</sup>, with improvements seen to a greater extent in new menu items compared to existing menu items (between 2012 and 2013<sup>18</sup>), in quick service restaurants (QSRs) compared to full-service restaurants (in 2005-2006<sup>19,20</sup> and 2010<sup>21</sup>), and in side items compared to entrées (in 2013<sup>22</sup>). Evaluations of



interventions that can improve the quality of parents' meal orders in restaurants have not yet been conducted, yet are warranted since parents can impact the quality of children's restaurants meals through food-related parenting practices<sup>24,25</sup> and role modeling<sup>26</sup>. Moreover, consumption data suggest that meals away from home continue to be longitudinally associated with excess intakes of kcal, total fat, saturated fat, cholesterol and sodium<sup>27-29</sup>, highlighting the need for further changes to the nutrition quality of meal offerings in this setting and/or the stronger promotion of healthier options that are already available.

The central motivation for this research is to uncover ways to improve the quality of children's meals at restaurants through evaluations of healthy menu changes and healthy children's meal promotions. As such, the objective of this dissertation is to evaluate changes in the availability of healthier side and beverages on children's menus across a sample of national restaurant chains, child meal ordering patterns after the introduction of a healthier children's menu in a regional restaurant chain, and the change in parent orders in a national quick-service restaurant after the introduction of a campaign promoting healthier children's menu options. We hypothesize that trends in healthy children's menu changes over the last decade have varied over time and by restaurant brand in the QSR setting and that local, state, and national policy efforts have coincided with these changes (Aim 3); that multiple ordering patterns will emerge in response to the implementation of a healthier children's menu (referred to herein as SD 2.0) at the Silver Diner, a regional full-service restaurant chain (Aim 1); and that a campaign which aims to motivate moms to choose healthier menu options for their kids when eating in restaurants will be associated with spillover - lower calorie parent orders (Aim 2). The proposed research aims to: 1) identify longitudinal industry trends in

healthy menu changes by examining the children's side and beverage offerings of the top 20 national QSR brands from 2004-2015; 2) further examine consumer responses to healthy menu changes by evaluating child meal orders after a healthy children's menu change using a regional chain as a case study; and 3) evaluate any spillover effects of a campaign promoting healthier children's meals on the healthfulness of parent meal orders. In describing the nature of menu changes over the last decade and evaluating consumer responses to healthy menu changes and healthy meal promotions, this proposed project aims to build on existing knowledge around consumer responses to healthy menu changes and inform program and policy efforts to improve the nutrition quality of children's meals away from home. The specific aims and hypotheses are:

Aim 1: To identify individual differences in child meal ordering patterns after the implementation of the SD 2.0 menu at a regional restaurant chain and the relationship between ordering patterns and the probability of meeting or exceeding calorie recommendations.

Aim 2: To evaluate the effect of a campaign promoting healthier children's menu options on the calorie content of parent orders. *Hypothesis 2. Parents exposed to the campaign promoting healthier children's menu options will have lower calorie orders compared to those in control restaurants.*

Exploratory aims 2a and 2b: *To evaluate the effect of a campaign promoting healthier children's menu options on the calorie content of orders in moms (2a) and in moms who are low-income, Black or Hispanic, and frequent fast food consumers (2b).*

Aim 3: To describe trends in the availability of healthy sides and beverages on children's menus from 2004 to 2015 in a sample of national restaurant chains and identify food policy efforts coinciding with healthy side and beverage changes.

## **CHAPTER 2: REVIEW OF THE LITERATURE**

### **Overview**

Food away from home (FAFH) has received attention for its potential to contribute to childhood obesity<sup>9,28,30</sup>, a disease outcome that can lead to negative consequences for individuals throughout their lifespans, including higher risk of adult obesity and type II diabetes, heart disease, stroke, and several types of cancer<sup>31</sup>. Over time, US adults have spent less time cooking, have consumed less of their daily energy from food at home and have spent more money on FAFH<sup>32-34</sup>. Concomitantly, there have been increases in child obesity<sup>9,35,36</sup> and the majority of children's meals in restaurants do not meet dietary guidelines and are higher in calories, saturated fat, sugar, and salt than food prepared at home<sup>8,37-39</sup>. Previous research suggests that approximately 35% of children's excess discretionary calories can be directly attributed to intake from QSRs<sup>9</sup>. Recent research also indicates that children do not compensate for excess calories by eating lower calorie meals and snacks outside of the restaurant meal<sup>40</sup>, with an estimated excess of 126 kcals on days when at least one QSR meal was consumed<sup>40</sup>. Given the potential of restaurant meals to contribute to excess calories<sup>27</sup> and adiposity<sup>4</sup>, the National Academies of Medicine has identified increasing the availability of lower calorie and healthy food and beverage options for children in restaurants as a key strategy to prevent child obesity<sup>41</sup>. The federal government has also taken steps to address restaurant meals through menu labeling legislation under the Patient Protection and Affordable Care Act (ACA)<sup>42</sup>, which will require U.S. restaurants with more than 20 outlets

to display calorie information on menus at the point-of-purchase, along with a prominent, succinct statement with recommended daily calorie intake for adults on the menu.

Since the menu labeling legislation passed in 2010, there have been improvements in restaurant menus, despite the delay in the law's implementation, which is currently scheduled for May 7, 2018<sup>16-18,23,43,44</sup>. However, researchers have highlighted the need for additional changes<sup>45,46</sup> and a focus on at-risk populations. Low socioeconomic status (SES) families have higher rates of frequent QSR consumption and lower quality diets overall than their high SES counterparts<sup>10,47,48</sup>; these populations also experience disproportionately high rates of obesity and other diet related diseases<sup>11</sup>. Menu labeling is currently the only broad-based policy addressing restaurant meals. However, the evidence available to date suggests menu labeling is only effective for a small minority of the population, including Caucasian women with high levels of education, and is not effective as a standalone strategy for the populations at risk for obesity<sup>49</sup>. There is also a limited body of information on how effective menu labeling is for children. In a survey of children and adolescents, 57% reported noticing calorie information in the restaurant setting, but only 9% reported using the information<sup>50</sup>. To date, the majority of studies have found that menu labeling does not result in changes to the total calorie content of the meals ordered for children or adults<sup>50-52</sup>, and there is some evidence that menu labeling is associated with an increase in the calorie content of the meal ordered<sup>50,53</sup>. Therefore, alternative strategies or improvements to current strategies are needed to reach these populations.

It is also important to consider what parents and caregivers are ordering in the restaurant setting because of their influence on children's eating behaviors. Previous research has

demonstrated a strong parental influence on children's diets. Often seen as the "gatekeepers" for food, parents are the primary decision makers with regards to what food is available in the home; what food is prepared for meals at home; when, where, and how often the parent eats outside of the home; and what children can and cannot eat<sup>54-58</sup>. In the context of the restaurant setting, parents can dictate where families eat out, what children can or cannot order, establish norms around meal sharing, and model healthy meal choices when eating out, yet to date few studies evaluate parent-child interactions in this setting<sup>12,24,25,59,60</sup>.

Given the many factors that can influence the quality of child meal orders, this dissertation explores changes in the availability of healthy sides and beverages on children's menus at a sample of national quick service restaurants, differences in how individual children respond to a healthier menu at a regional full service restaurant chain, and how parents respond to a promotional campaign encouraging the selection of healthier options for their children when dining out. Below we elaborate on the extant body of literature evaluating factors that influence: 1) healthy menu changes in the restaurant setting, 2) what children order in restaurants, and 3) how parents may affect child meal orders.

### **Factors Influencing Healthy Menu Changes in the Restaurant Setting**

Healthy menu changes have the potential to shift consumer meal orders to be in line with nutrition recommendations. Therefore, it is important to consider trends in the availability of healthy menu items over time and what might drive these changes. Media reports and recent scientific literature around restaurant meals indicate that children's meals are becoming healthier (e.g. fewer restaurants offering sugar sweetened beverages on menus and more restaurants offering fruit and vegetable sides and milk)<sup>16,18-20,22,39,43,61-64</sup>. Studies evaluating

menu changes in the restaurant setting have been limited to long-term changes in standard menus (1996-2013)<sup>16,17,44</sup>, short-term changes to both children's and standard menus (2010-2011<sup>63</sup>, 2012-2013<sup>18</sup>, 2012-2015<sup>39</sup>), and changes to both the standard and children's menus after restaurants participated in a voluntary portion reduction recognition program (2013-2014)<sup>62</sup>. Cross-sectional studies have also been published evaluating the nutrition quality of menu items in standard menu items (2004<sup>64</sup>, 2005<sup>65</sup> and 2006<sup>19</sup>), for adult and children's menus (2010<sup>21,66</sup> and 2011<sup>67</sup>), and for children's menus in 2005/06<sup>20</sup>, 2008<sup>68</sup>, 2010<sup>69</sup>, 2012<sup>61</sup>, and 2013<sup>22</sup>. Increasing the availability of fruit and vegetable sides and non-soda beverages, in particular, can significantly contribute to the calorie content of children's meals<sup>14,20-22,28,69</sup>, yet no studies to date have evaluated long-term changes in the availability of these healthier menu items.

There is also currently a limited body of knowledge around the factors that influence restaurants to make healthy changes to their menus<sup>70-77</sup>. In 2004, the National Restaurant Association identified a "heightened interest in health and nutrition" as a top industry trend<sup>78</sup>, yet widespread changes in the healthfulness of children's meals were still not apparent in 2008<sup>68</sup>. Motivators for making healthy menu changes include perceived sufficient demand and profit<sup>72,77,79</sup>, corporate social responsibility<sup>70</sup>, and a "fast follower" business strategy, where firms aim to quickly adopt the latest trends in menu offerings<sup>80</sup>. The cost of raw materials, cost of labor, skill level of staff needed, the availability of ingredients, and space and equipment requirements can influence what's available on menus as well<sup>77,79</sup>. Moreover, policy changes may influence children's menus. For example, the New York City Trans Fat ban has been associated with reductions in the Trans Fat content of fast food purchases<sup>81</sup>. The passing of the menu labeling requirements, as legislated in the ACA in

2010, have also been associated with decreases in the calorie content of new menu items<sup>18</sup>, children's meals in fast food restaurants<sup>63</sup>, and entrées<sup>82</sup>. Correspondingly, the Kids LiveWell Initiative (KLW), launched in July 2011, requires that participating restaurants offer at least one children's meal with  $\leq 600$  calories, which also meets specified benchmarks for fat, sugar, and sodium, and includes at least two food groups encouraged by the Dietary Guidelines for Americans such as fruits, vegetables, lean protein, whole grains, and low-fat dairy<sup>83</sup>.

### **Factors Influencing What Children Order in Restaurants**

While improvements in the quality of menu offerings over time seem promising, it is unclear whether children are ordering healthier items. Healthy changes to menus – including offering more fruit and vegetable sides automatically in bundled children's meals, adding more healthy entrées, offering fruit as a dessert, and removing unhealthy items like French fries and soda – have been associated with positive shifts towards healthier meal orders<sup>13,14,84</sup>. These types of menu-based changes also appear to be well-received by both children<sup>22</sup> and parents<sup>85</sup>. Yet previous research also suggests certain demographics of children (boys, infrequent restaurant goers, and frequent take-out diners) may be less receptive to healthier options such as fruit and vegetable sides in the restaurant setting<sup>22</sup>. Evidence also indicates that children select food based on taste, appearance, and familiarity<sup>60,86,87</sup>. In the restaurant setting, the top contributors of discretionary calories from QSR among youth are sugar-sweetened beverages, dairy desserts, and French fries<sup>28</sup> – highly palatable foods that are familiar to children and are consistent with children's strong liking for salty and sweet tastes<sup>88</sup>. These types of items and entrées such as chicken fingers, hamburgers, and grilled cheese are also highly prevalent on restaurant menus<sup>39,89</sup>, which makes them appear normative and more familiar in this setting as well. Additional research examining the

variability in how orders change after the implementation of a healthier menu is needed to elucidate the extent to which such changes may have widespread impact and to help inform where other menu modifications could further influence the nutrition quality of meal orders.

### **Factors Influencing How Parents May Affect Child Meal Orders**

Additionally, it is necessary to consider what factors influence adult orders because caregivers influence the meal decisions of their children via role modeling and food-related parenting practices<sup>24,90</sup>. Parents, therefore, have the potential to inhibit or enhance the effectiveness of healthy children's menu changes and healthy menu option promotional campaigns on the quality of child meal orders. In this dissertation, we evaluate whether parents respond to a promotional campaign encouraging the selection of healthier options for their children when dining out. These "spillover effects", or observed outcomes that result from seemingly unrelated or indirect exposures, are just now beginning to be explored in the public health literature. One recent study evaluated the effects of a multicomponent child-centered obesity prevention intervention on non-child members of the community and found that the intervention was associated with a significant decrease in parent body mass index<sup>91</sup>. Evidence from a farm to school intervention suggests spillover effects in the home environment as well, with an increase in children's requests for fruits and vegetables at home, an increase in availability of fruits and vegetables in the home, and an increase in parent's value of fruits and vegetables over the course of the intervention<sup>92</sup>. Other nutrition and physical activity interventions in childcare settings have also found increases in home fruit and vegetable intake and reductions in screen time during out-of-care-time in the home; however, this literature has solely focused on child outcomes and the majority of the studies also provided a parent-education component<sup>93</sup>. Though the empirical evidence is limited,



these same effects may also translate to parent meal decisions in the restaurant setting. For example, if after the implementation of a campaign promoting healthier children's menu options parents have an increased awareness of healthier children's menu options, they may be more likely to notice these options on the menu and may be primed by the children's menu to order healthier items for themselves from the standard menu. Parents may also decide to order a healthy meal when dining out to serve as a positive role model for their children and may feel empowered to do so knowing that healthier children's options exist<sup>26</sup>. These "unintended" mechanisms may stem from a seemingly un-related, child-centric change: the implementation of the campaign promoting healthier children's menu options.

In addition to priming<sup>94,95</sup> and the desire to serve as a positive role model<sup>26</sup>, there are many other factors that can influence the quality of parent meal orders. Taste, cost, familiarity and convenience are some of the most widely cited factors influencing food choices in adults<sup>96</sup>, yet few studies have examined adult food choices in the restaurant setting. Evidence suggests that contextual factors (including how the restaurant menu is laid out) can impact meal orders in adults<sup>94,97</sup>. Personal, social, and cultural factors may influence food choices in the restaurant context as well<sup>98-101</sup>. The aforementioned factors can modify parents' responses to promotional campaigns, though they were not explicitly explored as a part of this work.

## **Conclusions**

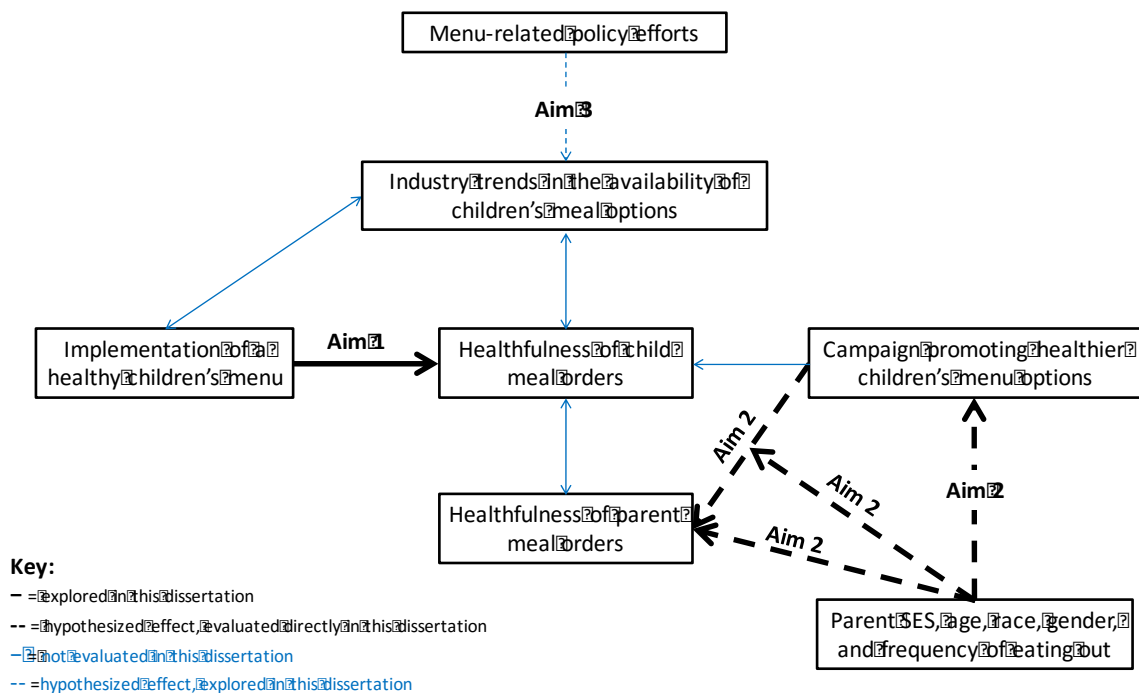
Restaurant meals are a significant contributor to excess calorie, fat, added sugar, and sodium consumption in US children. As described above, there are many factors that can influence the nutrition quality of child meal orders in restaurants including the availability of healthier items on menus, individual preferences for healthier items, and parent ordering behaviors

and food parenting practices. Yet there is little scientific understanding of how healthy menu changes occur in the industry and individual differences in how children may respond to healthier menus. There is also been limited exploration in whether promotional campaigns targeting healthier children's meals in restaurants will have any effect on parent orders, which can have implications for the whole family. This dissertation aims to begin to fill the above gaps by evaluating children's ordering patterns after the implementation of a healthier children's menu in a regional restaurant, the effect of a campaign promoting healthy children's meals in QSRs on total calories in parent orders, and co-occurring trends in healthy side and beverage changes and policy efforts in a sample of QSR chains.

## CHAPTER 3: METHODS

The proposed research combines methods in latent class analysis (Specific Aim 1); impact evaluation (Specific Aim 2); and a descriptive analysis of menu trends over time (Specific Aim 3). This section describes the conceptual model that has framed this dissertation research and elaborates on the methods used in each study.

**Figure 3 1** Conceptual Model



The above conceptual model highlights the various interactions between healthy menu changes (Aim 3), children's responses to healthy menus (Aim 1), and parent responses to a campaign promoting healthier children's menu options (Aim 2). The healthfulness of child meal orders is presented at the center of the diagram because the three research questions evaluated here were motivated by a desire to improve the quality of child meal orders in

restaurants. Arrows bolded in black were evaluated or explored here. Arrows in blue were not explicitly evaluated here, but are included to show the interconnected nature of the three research aims presented herein and are informed based on previous research. Dashed arrows demonstrate a hypothesized relationship that was either directly tested as a part of this research (in black) or where we explored the relationships as a part of this work, but were unable to draw conclusions about associations (in blue). Here, we aim to describe the industry trends in the availability of healthy children's meal options (Aim 3). We focus specifically on the availability of healthier sides and beverages because previous research suggests both have a significant contribution to the total calorie content of children's meal orders<sup>14,22,102</sup>. We also describe menu-related policy changes that are co-occurring with healthy side and beverage changes. Yet, given the many other factors that may influence a restaurant's decision to include healthier sides and beverages that were unmeasured here<sup>70,72,77,79,103-105</sup> and the descriptive study design, we cannot infer causality. As such, we have used the blue arrow to indicate that the associations between policies and menu changes are not being directly tested here. We highlight that perceived demand for healthier items can drive healthy menu changes<sup>72,79</sup>, and that industry trends can lead individual chains to adopt healthy menu changes<sup>80</sup>. At the same time, individual chains may be the leaders in industry trends, so the temporal nature of this relationship is likely heterogeneous and restaurant-dependent.

For Aim 1, we evaluate differences in how children respond to a healthier children's menu in a regional full service restaurant chain (FSR). Previously, we demonstrated that children's meal orders were healthier on average from before to after this FSR implemented their healthier children's menu<sup>102</sup>, and that orders remained healthy one to two years after the

initial evaluation<sup>106</sup>. However, additional research is needed to better understand variability in how children respond to healthy menu changes so as to better tailor nutrition interventions in this setting and achieve widespread impact. We acknowledge that parents can influence the healthfulness of their children's orders (via food parenting practices<sup>24,107</sup> and role modeling<sup>26</sup>) and that children may also influence the healthfulness of their parent's orders (via positive pester power<sup>108-110</sup> and child-directed social learning), though neither of these were directly explored here.

For Aim 2, we evaluate the potential spillover effects on the calorie content of parent orders from a promotional campaign aimed at empowering moms to choose healthier restaurant meals for their children. This sub-study is part of a larger evaluation of whether this promotional campaign influences the quality of children's meal orders. In the analysis presented here, we include demographic and behavioral factors that have been associated with the calorie content of adult meal orders including socioeconomic (SES) status, race/ethnicity, gender, and frequency of eating out<sup>48,111</sup>. These factors are tested both as confounders and as effect modifiers, since this campaign was specifically targeting moms who were low SES, Black or Hispanic, and frequent fast food consumers, given the disproportionately high rates of frequent restaurant meal consumption and diet-related chronic diseases in these subpopulations<sup>11,12,112</sup>. Here, we use the calorie content of parent meal orders as an indication of quality. However, calories are not the only measure of nutritional quality, and it is possible that meals higher in calories may also have better nutrient profiles given their fat, sugar, and fiber content<sup>113</sup>.

## **Aim 1: Silver Diner healthy children's menu change, dataset, and analyses**

### **Methods**

*Setting, study sample, and design.* A secondary analysis was conducted using itemized receipt (i.e. individual check; referred to herein as check) data from 13 outlets of the Silver Diner, a regional, full-service restaurant chain serving more than 4 million customers annually. More detailed information about the restaurant, menu changes, and order data can be found in Anzman-Frasca S *et al* 2015a and Anzman-Frasca S *et al* 2015b<sup>13,106</sup>. Briefly, the restaurant introduced a healthier menu (referred to throughout as SD 2.0; shown in Appendix 1) in April 2012 for children ages 12 and under which featured: 1) more children's meals meeting KIW nutrition standards (from 22% to 59% of offerings); 2) healthy, KIW side dishes bundled with all children's meals by default (strawberries, mixed vegetables, or salad); and 3) the removal of French fries and home fries (referred to herein as French fries) and fountain drinks (including soda and lemonade, referred to herein as soda), which could still be substituted at no charge. After implementation, all meals listed on the children's menu included a healthy, KIW side dish and beverage (skim, whole, chocolate, or soy milk or 100% juice); 50% of breakfast entrées and 62% of non-breakfast entrées were KIW-eligible. An image of the menu that was in use at this time corresponding to the order data presented herein was published previously (Figure 1B)<sup>13</sup>. Patrons were notified on the menu that they could substitute other items for the listed side dishes at no cost. Beverage choices were not listed in the meal descriptions, but were included on the menu and were part of the children's meal bundle. Breakfast items could be ordered all day.

To evaluate individual children's menu meal orders (referred to herein as child orders), we used a subsample of checks from after the menu changes were implemented (September

2012-March 2013; POST), which was abstracted for our previous work<sup>13</sup> and coded as described below (n=5971 checks with n=8612 child meals).

*Child meal components.* Check data included the type of entrée and the numbers and types of side dishes, beverages, and desserts ordered as part of each meal. K LW-eligible meals (entrées) and K LW side dishes were coded as healthy. Sides were also coded as default sides (as listed in the meal description on the menu) or as an additional a la carte side item (or "add-on"; indicated on the check). All default sides were K LW-eligible, but not all K LW-eligible sides were bundled with meals by default (i.e. edamame). Pancake toppings such as chocolate chips and add-on items like breakfast meats that were not automatically bundled with the meal were also characterized as "add-on" items (as indicated on the individual check). Entrées were categorized as breakfast items if they were listed under the breakfast section of the menu; but these items could be ordered all day. Beverages were identified as soda, milk, or juice. Skim, whole, and chocolate milk were under the same item code in the restaurant database, so orders of each type could not be differentiated. Tap water was also available, but was not included on the checks.

*Total energy content of the meal.* Energy content data provided by the restaurant were used to calculate the total calories for each child order. Calories were averaged across versions when different preparations of an item were available, and checks did not indicate the version of the meal ordered (i.e. pasta with butter or marinara sauce). Estimates from the United States Department of Agriculture were used, wherever possible, when calorie data were unavailable<sup>114</sup>. When not available from any of the above sources, calorie data were coded as missing and excluded from the analysis (n=1 order).

*Statistical analysis.* LCA was conducted on child orders (n=8611) using PROC LCA in SAS 9.2 <sup>115,116</sup>. LCA establishes statistically-derived profiles based on a set of categorical items, or "indicators." This approach enables description of latent subgroups, or classes, (here, child orders) that are similar to one another based on whether orders were likely to include certain characteristics. The LCA model estimates two sets of parameters: the proportion of the sample estimated to be in each latent class (class membership prevalence) and the likelihood of having a "yes" response for a particular indicator variable in each latent class (i.e., the probability of having dessert within a particular latent class; item-response probabilities). Posterior probabilities indicating the likelihood of class membership for each individual observation can also be estimated and used to assign each observation into a given class <sup>115</sup>. Item-response probabilities were considered high if the conditional probability representing the relationship between an individual indicator variable and a latent class was >0.7 and low if the conditional probability was <0.3 <sup>116</sup>. Names assigned to each latent class were determined by indicators with item-response probabilities of 0.7 or higher, as these indicators were considered to be key characteristics of that class. We also considered order properties that differentiated each class from the other classes when determining class names. The LCA method has been applied previously to research exploring individual variability in dietary patterns <sup>117</sup> and responses to intervention <sup>118</sup>.

Eight dichotomous indicator variables were used to estimate classes of ordering patterns. Indicator variables were selected based on their potential contribution to the total calorie content of the meal including: whether the child ordered soda <sup>119</sup>, French fries <sup>28</sup>, dessert <sup>28</sup>, a healthy (KLW-eligible) entrée <sup>13</sup>, a healthy (KLW-eligible) side <sup>22</sup>, and an additional a la carte



side dish/topping (add-on) <sup>22</sup>, as well as whether the meal was a breakfast item and whether all default sides were accepted based on how the child's meal bundle was listed on the menu (i.e. Champion Breakfast: one egg, strawberries, and multigrain toast).

We sequentially fit models with one through seven latent classes, stopping once fit indices indicated that model fit was no longer improving with the addition of another class. The best-fitting model was selected based on fit indices (log-likelihood ratio  $G^2$  statistic, Akaike Information Criterion [AIC], and Bayesian Information Criterion [BIC]), parsimony, and interpretability <sup>116</sup>. As the number of classes increased from one to six, the  $G^2$  statistic, AIC, and BIC decreased, indicating a better fit (Table 1). In the seven-class model, the  $G^2$  statistic and AIC continued to decrease, but BIC increased. BIC is also more sensitive to model complexity <sup>116</sup>. Thus, the six-class model had the best fit based on fit indices and parsimony.

Steps were taken to address clustering within the dataset (multiple child meal orders within an individual check and multiple checks and days within a restaurant outlet). First, to test whether clustering of orders within checks were affecting results, we repeated the analysis on a subset with one randomly selected children's meal order per check (n=5971), and results were consistent. Thus, we retained the full sample of orders (n=8611) in our final models.

We also adjusted the LCA for clustering at the location-day level using a pseudo-maximum-likelihood approach <sup>120,121</sup> to account for the hierarchical structure of the dataset.

To further inform our findings from the LCA, we calculated item order frequencies for side substitutions and add-ons across all individual check orders to describe the most common side items ordered with child meals.

All orders were classified into ordering classes based on the associated posterior probability using the final latent class model. The average posterior probabilities for individuals assigned

to each class ranged from 0.94 to 0.98, indicating the majority of orders were likely to be in a given class. We then used the classify analyze approach to test whether ordering classes were associated with the calorie content of the total order <sup>122</sup>. Linear mixed models were used to evaluate differences in the calorie content of meal orders in each of the ordering classes with a fixed effect for outlet and a random intercept for location-day (date nested within outlet). Least squares means were compared between groups and p-values were adjusted for multiple comparisons using Tukey adjustments. The proportion of orders  $\leq 600$  calories were calculated for each class; reflecting the recommended calorie content of a child's meal based on one third of the total daily calorie recommendations for sedentary children ages 5 to 12 <sup>123</sup>, which is consistent with calorie ranges required for reimbursable school meals <sup>124</sup> and KWL nutrition standards <sup>83</sup>.

## **Aim 2: *You're the Mom* campaign, dataset, and analyses**

We evaluated *You're the Mom*, a 16-week community-wide, social marketing campaign, using a group randomized design in two sociodemographically diverse mid-sized communities in Massachusetts that were ~50 miles apart. Parents and legal guardians of children ages 4-12 were recruited within 11 locations of a national quick service restaurant chain (QSR) (6 in the intervention community, 5 in the control community). Three locations were included later in the study period to increase recruitment (2 in the intervention community, 1 in the control). Parent and child meal orders were evaluated at two time points: before the campaign was implemented (PRE; April 1-May 21, 2016) and during the last 7 weeks of the campaign implementation period (POST; August 11-October 8, 2016). Only one parent-child pair was allowed to participate per family. When there were multiple children and

parents, the family chose which parent participated; to randomly identify one child, study staff had the parent identify the child with the most recent birthday and then all survey responses about the child were to be about that child. All parents were approached after ordering to minimize the influence of study staff on ordering behavior. In the intervention community, only those parents who lived, worked, or frequently traveled in the community could participate in the study to omit individuals who would not have had the opportunity to be exposed to the campaign (See recruitment script in Appendix 2A and 2B). The majority of parents that entered the restaurant with a child that appeared to be eligible were approached (90.6%). Across both time points 57.6% of the parents approached who were eligible agreed to participate in the study. A total of 2330 parent child pairs were recruited across both communities at both time points. We excluded parents with children who were 12 from the analyses because agreements between the research group and contacts in the restaurant chain (n=130 parent-child pairs included a 12-year-old child). All data were collected between 2:30 and 7pm on Thursdays and Fridays and between 10:30 am and 3pm on Saturdays. Calories were listed on the menus in all locations, providing access to this information at the point-of-purchase. All study materials were available in English and Spanish, and recruitment was conducted in both languages by trained study staff. Study procedures were reviewed and approved by the Tufts University Institutional Review Board.

### **Campaign Development and Dissemination**

The *You're the Mom* campaign (Harellick et. al., in prep) was developed in early 2016. The priority audience for the campaign was moms who were low socio-economic status (SES), African American or Hispanic, and who frequently ( $\geq 2$ -3 times/month) dine out at QSRs, since children in these sociodemographic groups are at a higher risk of obesity<sup>11</sup>, are more

likely to be exposed to targeted advertising from fast food companies<sup>125,126</sup>, are more likely to consume excess calories and fat from QSRs<sup>3,127</sup>, and tend to have higher rates of frequent fast food consumption<sup>10,12</sup> compared to higher-income, Non-Hispanic White youth. All materials were developed using consumer insights gathered via focus groups with low-income African American and Hispanic mothers (unpublished data), a national concept test (unpublished data), a review of the existing literature<sup>25,45,58,60,128</sup>, and our previous research<sup>22,102,129-132</sup>. The campaign was also informed by self-determination theory<sup>133</sup> and was centered around a theme of empowering moms in the priority population, given that minority women report having lower levels of agency, choice, and autonomy<sup>134</sup>. The overall goal of the campaign was to empower moms to select healthier items for their children in restaurants. While not an explicit campaign message, an underlying goal was to get mothers to order meals for their children that were  $\leq 600$  calories, which is consistent with the Kids LiveWell (KLW) criteria for a healthy meal<sup>123</sup>, RAND corporation standards<sup>135</sup>, and standards for the National School Lunch Program<sup>136</sup>. Direct calorie-related messaging was not used, as findings from our focus group participants indicated this information would not influence their ordering decisions (unpublished data); and previously published research suggests calorie-centered information-based strategies may not be effective in low-income populations<sup>49</sup>. Instead, the messaging targeted three small, actionable, and easy-to-implement ordering behaviors that would help reduce the overall calorie content of the child meal order: 1) add a fruit or vegetable to the meal and/or substitute fruit or vegetable sides in place of items like fries<sup>22</sup>, 2) choose water or milk over soda<sup>137</sup>, and 3) order smaller portions, such as kids' meals<sup>129</sup>. While the goal of the campaign was to empower parents to improve the quality of orders for their children, it's possible that parents would also make changes to the entrées, sides, and/or beverages in their own meals that reduce total calories through

priming effects and an enhanced motivation to serve as a positive role model for their child (as described above).

The *You're the Mom* campaign was disseminated in the intervention community in both English and Spanish via traditional media outlets (billboards, radio, social) and grassroots efforts including wallsapes, flyers, painted utility boxes, and banners in community centers. Community members were engaged in the dissemination of the campaign as well. An advisory committee comprised of three local, non-profit organizations provided insight into how best to disseminate the campaign and reach the priority population, moms from the community were featured on two wallsapes, and local artists created the utility box renditions. The campaign ran from June 11- September 30, 2016.

### **Measurements.**

*Total calories of the meal order.* Parent meal orders were identified from collected meal receipts, which contained information about each meal component (entrée, side, beverage, dessert, and condiments/sauces). Parents indicated which of the meal components they ordered and which items on the receipt they intended to consume, and these items were recorded by study staff. The restaurant provided a spreadsheet containing all currently available menu items and their calorie information, which was used to determine the calorie content of the items ordered. The total calorie content of parent meal orders was calculated by summing the calorie content of each item they ordered for themselves.

*Parent Demographics.* Parent gender, age, and educational attainment were collected via a short paper survey (Surveys are shown in Appendix 2C-2E). Highest level of parental educational

attainment was used as an indicator of SES, as research indicates educational attainment and income are highly correlated and that education is a more time-stable indicator of an individual's SES<sup>138</sup>. Because the primary outcome of the study was related to children's orders, frequency of dining out and race/ethnicity were collected for the child and were used as proxies for parent frequency of fast food intake and race/ethnicity in these analyses. For the purposes of this study, we considered frequent fast food consumers to be those whose children ate out at fast food restaurants  $\geq 2$ -3 times per month.

*You're the Mom campaign exposure.* For parents in the intervention community at POST, we evaluated whether they were exposed to the *You're the Mom* campaign based on their responses to questions about campaign recognition. Parents who responded "yes" to having seen advertisements from the campaign or who stated that they saw, read, or heard about ads with the campaign's slogan were considered exposed; those who did not were considered unexposed.

*Statistical Analysis.* All analyses were conducted in SAS version 9.4 (Cary, NC). The analytic sample included all parents with complete order calorie and demographic data ( $n=1570$ ). Parents whose total order was zero calories were excluded, since these parents were not considered to be dining during this meal occasion ( $n=37$ ). In total, 1533 parent orders were used in these analyses.

Summary and descriptive statistics were reported or computed for parent demographics and select order properties. Differences in the change in the calorie content of parent meal orders from PRE to POST in the intervention and control communities were assessed using

difference-in-differences regression analysis. All models were adjusted for demographic variables and clustering by location, with a random intercept for location. Robust standard errors were used, as values for total order calories were highly skewed. Since being female or low SES were significantly associated with order calories (Table 5.2) and the *You're the Mom* campaign priority audience was moms with children who identified as low SES, Hispanic or Black, and/or frequent fast food consumers, we also evaluated the time-by-treatment effect among moms (Table 5.3) and among moms who belonged to the priority campaign audience (moms of children who were low SES, Hispanic or Black, and frequent fast food consumers; Table 5.5). Models evaluating the campaign impact in moms were run as intent-to-treat analyses (Table 5.3), as well as including only those moms in the intervention community at POST who reported being exposed to the campaign (Table 5.4) to account for the possible variability in exposure to the campaign, since it was disseminated within the community and not directly in the restaurant locations where data collection occurred.

### **Aim 3: Technomic's MenuMonitor dataset and analyses**

*Sample and Study Design.* A historical children's menu analysis file was constructed in January-March of 2016 using data from Technomic Inc.'s MenuMonitor<sup>139</sup>, which provides complete information on children's menu items for ~800 restaurant chains from 2004 to the present. In this database, entrées, sides, beverages, and meal bundles are listed as they are on the menu. Data on the relative sales of healthier items over time were not available; therefore, we evaluated counts of available healthier and less healthy menu items as a method for understanding the scale of sales for restaurant food with these characteristics. Menu item data are collected from nationally representative non-urban restaurant locations by dedicated Technomic staff via quarterly in-person site visits and restaurant websites<sup>140</sup>. Whenever

menu offerings were unclear and clarification was needed, Technomic staff made phone calls to the restaurants to determine the items offered at that point in time<sup>140</sup>.

Children's menu item data were abstracted and coded by quarter from the third quarter of 2004 (July-September) to the fourth quarter of 2015 (October-December) for 20 of the 50 leading QSRs based on system wide sales (SYS) in 2014. The 20 chains evaluated here accounted for the majority of total sales from the 2014 top 50 QSRs (71%)<sup>141</sup>, had a children's menu offering sides and/or beverages as à la carte items or as a part of bundled meals, and had non-missing data for >50% of time points after examining all alternative data sources (as detailed below). Our analysis began in 2004 because this is the first available year of data from MenuMonitor. To further interpret menu trends, we also collected restaurant-level data on the total SYS each year<sup>28</sup>, because large firms may have a greater impact on marketplace trends and menu changes in these restaurants will impact more people.

When sides and/or beverage offerings were not available in the dataset or the exact item could not be identified from the description (e.g. Kids drink; n=537 location time points), archived menu data was abstracted from Way Back Machine (<https://archive.org/web/>), if available. When the items offered in the time periods immediately before and after the missing offerings were identical we assumed there was no change between the time points and filled in missing time points with those items. Only one location time point was missing after performing missing data procedures. We also evaluated how consistent the offerings listed in Technomic's MenuMonitor were with archived online versions of restaurant menus using a randomly selected subsample of location time points (n=46; 5% of the total location time points), and found high agreement between the two data sources: 83.4% of side and



beverage items listed in the Technomic's database were also listed on Way Back Machine archived menus.

To evaluate trends in the quantity of healthy side and beverage items available, each item was coded into nutritionally meaningful, mutually exclusive categories by two members of the study staff and assessed for inconsistencies. Sides were coded into fruit and non-fried vegetable sides (FV) using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>, which identified sides as FV based on the Dietary Guidelines for Americans and MyPlate<sup>142</sup>. Side items not considered FV sides based on the above protocol were coded as non-FV sides. Beverages were further characterized using the beverage groups outlined in the University of Minnesota's Nutrition Data System for Research food group list<sup>143</sup>. Sugary drinks were identified based on whether the beverage was sugar sweetened carbonated, fruit flavored, coffee, or "other" sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were not considered to be sugary drinks based on the Dietary Guidelines for Americans, MyPlate, and the National School Meals Program<sup>142</sup>. All fountain drinks (i.e. sodas, Hi-C fruit punch, sweetened teas) were collapsed into a single beverage item and coded as a sugary beverage, since fountain beverage options were not consistently listed out separately in the database or via archived menus. If a drink was not a sugary drink, it was coded as a non-sugary beverage (i.e. water, unflavored and low-fat flavored milk, 100% fruit juice). Whether meals were automatically bundled with a FV side and/or non-sugary drinks was also determined based on the meal description (e.g., Jr. Burger with Apple Slices and Minute Maid 100% Orange Juice).

A historical record of policy efforts at the local, state, and national levels (e.g. menu labeling legislation) were identified via the National Restaurant Association website to help contextualize our findings around healthy menu changes. Policy information was abstracted from Way Back Machine archives of the NRA policy and advocacy webpage because the policy issues listed on this page were likely to be the most salient to restaurants and a source of information on policy activity for restaurants. The NRA policy and advocacy webpage has included web segments devoted to policy issues of interest to the restaurant industry from 2004-present (the year 2003 was included in this review to inform our discussion during the earlier part of our timeframe)<sup>145,146</sup>. To be included in our analyses, the noted policy effort had to specifically mention a nutrition-related change to restaurant menus. Efforts targeting food safety and efforts that were related to nutrition, but did not directly propose to legislate menus/menu offerings (i.e. the Improved Nutrition and Physical Activity Act of 2003) were omitted. Additionally, the Dietary Guidelines for Americans (DGA) were included because the quinquennial release of updated dietary guidance is mandated by federal policy<sup>147</sup> and industry publications have previously indicated the importance of the DGAs in restaurateurs' decisions around menu offerings<sup>148</sup>. Policies issues at the local, state, and national level were considered relevant, since localized policy efforts have resulted in national menu changes in the past and were included in the NRA website as policy issues of concern<sup>44,61,63,81,149-152</sup>. If a policy activity was included on the webpage on multiple occasions over time, we included the activity the first time it was noted on the archived webpage.

*Analysis.* Summary and descriptive statistics were evaluated overall and by restaurant brand for side and beverage items offered (number of items offered, percentage of sides that were FV, percentage of beverages that were non-sugary beverages, etc.) and meal properties

(whether the meal included a FV side or non-sugary beverage as an option and as a default). Two chains (Checkers/Rally's and Hardees/Carl's Jr.) were formed via mergers prior to 2004, but were listed separately in MenuMonitor and SYS reports. For the merged chains, total offerings of meal bundles, sides, beverages, FV sides, non-FV sides, sugary beverages, and non-sugary beverages were averaged for each prior to calculating descriptive and summary statistics. All analyses were conducted in STATA 14 (College Station, TX, USA). Graphs demonstrating changes over time in the percentage of meal bundles that included FV sides and non-sugary beverages as options were compiled at the aggregate level and for each restaurant brand. In addition, diagrams were created using a weighted measure for item offerings based on the relative contribution of each brand to the sample's total SYS for each year to evaluate the potential reach of these supply-side changes. The number of policy efforts listed on NRA web page during each year was also compared against the number of restaurants that started offering healthier beverages or sides during each year.

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## **CHAPTER 4: Ordering Patterns Following the Implementation of a Healthier Children's Restaurant Menu: A Latent Class Analysis**

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Author contributions: MPM, SAF, CDE conceptualized and designed the research. MPM conducted all analyses and led the drafting and revision of the manuscript. CEB led all data abstraction and coding. CDE, SAF, SCF, and PW provided guidance on the interpretation of results. All authors were involved in reviewing and revising the manuscript and have approved the final version.

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**What is already known about the subject:**

- Healthy children's menu changes in the restaurant setting are associated with improvements in the nutritional quality (lower calories, more fruits and vegetables, more milk and juice) of meal orders from before to after the new, healthier menu.
- Previous research suggests that including healthy sides and beverages as a part of children's meals by default increases the acceptability of these items.
- Individual differences such as previous exposure to fruits and vegetables, habitual ordering decisions, parental support for healthy eating, and perceived norms around children's meals may determine the overall acceptability of healthier children's menu options.

**What this study adds:**

- No studies have utilized methods like latent class analysis to characterize the variability in how children respond to a healthier children's restaurant menu, and few have utilized complete order data from a restaurant chain.
- Using order data from a regional restaurant chain that recently implemented a healthier children's menu, we found six distinct ordering classes that differentiate based on whether they include healthy entrées, side substitutions, the addition of a la carte sides, and/or dessert.
- Order classes likely to contain healthy entrées and/or healthy sides were also more likely to include orders  $\leq 600$  kcal—the recommended calorie content for children's restaurant meals.

**Abstract**

*Objective:* Identify ordering patterns following implementation of a healthier children's menu.

*Methods:* A healthier children's menu was introduced in 2012 at a regional restaurant chain, featuring more meals meeting Kids LiveWell (KLW) nutrition standards, KLW side dishes bundled with meals, and the removal of French fries and soda. Latent class analysis was conducted on child meal orders placed after menu implementation (n=8611). The average calorie content and proportion of orders meeting calorie recommendations ( $\leq 600$  kcal) in each class were evaluated.

*Results:* The best-fitting model contained six latent classes representing different ordering patterns: "healthy meals" (27.0%), "healthy meals, add-ons" (9.6%), "unhealthy sides" (9.1%), "healthy substitutions" (30.9%), "healthy substitutions, add-ons" (1.0%), and "unhealthy substitutions" (22.4%). Classes denoted as "healthy" were likely to contain meals with KLW items. Orders in the healthy meals class contained fewer calories than orders in all other classes ( $p < 0.0001$ ). The majority of orders meeting calorie recommendations were in the healthy meals (59.4%) and healthy substitutions (27.1%) classes.

*Conclusion:* Ordering patterns consistent with the healthier menu were common and more likely to meet calorie recommendations. Ordering patterns inconsistent with menu changes also emerged and can inform intervention efforts to reach patrons who may reject or compensate for healthier items.

## Introduction

Restaurant meals contribute substantially to excess calorie intake and are longitudinally associated with excess weight gain in children <sup>3,4,153</sup>. Between 1977 and 2006, the percentage of children's daily calories from food away from home has increased from 23.9% to 33.9% <sup>27</sup>. In 2011-2012, 34% of US children were estimated to eat fast food on a given day <sup>6</sup>, with higher frequencies for African American youth and low-income families <sup>10</sup>, subgroups that have also experienced rapid increases in rates of obesity compared to the general population <sup>154,155</sup>.

Changes to children's menus that increase the availability of healthy items can impact the nutritional quality of child meal orders. In 2011, the National Restaurant Association launched Kids LiveWell (KLW), a voluntary program with established nutrition criteria for calories, sodium, fat, sugar, and the inclusion of specific food groups in children's meals and side items <sup>83</sup>. While this program promotes children's meals in line with the Dietary Guidelines for Americans <sup>123</sup>, it is currently unclear how effective it is at shifting ordering patterns across participating restaurants. Many participating restaurants offer only one KLW-meal and side item, and the percentage of children ordering these is unknown <sup>83</sup>. KLW eligibility for a given meal is established based on a specified bundle (entrée, side, and beverage). However, orders may still include modifications such as substitutions or add-ons that result in total meals containing excess calories or the omission of food groups like non-fried vegetables and fruit <sup>119,156,157</sup>. Individual differences such as previous exposure to fruits and vegetables <sup>88,158</sup>, habitual ordering decisions <sup>159</sup>, parental support for healthy eating <sup>58</sup>, and perceived norms around children's meals <sup>160</sup> may determine responses to menus that include KLW items.

We previously demonstrated overall shifts in the nutritional quality of child meal orders following healthy menu modifications in the full-service restaurant setting, with reductions in calorie-dense items like French fries and soda and increases in healthy sides and beverages from before (PRE) to after (POST) the healthier menu was implemented <sup>13,161</sup>. Yet some orders at POST included French fries and soda (even though these items were not listed on the healthier menu), and substitutions were common <sup>13</sup>. Moreover, the calorie content of child meal orders only decreased from PRE to POST for those orders that included the default sides, suggesting that individual differences in responses to such menu changes can modify the effectiveness of menu-based interventions in preventing excess caloric intake <sup>13</sup>.

Latent class analysis (LCA) is useful in this context to uncover subgroups of individuals ordering meals with similar characteristics, and can inform interventions in this setting. For example, if children were likely to order French fries and additional a la carte sides, interventions aimed just at reducing French fry intake would miss other important meal characteristics. LCA can also detect ordering patterns that represent a small, but meaningful subgroup of the study population, which can help avoid potential unintended consequences of interventions by enabling interventionists to tailor programs to reach all members of the population <sup>162</sup>.

To date, no studies have evaluated individual differences in children's ordering patterns after the implementation of a healthier children's menu, or how these patterns contribute to differences in the total calorie content of orders. The aim of this study was to identify latent classes of ordering patterns following the implementation of a healthier children's menu, building on our previous work evaluating overall shifts in orders in this same full-service



regional restaurant chain<sup>13</sup>. This exploratory approach has the potential to inform future restaurant interventions by leveraging individual differences in how children order from a healthier children's menu to achieve widespread impact.

## **Methods**

*Setting, study sample, and design.* A secondary analysis was conducted using itemized receipt (i.e. individual check; referred to herein as check) data from 13 outlets of the Silver Diner, a regional, full-service restaurant chain serving more than 4 million customers annually. More detailed information about the restaurant, menu changes, and order data can be found in Anzman-Frasca S *et al* 2015a and Anzman-Frasca S *et al* 2015b<sup>13,106</sup>. Briefly, the restaurant introduced a healthier menu in April 2012 for children ages 12 and under which featured: 1) more children's meals meeting KWL nutrition standards (from 22% to 59% of offerings); 2) healthy, KWL side dishes bundled with all children's meals by default (strawberries, mixed vegetables, or salad); and 3) the removal of French fries and home fries (referred to herein as French fries) and fountain drinks (including soda and lemonade, referred to herein as soda), which could still be substituted at no charge. After implementation, all meals listed on the children's menu included a healthy, KWL side dish and beverage (skim, whole, chocolate, or soy milk or 100% juice); 50% of breakfast entrées and 62% of non-breakfast entrées were KWL-eligible. An image of the menu that was in use at this time corresponding to the order data presented herein was published previously (Figure 1B)<sup>13</sup>. Patrons were notified on the menu that they could substitute other items for the listed side dishes at no cost. Beverage choices were not listed in the meal descriptions, but were included on the menu and were part of the children's meal bundle. Breakfast items could be ordered all day.

To evaluate individual children's menu meal orders (referred to herein as child orders), we used a subsample of checks from after the menu changes were implemented (September 2012-March 2013; POST), which was abstracted for our previous work<sup>13</sup> and coded as described below (n=5971 checks with n=8612 child meals).

*Child meal components.* Check data included the type of entrée and the numbers and types of side dishes, beverages, and desserts ordered as part of each meal. K LW-eligible meals (entrées) and K LW side dishes were coded as healthy. Sides were also coded as default sides (as listed in the meal description on the menu) or as an additional a la carte side item (or "add-on"; indicated on the check). All default sides were K LW-eligible, but not all K LW-eligible sides were bundled with meals by default (i.e. edamame). Pancake toppings such as chocolate chips and add-on items like breakfast meats that were not automatically bundled with the meal were also characterized as "add-on" items (as indicated on the individual check). Entrées were categorized as breakfast items if they were listed under the breakfast section of the menu; breakfast items could be ordered all day. Beverages were identified as soda, milk, or juice. Skim, whole, and chocolate milk were under the same item code in the restaurant database, so orders of each type could not be differentiated. Tap water was also available, but was not included on the checks.

*Total energy content of the meal.* Energy content data provided by the restaurant were used to calculate the total calories for each child order. Calories were averaged across versions when different preparations of an item were available, and checks did not indicate the version of the meal ordered (i.e. pasta with butter or marinara sauce). Estimates from the United States Department of Agriculture were used, wherever possible, when calorie data were unavailable<sup>14</sup>. When not available from any of the above sources, calorie data were coded as missing and excluded from the analysis (n=1 order).

*Statistical analysis.* LCA was conducted on child orders (n=8611) using PROC LCA in SAS 9.2 <sup>115,116</sup>. LCA establishes statistically-derived profiles based on a set of categorical items, or "indicators." This approach enables description of latent subgroups, or classes, (here, child orders) that are similar to one another based on whether orders were likely to include certain characteristics. The LCA model estimates two sets of parameters: the proportion of the sample estimated to be in each latent class (class membership prevalence) and the likelihood of having a "yes" response for a particular indicator variable in each latent class (i.e., the probability of having dessert within a particular latent class; item-response probabilities). Posterior probabilities indicating the likelihood of class membership for each individual observation can also be estimated and used to assign each observation into a given class <sup>115</sup>. Item-response probabilities were considered high if the conditional probability representing the relationship between an individual indicator variable and a latent class was >0.7 and low if the conditional probability was <0.3 <sup>116</sup>. Names assigned to each latent class were determined by indicators with item-response probabilities of 0.7 or higher, as these indicators were considered to be key characteristics of that class. We also considered order properties that differentiated each class from the other classes when determining class names. The LCA method has been applied previously to research exploring individual variability in dietary patterns <sup>117</sup> and responses to intervention <sup>118</sup>.

Eight dichotomous indicator variables were used to estimate classes of ordering patterns. Indicator variables were selected based on their potential contribution to the total calorie content of the meal including: whether the child ordered soda <sup>119</sup>, French fries <sup>28</sup>, dessert <sup>28</sup>, a healthy (KLW-eligible) entrée <sup>13</sup>, a healthy (KLW-eligible) side <sup>22</sup>, and an additional a la carte side dish/topping (add-on) <sup>22</sup>, as well as whether the meal was a breakfast item and whether

all default sides were accepted based on how the child's meal bundle was listed on the menu (i.e. Champion Breakfast: one egg, strawberries, and multigrain toast).

We sequentially fit models with one through seven latent classes, stopping once fit indices indicated that model fit was no longer improving with the addition of another class. The best-fitting model was selected based on fit indices (log-likelihood ratio  $G^2$  statistic, Akaike Information Criterion [AIC], and Bayesian Information Criterion [BIC]), parsimony, and interpretability<sup>116</sup>. As the number of classes increased from one to six, the  $G^2$  statistic, AIC, and BIC decreased, indicating a better fit (Table 1). In the seven-class model, the  $G^2$  statistic and AIC continued to decrease, but BIC increased. BIC is also more sensitive to model complexity<sup>116</sup>. Thus, the six-class model had the best fit based on fit indices and parsimony.

Steps were taken to address clustering within the dataset (multiple child meal orders within an individual check and multiple checks and days within a restaurant outlet). First, to test whether clustering of orders within checks were affecting results, we repeated the analysis on a subset with one randomly selected children's meal order per check ( $n=5971$ ), and results were consistent. Thus, we retained the full sample of orders ( $n=8611$ ) in our final models. We also adjusted the LCA for clustering at the location-day level using a pseudo-maximum-likelihood approach<sup>120,121</sup> to account for the hierarchical structure of the dataset.

To further inform our findings from the LCA, we calculated item order frequencies for side substitutions and add-ons across all individual check orders to describe the most common side items ordered with child meals.

All orders were classified into ordering classes based on the associated posterior probability using the final latent class model. The average posterior probabilities for individuals assigned to each class ranged from 0.94 to 0.98, indicating the majority of orders were likely to be in a

given class. We then used the classify analyze approach to test whether ordering classes were associated with the calorie content of the total order <sup>122</sup>. Linear mixed models were used to evaluate differences in the calorie content of meal orders in each of the ordering classes with a fixed effect for outlet and a random intercept for location-day (date nested within outlet). Least squares means were compared between groups and p-values were adjusted for multiple comparisons using Tukey adjustments. The proportion of orders  $\leq 600$  calories were calculated for each class; reflecting the recommended calorie content of a child's meal based on one third of the total daily calorie recommendations for sedentary children ages 5 to 12 <sup>123</sup>, which is consistent with calorie ranges required for reimbursable school meals <sup>124</sup> and KLV nutrition standards <sup>83</sup>.

## **Results**

The best-fitting model contained six latent classes representing different ordering patterns, which were labeled as follows based on the values for the item-response probabilities for all indicators in each class: “healthy meals” (27.0%), “healthy meals, add-ons” (9.6%), “unhealthy sides” (9.2%), “healthy substitutions” (30.9%), “healthy substitutions, add-ons” (1.0%), and “unhealthy substitutions” (22.4%). Estimates of class membership and overall item-response probabilities are depicted in Table 2. Classes differentiated by whether orders were likely to include breakfast entrées, KLV entrées, KLV sides, default sides, add-ons, and/or desserts. Classes labeled as “healthy” were likely to include KLV entrées or sides. Classes labeled as “substitutions” had a low likelihood of including the default side. Since classes clearly differentiated based on whether they were likely to include a breakfast entrée or not, the results for “breakfast” and “non-breakfast” classes are presented separately in Table 2 for ease of interpretation.

Given class membership was largely determined by add-ons and substitutions, we further evaluated the side items likely to be substitutions and add-ons by entrée type to better understand how these properties could contribute to the order's total calorie content. The top item order frequencies for side substitutions and add-ons varied based on entrée type (Tables 3 and 4). The most common add-ons in breakfast entrée orders were pancake toppings (chocolate chips and blueberries), processed breakfast meats, and eggs. For non-breakfast entrée orders the most common add-ons were strawberries, French fries, and burgers (Table 3). Across all breakfast orders, the most common side substitutions were processed breakfast meats, fried potatoes, and applesauce, whereas common non-breakfast side substitutions were fried potatoes and strawberries (Table 4).

Meals orders assigned to the healthy meals class based on posterior probabilities were significantly lower in calories than the other ordering classes and met calorie recommendations on average (Figure 1). Orders assigned to both the unhealthy substitutions and the healthy substitutions, add-ons classes were on average significantly higher in calories than the other classes (>1159 calories). Almost one-third of meal orders across all classes met calorie recommendations, the majority of which fell into the healthy meals (59.4%) and healthy substitutions (27.1%) classes (Table 5). Ordering patterns more likely to exceed calorie recommendations were characterized by unhealthy side substitutions, add-on sides, and/or a non-KLW entrée. However, almost all the ordering classes included orders that both met and exceeded calorie recommendations. The healthy meals class was the only class where the majority of orders met calorie recommendations, yet ~30% of the orders still exceeded recommendations (Figure 2).

## Discussion

Overall, these findings illustrate individual differences in ordering patterns after the implementation of healthier menus and demonstrate that orders assigned to the six ordering classes uncovered here differed in their associations with total meal calories. Child meal orders classified into the healthy meals and healthy substitutions classes were more likely to include healthy sides and lack add-ons, soda, dessert, and French fries. These classes were also more likely to include orders that met calorie recommendations compared to the healthy meals, add-ons; unhealthy sides; healthy substitutions, add-ons; and unhealthy substitution classes. Healthier meal patterns (meals in the healthy meals and healthy substitutions classes) comprised a substantial percentage of the total meal orders (57.9%), consistent with our previous research highlighting the overall success of healthy menu modifications in encouraging healthier ordering patterns among those ordering off the children's menu in this restaurant <sup>13,106</sup>.

This study adds to our previous work by examining classes of ordering patterns to better understand variability among patrons ordering from the healthy children's menu <sup>13,106</sup>. The approach taken here also allowed us to inductively determine these groupings, thereby accounting for the many ways an individual can achieve a healthy meal <sup>163</sup>. LCA enabled us to evaluate co-occurring order properties that may otherwise be missed using traditional approaches (i.e. meals with high probabilities of including the default side and low probabilities of KWL entrées).

In this analysis, meals likely to include side substitutions and/or add-ons were also more likely to exceed calorie recommendations, which may be due, in part, to the specific side and add-ons in these meals. Across all meal orders (regardless of class membership), the most popular side substitutions and add-ons were calorie-dense items like breakfast meats and fried potatoes rather than the KIW-eligible sides. Thus, while meal orders in the healthy meals; healthy meals, add-ons; healthy substitutions; and healthy substitutions, add-ons classes were likely to include at least one healthy side, these findings point to the potential need to further tailor children's menu changes to reach patrons who may reject or compensate for healthier menu items <sup>13</sup>. Efforts to reduce the portion sizes of the most popular add-ons, further exclude higher-calorie items from the menu, or promote lower-calorie sides (i.e. apple sauce rather than French fries) and add-ons (i.e. blueberry rather than chocolate chip pancake toppings) may help shift ordering patterns to be more consistent with the overarching nature of healthy menu changes. Previous research suggests certain demographics of children (boys, infrequent restaurant goers, and frequent take-out diners) may be less receptive to fruit and vegetable sides in the restaurant setting <sup>22</sup>. Additional research evaluating the characteristics of individuals likely to make order modifications in response to healthier restaurant menus can help inform the content and targeting of future menu change efforts, marketing efforts, and other restaurant interventions. However, it is also possible that differences in the calorie content of meal orders resulted from differences in the portion size of meals (portion size data were not available here)<sup>45</sup>. Future research should evaluate the relative impact of side/beverage modifications and differences in portion size on the total calorie content of meal orders.



Our analysis suggests KLW breakfast entrées were more likely to be accepted relative to non-breakfast KLW entrees, possibly because the KLW breakfast entrées offered may look more familiar to children (Table 2). In an analysis of 41 quick-service and full-service restaurant chains, the most common children's menu entrées included fried chicken entrées, pasta, burgers, and grilled cheese sandwiches, entrées that are generally high in calories and unlikely to meet KLW criteria <sup>89</sup>. Classes likely to include breakfast entrées were also less likely to include unhealthy items like French fries, dessert, and soda—items are not typically consumed in combination with items like pancakes and waffle—compared to classes that were likely to include a non-breakfast entrée. Experimental and observational studies highlight the importance of repeated exposure and familiarity for food acceptance in children <sup>158,164</sup>. Therefore, collective and widespread changes to restaurant children's menus, in concert with changes to meals offered to children in other settings such as schools <sup>165</sup>, are likely to help make healthy entrées, sides, and beverages more normative and acceptable overall.

Children who reject the healthier entrées and sides may benefit from additional modifications to popular entrée items that reduce the overall calories of the meal without substantial changes to the menu itself (for example, a reduction in the size of the children's serving of French fries, which in the time period studied here was an adult-sized portion). Our findings suggest that menu changes that involve both increases in the availability of healthy items (especially breakfast items) and healthy modifications to existing items would be more likely to have widespread reach, impacting all subgroups of children and having a broader impact on the overall quality of children's restaurant meals.

The current study is not without limitation. While we are able to evaluate variability among orders in this sample, our analysis was conducted in a single, regional full-service restaurant chain during a specified time frame and cannot be generalized to menu changes in the restaurant setting broadly or over time. We also cannot evaluate on the roles of child characteristics (demographics, frequency of dining out, etc.) or caloric intake (vs. calories ordered) in this dataset. In addition, we were unable to distinguish between orders that included fat free or whole milk vs those that included flavored milk, as these items were listed under the same code in the database. It is important to note that the 600 calorie cutpoint is specific to sedentary children ages 5-12, and individual calorie needs vary by age, sex, and physical activity level. Additionally, calories are not the only measure of nutritional quality, and it is possible that some meals higher in calories may also have better nutrient profiles given their fat, sugar, and fiber content <sup>113</sup>. Although children's menu offerings in this restaurant were specified for children  $\leq 12$  years old, we cannot be certain if children were the only patrons to order these items, items were shared among the dining group, or if children supplemented their meals with adult menu items. Future controlled research should evaluate whether interventions tailored based on the above ordering patterns are effective at shifting meal orders in the short-term and over time. Additional research examining whether and how the overall ordering patterns observed here vary over time, based on restaurant type (i.e. quick service), and based on the type and degree of menu changes would further inform child obesity prevention efforts in the restaurant setting.

This is the first study to examine individual differences in ordering patterns after the implementation of a healthier children's menu in the restaurant setting. Strengths of the current study include our evaluation of order characteristics most likely to contribute to the

caloric content of the meal and the academic-business partnership that afforded the opportunity to examine comprehensive, ecologically-valid order data. Since KIW eligibility is determined by the content of the total meal, our application of latent class analysis enables us to better understand patterns associated with meals that were KIW approved, but also included modifications that resulted in excess calories (i.e. add-ons and substitutions), findings which can further inform menu change efforts like these and help ensure that interventions reach subsets of the population that may disproportionately suffer from diet-related disease, but may not otherwise be reached using intervention approaches targeted to the population average <sup>166</sup>.

These findings illustrate the potential of LCA in exploring meal order subgroups after the implementation of a healthier children's menu. While a large percentage of child meal orders fell into ordering patterns consistent with healthier children's menu changes and were likely to meet calorie recommendations, orders inconsistent with menu changes emerged in over one-third of children's meal orders. Understanding the variability in ordering behavior in response to healthier menus can help inform restaurant-based intervention efforts to reach patrons that may reject or compensate for healthier items.

**Table 4.1 Criteria to Assess Model Fit for Latent Class Analysis Model**

	Number of Classes						
	1	2	3	4	5	6	7
G <sup>2</sup>	15293.8	4662.6	2385.1	734.2	370.1	222.0	182.9
AIC	15309.8	4696.6	2437.1	804.2	458.1	328.0	306.9
BIC	15366.3	4816.6	2620.7	1051.3	768.7	702.2	744.7

Note: Fit statistics displayed above are from the model selection phase: i.e. examination of multiple latent class analysis models with consecutively increasing numbers of classes, before deciding on the best-fitting model.

**Table 4.2 Class Membership and Conditional Item-Response Probabilities for Six Latent Classes of Children’s Ordering Patterns**

Class Indicators	Latent Class					
	<i>Breakfast</i>			<i>Non-Breakfast</i>		
	Healthy Meal	Healthy Meals, Add-Ons	Unhealthy Sides	Healthy Substitutions	Healthy Substitutions, Add-Ons	Unhealthy Substitutions
<i>Class Membership Probabilities</i>	0.27	0.10	0.09	0.31	0.01	0.22
<i>Item-Response Probabilities<sup>1</sup></i>						
Soda	0.12	0.12	0.16	0.18	0.26	0.25
Dessert	0.15	0.19	0.16	0.28	0.33	0.29
Fries	0.00	0.03	0.13	0.00	0.84	0.83
Add-on Items	0.00	0.99	0.20	0.07	1.00	0.05
Kids LiveWell Meal	0.66	0.83	0.69	0.26	0.08	0.08
Healthy, Kids LiveWell Side	1.00	1.00	0.18	1.00	0.96	0.00
Accepted Default Side	0.89	0.91	0.00	0.54	0.32	0.00
Breakfast Entrée	0.96	0.97	0.88	0.02	0.01	0.00

*Notes:* Class membership probabilities demonstrate the percentage of the sample estimated to be in each latent class. The item-response probabilities demonstrate the relationships between the indicator variables and the latent classes. All analyses were adjusted for clustering at the restaurant level. <sup>1</sup>The response probabilities presented here represent “yes” responses to the indicator variable. High probabilities indicate that a member of that particular latent class is likely to have a “yes” value for that particular indicator variable, and low probabilities indicate that a member of that class is likely to have a “no” value for that indicator variable. High (>0.7) and low (<0.3) probabilities are shaded in dark and light grey for ease of interpretation. Names assigned to each latent class were determined by indicators with item-response probabilities of 0.7 or higher, as these indicators were considered to be key characteristics of that class. Those classes denoted as “healthy” were likely to contain Kids LiveWell-eligible meal or side. The non-breakfast classes were characterized by the additions/substitutions of side items, since all three classes were characterized by having a low probability of Kids LiveWell-eligible meals.

**Table 4.3 Top Five A La Carte Side Items added to Orders, by Menu Section (Breakfast, Non-breakfast Entrees)**

<i>Item</i>	<i>Count</i>	<i>Percentage of orders</i>
Breakfast Entrée Add-Ons		
Chocolate Chips	379	34.8
Bacon	267	24.5
Sausage <sup>1</sup>	136	12.5
Blueberries	66	6.1
Egg	61	5.6
Total Breakfast Entrée Add-Ons	1089	83.5
Non-Breakfast Entrée Add-Ons		
Strawberries	95	22.0
French fries <sup>2</sup>	52	12.0
Burger	43	10.0
Bacon	38	8.8
Apple Sauce	36	8.3
Total Non-Breakfast Entrée Add-Ons	432	61.1

*Notes:* These descriptive analyses include aggregate order data from the subsample of individual checks that included an add-on item and an entrée (n=1521).

<sup>1</sup>Included items listed as pork sausage, maple sausage, veggie sausage, and sausage in the order database.

<sup>2</sup>Included items listed as home fries (or potato wedges) and French fries.

**Table 4.4. Top Five Side Substitution Items included in Orders by Menu Section (Breakfast, Non-Breakfast Entrées)**

<i>Item</i>	<i>Count</i>	<i>Percentage of orders</i>
<b>Breakfast Sides Substitutions</b>		
Bacon	408	34.8
French Fries	327	27.9
Sausage <sup>1</sup>	137	11.7
Turkey Bacon	51	4.3
Apple Sauce	65	5.5
<b>Total Breakfast Entrée Side Substitutions</b>	1173	84.2
<b>Non-Breakfast Sides Substitutions</b>		
French Fries <sup>2</sup>	1656	50.1
Strawberries	734	22.1
Apple Sauce	270	8.2
Corn	143	4.3
Mashed Potatoes	141	4.3
<b>Total Non-Breakfast Entrée Side Substitutions</b>	3307	88.9

*Notes:* These descriptive analyses include aggregate order data from the subsample of individual checks that included a side substitution and an entrée (n=4480).

<sup>1</sup>Included items listed as pork sausage, maple sausage, veggie sausage, and sausage in the order database.

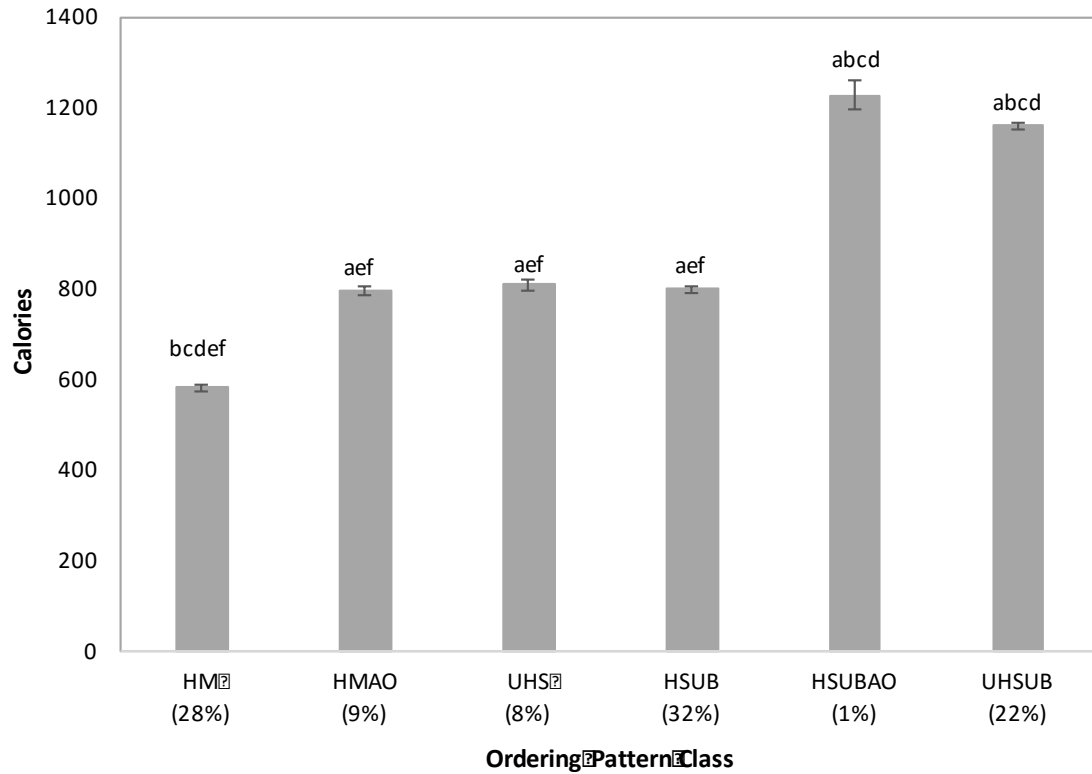
<sup>2</sup>Included items listed as home fries (or potato wedges) and French fries.

**Table 4.5 The Percentage of Orders that Met or Exceeded Calorie Recommendations in Each Ordering Class**

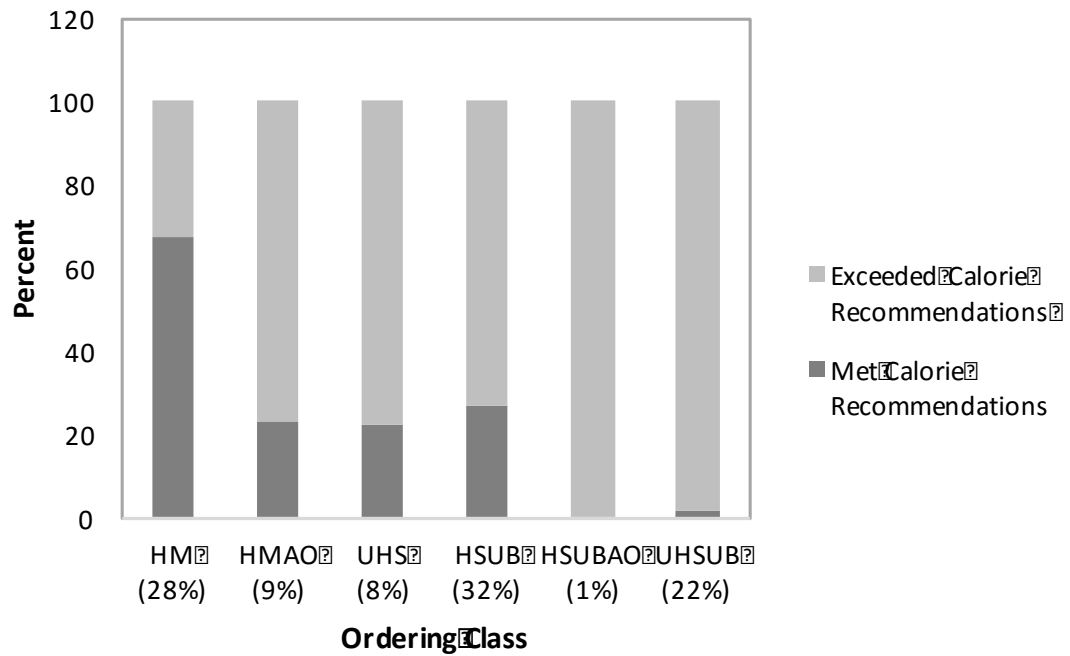
<i>Ordering Class</i>	<i>Met Calorie Recommendations</i>	<i>Exceeded Calorie Recommendations</i>
HM (28%)	59.4	13.2
HMAO (9%)	7.1	10.8
UHS (8%)	5.3	8.7
HSUB (32%)	27.1	33.8
HSUBAO (1%)	0.0	1.2
UHSUB (22%)	1.0	32.3

*Notes:* Percentage of orders that met or exceed calorie recommendations were calculated from the probability of class membership for each ordering class conditional on meeting or exceeding calorie recommendations (based on the total meal being  $\leq 600$  calories). Of those orders that met calorie recommendations, results show the percent that are in the HM, HMAO, UHS, etc. class (column percent). Abbreviations for classes are as follows: HM=Healthy Meals; HMAO=Healthy Meals, Add-Ons; UHS=Unhealthy Sides; HSUB=Healthy Substitutions; HSUBAO= Healthy Substitutions, Add-Ons; UHSUB=Unhealthy Substitutions. Percentages listed in parentheses next to the class names represent the percent of orders assigned to each of the latent classes.





**Figure 4 1** Average total calorie content of meal orders in each of the six ordering classes (n=8611). Values shown are LS means (least square means) and standard errors from linear mixed models with a fixed effect for outlet and a random intercept for location-day (date nested within outlet). Bars marked with different letters were significantly different (<0.0001, Adjusted p-value for LS means difference). Bars were labeled in alphabetical order; for example, the HM class was bar “a” and was significantly different from bars “b-f” (all the other classes). Abbreviations for classes are as follows: HM=Healthy Meals; HMAO=Healthy Meals, Add-Ons; UHS=Unhealthy Sides; HSUB=Healthy Substitutions; HSUBAO= Healthy Substitutions, Add-Ons; UHSUB=Unhealthy Substitutions. Percentages listed under the class names represent the percentage of orders that were assigned to each of the latent classes.



**Figure 4 2** The distribution of orders that met or exceeded calorie recommendations (based on the total meal being  $\leq 600$  calories) for each ordering class. Of those orders that were in the HM, HMAO, UHS, etc. classes, the percent that met or exceeded calorie recommendations (row percent). HM=Healthy Meals; HMAO=Healthy Meals, Add-Ons; UHS=Unhealthy Sides; HSUB=Healthy Substitutions; HSUBAO= Healthy Substitutions, Add-Ons; UHSUB=Unhealthy Substitutions. Percentages listed in parentheses next to the class names represent the percent of orders assigned to each of the latent classes.

## **CHAPTER 5: Evaluating spillover effects on parent orders from a campaign aimed at empowering moms to select healthier restaurant meals for their children**

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## ABSTRACT

**Objective:** Evaluate the spillover effects of the *You're the Mom* campaign on the calorie content of parent meal orders.

**Design:** Community randomized trial.

**Setting:** Parents surveyed at PRE (April-May 2016) and POST (August-October 2016) in 11 locations of a national quick service restaurant (QSR) chain in two sociodemographically matched communities in Massachusetts.

**Participants:** Parents of children ages 4 to 11 (n=1533).

**Intervention:** The *You're the Mom* campaign aimed to empower moms to select healthier items for their children in QSRs via simple, actionable messages and may influence parent orders through priming or the desire of parents to serve as positive role models. The campaign's priority population included moms who identify as having a lower level of educational attainment, Hispanic or Black and frequent fast food consumers, since children from these population subgroups have disproportionately high rates of obesity and are more likely to consume excess calories from restaurants. The campaign was disseminated during Summer 2016.

**Main Outcome Measures:** Total calorie content of parent orders.

**Analysis:** Difference-in-differences multivariable regression.

**Results:** Among all moms and moms exposed to the campaign, differences between the intervention and control communities in the change in calories ordered from PRE to POST were in the expected direction, but were not statistically significant ( $\beta=-9.6$  and  $\beta=-15.4$ , respectively). Among all parents and moms in the priority population, we find no significant differences in the change in order calories from PRE to POST between the intervention community and the control community ( $\beta=37.7$  and  $\beta=7.5$ , respectively).

**Conclusions and Implications:** These findings suggest there are no spillover effects of the campaign on parent orders. To also influence parent orders, we may need to consider strategies that explicitly ask them to consider their own ordering habits as part of interventions targeting children's meals in restaurants.

**Key words:** restaurants, communication campaigns, spillover, families

## INTRODUCTION

Spillover effects can potentially have important effects in public health interventions, and this has been demonstrated in a variety of interventions. For example, in a conditional cash transfer program<sup>167</sup> non-eligible households in the same villages experienced economic benefits from the program by borrowing more from family and friends, receiving more transfers, and reducing precautionary savings<sup>167</sup>. Similarly, in a deworming drug program administered in schools, investigators found that untreated students in schools experienced improvements in health and school participation<sup>168</sup>. Despite compelling evidence in other areas, there have been very few studies evaluating spillover in the nutrition literature. Most recently, spillover effects were observed in a multicomponent child-centered obesity prevention intervention, where the intervention was associated with a significant decrease in parent body mass index<sup>91</sup>. Similar spillover effects on parents were observed in a farm to school intervention, with an increase in children's requests for fruits and vegetables at home, an increase in availability of fruits and vegetables in the home, and an increase in parent's value of fruits and vegetables over the course of the intervention<sup>92</sup>. Other nutrition and physical activity interventions in childcare settings have also found effects on parents during out-of-care time<sup>93</sup>.

Similar unintended positive effects may occur in child-directed interventions aimed at improving the nutrition quality of children's meals in restaurants as well, although they have not been investigated. The growing number of interventions aimed at improving the quality of children's restaurant meals creates a large potential for spillover effects on parents through two hypothesized mechanisms: 1) parents may be influenced by intervention

messaging via priming, and may choose healthier options for themselves from the standard menu as a result<sup>94,95</sup> and 2) parents may decide to order a healthier meal when dining out based on their desire to serve as a positive role model for their children<sup>26</sup>. These unintended benefits have health implications due to the contribution of restaurant meals to excess calories, weight gain, and poor diet quality<sup>4,35</sup>, particularly among frequent restaurant meal consumers<sup>3,127</sup>. Here we focus on a study evaluating the *You're the Mom* campaign that aimed to empower moms to select healthier items for their children in quick service restaurants (QSRs) via simple, actionable messages that are centered around healthy changes that can be made to the child's meal. While this campaign was developed with the intention to improve the quality of child meal orders (Economos et al., in prep), it is possible that parents may be positively impacted by the campaign as well.

Interactions between parents and children in the restaurant setting have the potential to enhance the intended effects of campaigns like *You're the Mom*. Research in other settings suggests that children learn many health behaviors from their parents via role modeling and food-related parenting practices<sup>26,107</sup>. Here, if parents are reached by the campaign, there is the potential for a positive feedback loop where parents are simultaneously influencing their kids through parenting practices informed by this messaging campaign, and parents are further influencing their children when they change their own behavior (via role modeling). These types of positive unintended consequences can also benefit parents directly, since restaurant meals are associated with excess intake of calories and higher BMIs in adults<sup>169-171</sup>. Given the potential benefits of spillover effects on nutrition interventions, it is important to consider whether these effects exist. As such, the purpose of this study was to evaluate

whether there were spillover effects from the *You're the Mom* campaign on the calorie content of parent meal orders.

## **METHODS**

### **Study design**

We evaluated *You're the Mom*, a 16-week community-wide, social marketing campaign, using a group randomized design in two sociodemographically diverse mid-sized communities in Massachusetts that were ~50 miles apart. Parents and legal guardians of children ages 4-11 were recruited within 11 locations of a national quick service restaurant chain (QSR) (6 in the intervention community, 5 in the control community). Parent and child meal orders were evaluated at two time points: before the campaign was implemented (PRE; April 1-May 21, 2016) and during the last 7 weeks of the campaign implementation period (POST; August 11-October 8, 2016). Only one parent-child pair was allowed to participate per family. When there were multiple children and parents, the family chose which parent participated; to randomly identify one child, study staff had the parent identify the child with the most recent birthday and then all survey responses were to be about that child. All parents were approached after ordering to minimize the influence of study staff on ordering behavior. In the intervention community, only those parents who lived, worked, or frequently traveled in the community could participate in the study to omit individuals who would not have had the opportunity to be exposed to the campaign. A total of 2200 parent child pairs were recruited across both communities at both time points. All data were collected between 2:30 and 7pm on Thursdays and Fridays and between 10:30 am and 3pm on Saturdays. Times for data collection were determined based on our previous experience collecting data in



restaurants and information from restaurant managers. Calories were listed on the menus in all locations, providing access to this information at the point-of-purchase. All study materials were available in English and Spanish, and recruitment was conducted in both languages by trained study staff. Study procedures were reviewed and approved by the Tufts University Institutional Review Board.

### **Campaign Development and Dissemination**

The *You're the Mom* campaign was developed in early 2016 (Harellick et. al., in prep). The priority audience for the campaign was moms who were low socio-economic status (SES), African American or Hispanic, and who frequently ( $\geq 2$ -3 times/month) dine out at QSRs, since children in these sociodemographic groups are at a higher risk of obesity<sup>11</sup>, are more likely to be exposed to targeted advertising from fast food companies<sup>125,126</sup>, are more likely to consume excess calories and fat from QSRs<sup>3,127</sup>, and tend to have higher rates of frequent fast food consumption<sup>10,12</sup> compared to higher-income, Non-Hispanic White youth. All materials were developed using consumer insights gathered via focus groups with low-income African American and Hispanic mothers (unpublished data), a national concept test (unpublished data), a review of the existing literature<sup>25,45,58,60,128</sup>, and our previous research<sup>22,102,129-132</sup>. The campaign also was informed by self-determination theory<sup>133</sup>. The overall goal of the campaign was to empower moms to select healthier items for their children in restaurants. While not an explicit campaign message, an underlying goal was to get mothers to order meals for their children that were  $\leq 600$  calories, which is consistent with the Kids LiveWell (KLW) criteria for a healthy meal<sup>123</sup>, RAND corporation standards<sup>135</sup>, and standards for the National School Lunch Program<sup>136</sup>. Direct calorie-related messaging was not used, as findings from our focus group participants indicated this information would

not influence their ordering decisions (unpublished data); and previously published research suggests calorie-centered information-based strategies may not be effective in low-income populations<sup>49</sup>. Instead, the messaging targeted three small, actionable, and easy-to-implement ordering behaviors that would help reduce the overall calorie content of the child meal order: 1) add a fruit or vegetable to the meal and/or substitute fruit or vegetable sides in place of items like fries<sup>22</sup>, 2) choose water or milk over soda<sup>137</sup>, and 3) order smaller portions, such a kids' meals<sup>129</sup>. While the goal of the campaign was to empower parents to improve the quality of orders for their children, it's possible that parents would also make changes to the entrées, sides, and/or beverages in their own meals that reduce total calories through priming effects and an enhanced motivation to serve as a positive role model for their child (as described above).

The *You're the Mom* campaign was disseminated in the intervention community in both English and Spanish via traditional media outlets (billboards, radio, social) and grassroots efforts including wallsapes, flyers, painted utility boxes, and banners in community centers. Community members were engaged in the dissemination of the campaign as well. An advisory committee comprised of three local, non-profit organizations provided insight into how best to disseminate the campaign and reach the priority population, moms from the community were featured on two wallsapes, and local artists created the utility box renditions. The campaign ran from June 11- September 30, 2016.

### **Measurements.**

*Total calories of the meal order.* Parent meal orders were identified from collected meal receipts, which contained information about each meal component (entrée, side, beverage, dessert,

and condiments/sauces). Parents indicated which of the meal components they ordered and which items on the receipt they intended to consume, and these items were recorded by study staff. The restaurant provided a spreadsheet containing all currently available menu items and their calorie information, which was used to determine the calorie content of the items ordered. The total calorie content of parent meal orders was calculated by summing the calorie content of each item they ordered for themselves.

*Parent Demographics.* Parent gender, age, and educational attainment were collected via a short paper survey. Highest level of parental educational attainment was used as an indicator of SES, as research indicates educational attainment and income are highly correlated and that education is a more time-stable indicator of an individual's SES<sup>138</sup>. Because the primary outcome of the study was related to children's orders, frequency of dining out and race/ethnicity were collected for the child and were used as proxies for parent frequency of fast food intake and race/ethnicity in these analyses. For the purposes of this study, we considered frequent fast food consumers to be those whose children ate out at fast food restaurants  $\geq 2$ -3 times per month.

*You're the Mom campaign exposure.* For parents in the intervention community at POST, we evaluated whether they were exposed to the *You're the Mom* campaign based on their responses to questions about campaign recognition. Parents who responded "yes" to having seen advertisements from the campaign or who stated that they saw, read, or heard about ads with the campaign's slogan were considered exposed; those who did not were considered unexposed.

*Statistical Analysis.* All analyses were conducted in SAS version 9.4 (Cary, NC). The analytic sample included all parents with complete order calorie and demographic data (n=1570). Parents whose total order was zero calories were excluded, since these parents were not considered to be dining during this meal occasion (n=37). In total, 1533 parent orders were used in these analyses.

Summary and descriptive statistics were reported or computed for parent demographics and select order properties. Differences in the change in the calorie content of parent meal orders from PRE to POST in the intervention and control communities were assessed using difference-in-differences regression analysis. All models were adjusted for demographic variables and clustering by location, with a random intercept for location. Robust standard errors were used, as values for total order calories were highly skewed. Since being female or low SES were significantly associated with order calories (Table 5.2) and the *You're the Mom* campaign priority audience was moms with children who identified as low SES, Hispanic or Black, and/or frequent fast food consumers, we also evaluated the time-by-treatment effect among moms (Table 5.3) and among moms who belonged to the priority campaign audience (moms of children who were low SES, Hispanic or Black, and frequent fast food consumers; Table 5.5). Models evaluating the campaign impact in moms were run as intent-to-treat analyses (Table 5.3), as well as including only those moms in the intervention community at POST who reported being exposed to the campaign (Table 5.4) to account for the possible variability in exposure to the campaign, since it was disseminated within the community and not directly in the restaurant locations where data collection occurred.

## RESULTS

Table 5.1 describes the sociodemographic and select behavioral characteristics of parents surveyed at each time point in each community. Parents and caregivers were predominantly female and low SES at both time points and in both communities. They were also likely to be the parents of children who identified as Hispanic and were frequent fast food consumers. Parents in the control community were more likely to be older, have lower levels of educational attainment, have children who identified as White, and have children with a lower prevalence of frequent eating out than parents in the intervention community. There were no significant differences in total calories of meals ordered by parents between the two communities at either time point (Figure 5.2).

Table 5.2 presents the unadjusted and adjusted results from the difference-in-differences analysis evaluating the time-by-treatment effect of the *You're the Mom* campaign on all parent orders. At baseline, parents in the intervention community ordered 65.1 fewer calories than parents in the control ( $\beta=-65.1$ ; 95% CI: -99.8, -30.3). The change in calories ordered from PRE to POST was not significantly different in the intervention and control communities ( $\beta=37.7$ ; 95% CI: -32.7, 108.2).

Among moms and moms who reported being exposed to the *You're the Mom* campaign (42.6% of moms in the intervention community at POST), we found the differences between the intervention and control communities in change in order calories from PRE to POST was in the expected direction, but not significant (Tables 3 and 4;  $\beta=-9.6$  95% CI: -63.6, 44.4 and  $\beta=-15.4$  95% CI: -81.3, 50.4, respectively). For those moms who identified as belonging to the priority audience (regardless of campaign exposure; 43.0% of all moms in the study), the

difference between the intervention and control communities in change in the calories ordered from PRE to POST was also not significant (Table 5.5;  $\beta=7.5$  95% CI: -54.7, 69.7).

## DISCUSSION

These findings suggest there were no spillover effects from the *You're the Mom* campaign on the calorie content of parent orders. Specifically, we found that the changes in order calories over time were not significantly different in parents in the intervention community compared to the control. Given the messaging was around improvements that could be made to child meal orders, parents may not have internalized these messages with regard to their own orders. Yet, since children can learn healthier ordering behavior from their parents<sup>26</sup>, even small positive changes to parent orders that result in improvements in the nutrition quality of parent meal orders can have an impact on the quality of orders for the whole family. Therefore, a consideration of how we can directly impact parent ordering behaviors via healthy meal promotional campaigns is needed.

To also influence parent orders, we may need to promote strategies that explicitly ask them to consider their own ordering habits as part of interventions targeting children's meals in restaurants. Though our study was informed by previous research that observed spillover effects in other contexts<sup>91,92</sup>, it is possible that these interventions engaged parents in ways that were more effective. Both *Shape Up Somerville*<sup>91</sup> and the *Delicious and Nutritious Garden*<sup>92</sup> interventions utilized school-based parent events and/or take home activities that engaged parents directly in intervention components. These more direct-to-parent modes of engagement may be imperative to spillover effects in the restaurant setting. Efforts to elicit

parents' motivations to serve as a positive role model for their child and/or to provide strategies for making healthier menu choices for the whole family may be effective at improving the quality of parent meal orders in the restaurant setting<sup>26</sup>.

There are several possible explanations for our observed non-significant findings in these analyses as well. First, it's possible that the focus of the *You're the Mom* campaign on small actionable ordering behaviors that, if enacted individually rather than simultaneously or in combination, may not have had a significant impact on overall calories. For example, if parents focused on the portion of the campaign promoting the addition of fruit or vegetables to meals or the substitution of milk for soda, it is likely that these changes, while improving the overall nutrition quality of parent meals<sup>172</sup>, would not significantly reduce the overall calorie content. Second, this sub-study was a part of a larger research study, which was designed to evaluate the impact of the *You're the Mom* campaign on the calorie content of child meal orders. The overall study was powered to detect a -80 calorie difference in the orders of children in the intervention community at POST. Given that the study was designed and powered to detect this large effect among children, and the campaign would likely have an even smaller impact on parents, it is not surprising that our findings in this sub-study were non-significant. Third, for both the child and parent analyses, we observed a larger than expected decline in order calories over time in both the intervention and control communities. Since both analyses employed a difference-in-differences regression to evaluate the campaign impact, these temporal shifts have significant influence on the estimated effect of the campaign (as evaluated by the time-by-treatment interaction term in all models).

It is also possible that the findings presented here are further confounded by underlying differences in the populations sampled at the different time points in the two communities. As Table 5.1 demonstrates, there were some significant differences between the intervention and control communities at both time points, as well as some differences in the study populations within each community over time. While we adjusted for these sociodemographic characteristics in our final models, there may be residual confounding from other unmeasured characteristics in these four sub-populations that were not accounted for here. There are a number of factors that influence food choices in adults that may influence whether parents internalize the messaging from the *You're the Mom* campaign and were not measured as a part of this study including taste, cost, familiarity, and convenience<sup>96</sup>. Personal, social, and cultural factors may influence parent food choices in the restaurant context as well and were not explicitly explored here<sup>98-101</sup>. Moreover, it's possible that, in using the race/ethnicity and frequency of dining out of the child, some participants may have been misclassified.

Additional research is needed to uncover underlying mechanisms that may help improve parent meal orders in the restaurant setting. It is possible that the effects of a messaging campaign promoting healthier options were attenuated in an environment where unhealthy food advertisements are highly prevalent<sup>173</sup>. Moreover, other promotional campaigns in the restaurant setting have found non-significant results<sup>174,175</sup>, suggesting that competing factors including habitual ordering<sup>48,159</sup>, pre-conceived expectations around what restaurant meals should come with, and/or other contextual factors<sup>94</sup> may interfere with these types of campaigns. Efforts to improve the quality of standard menu offerings may be necessary to see significant changes in the nutrition quality of parent meal orders. In particular, strategies



that include more healthy entrée options and offer healthy sides and beverages by default could make these items appear more normative in this setting and help improve the nutrition quality of parent meal orders.

Despite the aforementioned limitations, this is the first study to evaluate spillover effects from a community-wide messaging campaign on parent orders in locations of a large national QSR chain at the point of purchase. We successfully recruited a large number of participants from our priority population (low-income, Hispanic or Black, and frequent fast food consumers), who have historically been underrepresented in published research<sup>176</sup>, but are an important population given the disproportionately high rates of diet-related diseases<sup>177</sup>. In developing the *You're the Mom* campaign, we engaged community members as well as an advertising agency with experience in targeted campaigns to ensure that our campaign would resonate with the priority audience. When collecting data in the field, all parents were recruited after ordering, which limits the potential for study staff to alter or bias ordering behavior. Moreover, we were able to collect primary data on individuals as opposed to abstracting aggregate order data, which allows us to control for individual characteristics that can influence ordering behavior in restaurants. Future controlled studies should evaluate whether increasing the dose or duration of similar campaigns and/or evaluating exposure to these campaigns at the point of purchase could help ensure that more parents see and use the campaign messaging while ordering for themselves and/or their children.

## Implications for research and practice

The *You're the Mom* campaign aimed to engage and empower moms to make healthier choices for their children in QSRs, and did not have any significant effect on the calorie content of parents' own orders. It is imperative that future research consider spillover effects, as they have the potential to enhance or diminish the intended effect and, in some cases, may be associated with unintended harm<sup>178</sup>. The findings from this research suggest that efforts to encourage parents to make positive changes to their own orders are needed when targeting parental ordering behaviors in nutrition interventions aimed at improving the quality of children's restaurant meals.

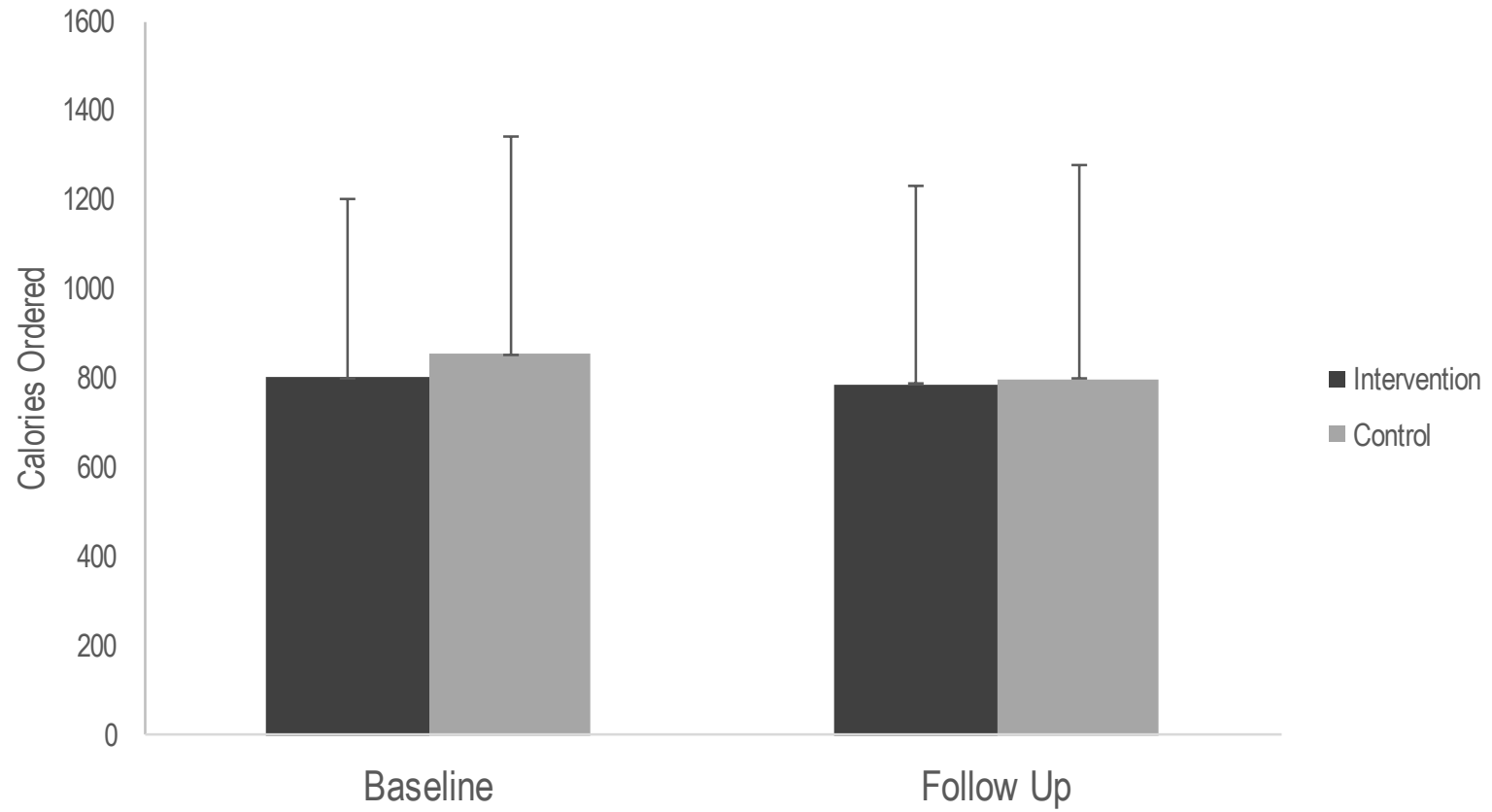


**Figure 5 1** An example advertisement from the You're the Mom campaign, which was disseminated in the intervention community in both English and Spanish via traditional media outlets (billboards, radio, social) and grassroots efforts including wallscapes, flyers, painted utility boxes, and banners in community centers, as well as through public relations and community engagement. The campaign ran from June 11- September 30, 2016.

**Table 5 1 Demographic and select behavioral characteristics of parents and children at baseline and follow up**

	Baseline		Follow up	
	Intervention (N=210)	Control (N=309)	Intervention (N=530)	Control (N=484)
Age (yrs)				
Mean (standard deviation)	35.2 (9.4)	36.2 (8.6)	34.7 (8.7)	36.4 (8.3)*
Associate's degree or lower (%)	86.7	77.7*	88.9	73.1*
Female (%)	71.0	76.1	73.6	72.5
Child race/Ethnicity (%)				
<i>Black</i>	9.0	8.7*	10.4	8.0*
<i>Hispanic</i>	70.5	54.1	68.5	39.3
<i>White</i>	15.7	30.4	13.9	40.5
<i>Other or N/A</i>	4.8	6.8	7.2	12.2
Child ate at fast food $\geq$ 2-3 times/month (%)	70.5	65.4	72.7	61.6*

\*Significantly different from the intervention by t test (age, calories) and chi-squared (all others) at  $p < 0.05$ . These analyses include all observations with non-missing data for variables of interest and including snacks.



**Figure 5 2. Differences in calories ordered between parents at baseline and follow up in the two communities (n=1533). None of the values were significantly different from each other based on t-tests.**

**Table 5 2 Difference in differences estimates of the impact of the *You're the Mom* campaign on calories ordered for all parents (All Parents, Intent to Treat, n=1533)**

	Model 1	Model 2
YTM	-51.5 [-79.0, -23.9]	-65.1 [-99.8, -30.3]
Follow-Up	-54.4 [-109.3, 0.5]	-50.7 [-103.5, 2.1]
YTM*Follow-Up	39.9 [-30.4, 110.2]	37.7 [-32.7, 108.2]
Fast Food Frequency		
<i>4+ times/week</i>	--	-23.6 [-214.8, 167.6]
<i>1-3 times/week</i>	--	23.2 [-48.5, 94.8]
<i>2-3 times/month</i>	--	4.0 [-63.3, 71.3]
<i>1 time/month</i>	--	51.1 [-11.0, 113.3]
<i>A few times/year</i>	--	--
Age	--	-1.6 [-6.4, 3.2]
Race/Ethnicity		
<i>Black</i>	--	-25.4 [-94.7, 44.0]
<i>Hispanic</i>	--	-4.4 [-72.6, 63.8]
<i>Other</i>	--	-46.1 [-158.6, 66.5]
<i>N/A</i>	--	-66.0 [-159.2, 27.2]
<i>White</i>	--	--
Female	--	-107.1 [-166.6, -47.5]
Associate's or Lower	--	97.4 [69.9, 124.9]

Notes: Values shown are from a linear mixed model with a random intercept for location. Model 1 is unadjusted, Model 2 is adjusted for parent age, education level, gender, race/ethnicity, and frequency of eating out at fast food restaurants. These analyses include all observations with non-missing data for variables of interest and including snacks. Robust standard errors were used because values for total order calories were highly skewed. Values in brackets represent 95% confidence intervals. YTM=You're the Mom

**Table 5 3 Difference in differences estimates of the impact of the *You're the Mom* campaign on calories ordered for moms (Moms Only, Intent to Treat, n=1125)**

	Model 1	Model 2
YTM	-14.2 [-73.8, 45.3]	-32.1 [-103.7, 39.5]
Follow-Up	-15.2 [-51.7, 21.3]	-8.4 [-42.9, 26.1]
YTM*Follow-Up	-1.2 [-51.6, 49.2]	-9.6 [-63.6, 44.4]
Fast Food Frequency		
<i>4+ times/week</i>	--	63.8 [-124.9, 251.1]
<i>1-3 times/week</i>	--	11.0 [-85.7, 107.8]
<i>2-3 times/month</i>	--	-1.9 [-89.7, 85.9]
<i>1 time/month</i>	--	20.6 [-52.4, 93.6]
<i>A few times/year</i>	--	--
Age	--	-0.9 [-6.6, 4.7]
Race/Ethnicity		
<i>Black</i>	--	9.1 [-77.9, 96.1]
<i>Hispanic</i>	--	33.5 [-44.8, 111.9]
<i>Other</i>	--	-93.0 [-197.9, 12.0]
<i>N/A</i>	--	8.3 [-62.8, 79.5]
<i>White</i>	--	--
Associate's or Lower	--	63.8 [35.1, 92.5]

Notes: Values shown are from a linear mixed model with a random intercept for location. Model 1 is unadjusted, Model 2 is adjusted for parent age, education level, race/ethnicity, and frequency of eating out at fast food restaurants. These analyses include all observations with non-missing data for variables of interest and including snacks. Robust standard errors were used because values for total order calories were highly skewed. Values in brackets represent 95% confidence intervals. YTM=You're the Mom

**Table 5 4 Difference in differences estimates of the impact of the *You're the Mom* campaign on calories ordered among those moms who were exposed to the campaign (Moms Only, n=897)**

	Model 1	Model 2
YTM	-3.6 [-68.1, 60.9]	-30.6 [-101.7, 40.6]
Follow-Up	-14.0 [-49.9, 21.8]	-4.9 [-38.7, 28.8]
YTM*Follow-Up	-2.0 [-66.2, 62.3]	-15.4 [-81.3, 50.4]
Fast Food Frequency		
<i>4+ times/week</i>	--	24.8 [-192.1, 241.8]
<i>1-3 times/week</i>	--	47.3 [-65.2, 159.8]
<i>2-3 times/month</i>	--	43.3 [-48.9, 135.6]
<i>1 time/month</i>	--	49.9 [-30.6, 130.5]
<i>A few times/year</i>	--	--
Age	--	-2.3 [-8.49, 3.8]
Race/Ethnicity		
<i>Black</i>	--	18.9 [-67.7, 105.6]
<i>Hispanic</i>	--	41.6 [-42.6, 124.8]
<i>Other</i>	--	-73.4 [-214.6, 67.9]
<i>N/A</i>	--	0.2 [-70.6, 70.9]
<i>White</i>	--	--
Associate's or Lower	--	71.0 [23.3, 118.7]

Notes: Values shown are from a linear mixed model with a random intercept for location. Model 1 is unadjusted, Model 2 is adjusted for parent age, education level, race/ethnicity, and frequency of eating out at fast food restaurants. These analyses include all observations with non-missing data for variables of interest and including snacks. Robust standard errors were used because values for total order calories were highly skewed. Values in brackets represent 95% confidence intervals. YTM=You're the Mom



**Table 5 5 Priority population difference in differences estimates of the impact of the *You're the Mom* campaign on calories ordered (n=484)**

	Model 1	Model 2
YTM	-110.3 [-224.4, 3.9]	-108.1 [-228.7, 12.5]
Follow-Up	-42.9 [-101.7, 15.9]	-41.9 [-101.1, 17.3]
YTM*Follow-Up	8.6 [-53.9, 71.1]	7.5 [-54.7, 69.7]
Age	--	1.1 [-6.9, 9.1]
Race/Ethnicity		
<i>Black</i>	--	20.9 [-129.8, 171.6]
<i>Hispanic</i>	--	--

Notes: The priority population includes moms who are low SES, Black/Hispanic, and frequent fast food consumers. Values shown are from a linear mixed model with a random intercept for location. Model 1 is unadjusted, Model 2 is adjusted for parent age and race/ethnicity. These analyses include all observations with non-missing data for variables of interest and including snacks. Robust standard errors were used because values for total order calories were highly skewed. Values in brackets represent 95% confidence intervals. YTM=You're the Mom

## **CHAPTER 6: Healthy sides and beverages on children's menus between 2004 and 2015: a descriptive analysis of industry trends and concurrent policy efforts**

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## **ABSTRACT**

*Introduction:* Children's restaurant menu meal offerings have historically been of poor nutritional quality. Yet historical trends in the availability of healthy sides and beverages have not been evaluated. Given the contribution of quick service restaurants (QSRs) to excess calories, it is necessary to understand supply-side trends in the availability of healthier children's menu items and consider policy efforts that may influence business decisions.

*Methods:* A dataset of children's menu items available from 2004 to 2015 for top 20 national QSR chains was constructed using Technomic, Inc.'s MenuMonitor. Healthy sides and beverages were identified as fruit and non-fried vegetable (FV) sides and non-sugary beverages. We calculated descriptive statistics to depict: 1) changes in the percentage of sides and beverages that were healthy and 2) the percentage of meal bundles that included healthy sides and beverages as options and by default. The nutrition policy efforts most salient to restaurants were identified via archived National Restaurant Association policy and advocacy webpages.

*Results:* The percentage of meal bundles with healthy side options increased from 25.0 to 82.5% and with healthy beverage options increased from 50.0 to 75.0% between 2004 and 2015. The percentage of meal bundles with healthy sides and beverages by default also increased, though not until 2010 and in only 16.7% of meal bundles at the end of 2015. These healthy menu changes coincided with periods of high policy activity and occurred initially in the largest QSR chains in or prior to 2004.

*Conclusions:* The top QSRs have made improvements in the quality of sides and beverages offered on children's menus between 2004 and 2015, yet additional efforts are needed to increase the number of healthier options offered by default.

## INTRODUCTION

Children's meal offerings at quick service restaurants (QSRs) have historically been of poor nutritional quality, but there is evidence of recent improvement, particularly for side and beverage options<sup>22,38,39,63,68,129</sup>. Publicized brand commitments and recent studies indicate that fewer restaurants are offering sugar sweetened beverages on menus and more restaurants are offering fruit and vegetable sides and milk<sup>16,18-20,22,61-64,129</sup>. Some restaurants are also starting to offer healthier side and beverage items by default in their children's meal bundles<sup>22,179,180</sup>. Moreover, a growing number of restaurant chains have committed to offering at least one meal that meets nutrition criteria for their entrées, sides, and beverages as a part of the National Restaurant Associations (NRA) voluntary Kids LiveWell (KLW) program. This program requires that KLW meals come with at least two servings from the following food groups: fruit, non-fried vegetables, whole grains, lean protein, and/or low-fat dairy<sup>83</sup>.

Increasing the availability of fruit and vegetable side and non-sugary beverage options can encourage the consumption of food groups currently lacking in the diets of American children such as fruits, vegetables, and low-fat dairy<sup>172</sup>. Children's restaurant meals that include fruit and vegetable sides and non-sugary beverages are also more likely to meet National School Lunch Program nutrition criteria and be  $\leq 600$  calories, which is the recommended calorie cut point for children's restaurant meals based on one third of the daily calorie requirements for a sedentary child ages 5 to 12<sup>14,20-22,28,69,135,172,181</sup>. In a study evaluating all possible children's meal combinations at the top 20 quick and full service restaurants, investigators found that substituting a fruit or vegetable side for French fries resulted in an average 170 calorie reduction in overall meal calories<sup>22</sup>. Given that children eat an average of 126 excess calories on days when they eat out<sup>3</sup>, the calorie reductions from these types of healthy side substitutions could help counteract some of the negative effects

of restaurant meals on diet. Substituting milk for sugary beverages has also been inversely associated with weight gain and BMI z-score among children predisposed to obesity<sup>144</sup>.

While some milk options are not necessarily lower in overall calories than sugary beverages, milk provides numerous essential nutrients including calcium, phosphorus, vitamin A, and vitamin D that are not provided by beverages like soda and flavored juice drinks<sup>172</sup>.

Historical trends in the availability of healthy sides and beverages in the restaurant setting and co-occurring policy efforts have not yet been explored in the scientific literature, but may provide insight into industry behavior around healthy menu changes and may help highlight effective public health partnerships<sup>182,183</sup>. For example, since the QSR industry has adopted a “fast follower” business strategy, where firms aim to quickly adopt the latest trends in menu offerings, insight into which firms lead trends within the restaurant industry can demonstrate restaurant partners that may have a wide-reaching impact on menu offerings<sup>80</sup>. At the same time, policy changes can influence what is offered on children’s menus. The most notable recent example is the menu labeling requirements included in the Affordable Care Act in 2010, which have been associated with decreases in the calorie content of new menu items<sup>18</sup>, children’s meals in fast food restaurants<sup>63</sup>, and entrées<sup>151</sup>. Yet it is unclear whether policies like menu labeling also impact the quality of side and beverage items offered on children’s menus. Since both internal (i.e. the desire to adopt the latest menu trends) and external forces (i.e. policy efforts) can influence whether and when healthier items are offered on children’s menus, this research aims to describe trends in the availability of healthy sides and beverages on children’s menus from 2004 to 2015 in a sample of leading national QSR chains, and identify corresponding nutrition policy efforts coinciding with healthy side and beverage changes.

## METHODS

*Sample and Study Design.* A historical children's menu analysis file was constructed in January-March of 2016 using data from Technomic Inc.'s MenuMonitor<sup>139</sup>, which provides complete information on children's menu items for ~800 restaurant chains between 2004 to the present. In this database, entrées, sides, beverages, and meal bundles are listed as they are on the menu. Data on the relative sales of healthier items over time were not available; therefore, we evaluated counts of healthier and less healthy menu items as a method for understanding the availability of restaurant food with these characteristics. Menu item data are collected by dedicated Technomic staff from nationally representative non-urban restaurant locations via quarterly in-person site visits and restaurant websites<sup>140</sup>. Whenever menu offerings were unclear and clarification was needed, Technomic staff made phone calls to the restaurants to determine the items offered at that point in time<sup>140</sup>.

Children's menu item data were abstracted and coded by quarter from the third quarter of 2004 (July-September) to the fourth quarter of 2015 (October-December) for 20 of the 50 leading QSRs based on SYS in 2014. The 20 chains evaluated here accounted for the majority of total sales from the 2014 top 50 QSRs (71%)<sup>141</sup>, had a children's menu offering sides and/or beverages as à la carte items or as a part of bundled meals, and had non-missing data for >50% of time points after examining all alternative data sources (as detailed below). Our analysis began in 2004 because this is the first available year of data from MenuMonitor. To further interpret menu trends, we also collected restaurant-level data on the total system wide sales each year<sup>28</sup>, because large firms may have a greater impact on marketplace trends and menu changes in these restaurants will impact more people.

When sides and/or beverage offerings were not available in the dataset or the exact item could not be identified from the description (e.g. Kids drink; n=537 location time points), archived menu data was abstracted from Way Back Machine (<https://archive.org/web/>), if available. When the items offered in the time periods immediately before and after the missing offerings were identical we assumed there was no change between the time points and filled in missing time points with those items. Only one location time point was missing after performing missing data procedures. We also evaluated how consistent Technomic offerings were with archived online versions of restaurant menus using a randomly selected subsample of location time points (n=46; 5% of the total location time points), and found high agreement between the two data sources: 83.4% of side and beverage items listed in the Technomic's database were also listed on Way Back Machine archived menus.

To evaluate trends in the quantity of healthy side and beverage items available, each item was coded into nutritionally meaningful, mutually exclusive categories by two members of the study staff and assessed for inconsistencies. Sides were coded into fruit and non-fried vegetable sides (FV) using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>, which identified sides as FV based on the Dietary Guidelines for Americans and MyPlate<sup>142</sup>. Items not considered FV sides based on the above protocol were coded as non-FV sides.

Beverages were further characterized using the beverage groups outlined in the University of Minnesota's Nutrition Data System for Research food group list<sup>143</sup>. Sugary drinks were identified based on whether the beverage was sugar sweetened carbonated, fruit flavored, coffee, or "other" sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were not considered to be sugary drinks based on the Dietary Guidelines for Americans, MyPlate, and the National School Meals Program<sup>142</sup>. All fountain drinks (i.e. sodas, Hi-C®

fruit punch, sweetened teas) were collapsed into a single beverage item and coded as a sugary beverage, since fountain beverage options were not consistently listed out separately in the database or via archived menus. If a drink was not a sugary drink, it was coded as a non-sugary beverage (i.e. water, unflavored and low-fat flavored milk, 100% fruit juice). Whether meals were automatically bundled with a FV side and/or non-sugary drinks was also determined based on the meal description (e.g., Jr. Burger with Apple Slices and Minute Maid 100% Orange Juice).

A historical record of policy efforts at the local, state, and national levels (e.g. menu labeling legislation) were identified via the NRA website to help contextualize our findings around healthy menu changes. Policy information was abstracted from Way Back Machine archives of the NRA policy and advocacy webpage because the policy issues listed on this page were likely to be the most salient to restaurants and a source of information on policy activity for restaurants. The NRA policy and advocacy webpage has included web segments devoted to policy issues of interest to the restaurant industry from 2003-present (the year 2003 was included in this review to inform our discussion during the earlier part of our timeframe)<sup>145,146</sup>. To be included in our analyses, the noted policy effort had to specifically mention a nutrition-related change to restaurant menus. Efforts targeting food safety and efforts that were related to nutrition, but did not directly propose to legislate menus/menu offerings (i.e. the Improved Nutrition and Physical Activity Act of 2003) were omitted (Supplementary Table 6.1). Additionally, the Dietary Guidelines for Americans (DGA) were included because the quinquennial release of updated dietary guidance is mandated by federal policy<sup>147</sup> and industry publications have previously indicated the importance of the DGAs in restauranters' decisions around menu offerings<sup>148</sup>. Policy issues at the local, state,



and national level were considered relevant, since localized policy efforts have resulted in national menu changes in the past and were included in the NRA website as policy issues of concern<sup>44,61,63,81,149-152</sup>. Policies identified as important based on this process were confirmed with an outside expert in menu-based policy.

*Analysis.* Summary and descriptive statistics were evaluated overall and by restaurant brand for side and beverage items offered (number of items offered, percentage of sides that were FV, percentage of beverages that were non-sugary beverages, etc.) and meal properties (whether the meal included a FV side or non-sugary beverage as an option and as a default). Two chains (Checkers/Rally's and Hardees/Carl's Jr.) were formed via mergers prior to 2004, but were listed separately in MenuMonitor and SYS reports. For the merged chains, total offerings of meal bundles, sides, beverages, FV sides, non-FV sides, sugary beverages, and non-sugary beverages were averaged for each prior to calculating descriptive and summary statistics. All analyses were conducted in STATA 14 (College Station, TX, USA). Graphs demonstrating changes over time in the percentage of meal bundles that included FV sides and non-sugary beverages as options were compiled at the aggregate level. In addition, diagrams were created using a weighted measure for item offerings based on the relative contribution of each brand to the sample's total SYS for each year to evaluate the potential reach of these supply-side changes. The number of policy activities noted on NRA web page during each year was also compared against the number of restaurants that started offering healthier beverages or sides during each year.

## RESULTS

Overall these QSRs offered between 0 and 5 non-sugary beverages, and between 0 and 8 FV sides between 2004 and 2015. Restaurants increased the average number of healthy offerings over time from 0.6 FV sides and 1.0 non-sugary beverages in Q3 2004 to 1.6 and 1.8, respectively, in Q4 2015 (Table 6.1). Non-FV sides were more common than FV sides across all time points (Table 6.1). Sugary beverages were more common than non-sugary beverages in Q3 2004, but were less common than non-sugary beverages at the end of 2015 (Table 6.1). Meal bundles were likely to include sugary beverages and non-FV sides by default in 2004 and 2015 (Table 6.1); however, the percentage of meal bundles that include these less healthy options by default decreased over time (from 80.0 to 18.5% for non-FV sides and from 55.0 to 30.0% for sugary beverages, Supplemental Figure 6.1). At the same time, restaurants have increased the percentage of meal bundles that include healthy options by default (from 0.0 to 16.7% for FV sides and from 5.0 to 16.7% for non-sugary beverages, Figure 6.2). Yet some of these healthy default sides were also bundled with less healthy options (e.g. a small French fry and apple slices; between 0.0 of meal bundles in Q3 2004 and 5.0% of meal bundles in Q4 2015). All other meal bundles included the option of any side or beverage.

The average percentage of meal bundles that included at least one FV side or non-sugary beverage option increased over this time period as well (from 25.0% with FV side option in Q3 2004 to 82.5% in Q4 2015 and 50.0% meal bundles with a non-sugary beverage option in Q3 2004 to 75.0% in Q4 2015, respectively; Figure 6.1). Weighted estimates of the percentage of meal bundles that included healthier sides and beverages were larger over time than unweighted estimates, indicating that larger chains are driving overall trends (Figure 6.1). Multiple chains started offering FV sides in Q3 2005 (n=3), Q1 2009 (n=3), and Q3

2009 (n=2). Five QSR chains offered FV sides and ten chains offered non-sugary beverages in or before 2004 (data not shown); these same chains were some of the largest based on SYS. Many of these same chains also offered FV sides and non-sugary beverages by default, with 30% of chains (6/20) offering FV sides by default between Q4 2011 and Q4 2015 and 30% of chains offering non-sugary beverages by default—one chain offered non-sugary beverages by default between 2004-2015 and five chains offered them by default between Q3 2010 and Q4 2015 (data not shown).

We identified a wide variety of policy activities related to menu offerings that occurred in concert with periods of greater menu changes. As shown in Figure 6.3, the majority of restaurants began to offer FV sides or non-sugary beverages on their menus and most policy activity occurred between 2005 and 2010 (14 menu changes and 15 policy activities, respectively). Menu labeling emerged as a policy activity of note throughout the time frame at the state, local, and federal level—from its introduction as the Menu Labeling and Education Act in 2003 to its final enactment as a part of the Affordable Care Act in 2010. Other policy efforts that were of interest to the NRA included Trans Fat bans, soda size restrictions, toy ordinances for children’s menus, and restrictions around advertising to children. Most policies noted were not enacted.

## **DISCUSSION**

This is the first study to evaluate trends in the availability of healthier FV side and non-sugary beverage options on children’s menus and co-occurring policy efforts over an eleven-year period. Our results suggest positive shifts in the availability of healthier side and beverage options in children’s meal bundles from 2004-2015, with a select group of large

QSR firms offering these items in or before 2004 and many policy activities happening during the same time. Greater improvements have occurred over time in healthy sides compared to healthy beverages, as most QSRs already offered healthy beverage options with their meals in or before 2004, and non-sugary beverages were more commonly included by default than FV sides throughout the time period. Given that sides and beverages contribute substantially to the total calories and overall quality of restaurant meals<sup>13,22,161,181</sup>, positive trends in the availability of healthier side and beverage menu offerings have important implications for ~25.3 million US children that eat out every day<sup>6</sup>.

These findings add to the existing literature on menu changes, which have found promising shifts in the Healthy Eating Index (a measure of nutrition quality based on conformity of the meal/item to the DGA) of menu items at QSR chains<sup>16</sup>, declines in side item calories<sup>17,38</sup>, declines in the calorie content of children's menu entrées<sup>18,63</sup>, and increases in the percentage of meals that met the Guidelines for Responsible Food Marketing to Children nutrition criteria<sup>89</sup> throughout our study period. Previous research has attributed policies like the New York City Trans Fat ban<sup>44,81</sup> and menu labeling legislation<sup>63,151,152</sup> to reductions in the Trans Fat content of fast food purchases and calories of menu items, respectively. Here, we observed that activity around policies like menu labeling and Trans Fat bans were occurring as these QSRs began to offer healthier sides and beverages. Although we cannot assess causality between policy discussions and the specific business decisions made by the restaurants in our sample, the co-occurrence of these many policy efforts and healthy menu changes speaks to the complex landscape in which businesses are making decisions that influence what ends up on our plates.

Variability in trend lines can be explained, in part, by the introduction/removal of meal bundles (particularly breakfast meals, which may be more likely to include a FV side) and the automatic inclusion of beverages like flavored fruit drinks that are classified as sugary beverages. One restaurant also fluctuated in whether they offered FV sides over time. Having healthy standard menu offerings like side salads and 100% orange juice may facilitate the incorporation of healthy sides and beverages in children's meals, since these items are already stocked by restaurant chains and could be easily incorporated onto the children's menu<sup>79</sup>. Additional factors such as increased perceived demand for healthier items, promoting healthy menu changes as a corporate social responsibility measure or as giving firms a competitive advantage<sup>77</sup>, and having fewer perceived obstacles (low concerns for: the short shelf life of some healthier items, the increased preparation times, low sales, and high labor costs) may also help facilitate adoption of healthier items<sup>70,72,77,79,103-105</sup>.

Despite positive trends, there are still areas for improvement in the quality of sides and beverages offered on children's menus. The majority of chains offered at least one FV side and/or non-sugary beverage, but offered only slightly more than one option on average in 2015. Although more chains are offering FV sides and non-sugary beverages by default, this practice has only emerged in more-recent years (between 2010 and 2015) and remains relatively uncommon across all chains (only 30% of the chains in our analysis included healthy sides and/or beverages by default). Previous research in restaurants suggests that including the healthier side and beverage options by default can help increase orders of these items<sup>13,14</sup>. In a study using order data from a large QSR chain, orders of apple slices increased by 87.7 percentage points when they were included in the children's meal bundle by default compared to when they were offered as an option<sup>161</sup>. Increases in the availability of bundled

healthier sides and beverages can also help change normative perceptions around what kids' meals "should" come with, and can increase exposure to these types of foods, which can increase acceptability<sup>158,164,184</sup>. Continued improvements in the percentage of meal bundles that include healthier items by default may impact intake of these healthier items by children in the restaurant setting. Research also suggests that there have been limited reductions in calories, sodium, and saturated fat of children's entrées, sides, and beverages in recent years<sup>38,39</sup>. Given that most children's meals still do not meet nutritional criteria<sup>129</sup>, additional advocacy and policy efforts to reduce the portion size of popular less-healthy items, reduce the amount of salt and saturated fat added to prepared foods, and to add fruits or vegetables to existing dishes can help further improve the overall nutrition quality of children's meals in this setting<sup>103,185</sup>.

### **Limitations**

There are several notable limitations to this research. First, the longitudinal observational design employed here does not allow us to account for all unobservable factors that may influence these trends including temporal shifts in overall consumer demand and/or changes in the cost of raw materials, cost of labor, profitability of healthier items, availability of healthier items, the skill level of the staff needed, and/or space and equipment requirements<sup>77</sup>. We can also not say for certain which chains led these trends, since many of the QSRs in this sample offered healthier sides and beverages in or prior to 2004. Additional research evaluating restaurant executives' perceptions around why menu changes occurred would help elucidate whether these trends were in response to policy activity, the competitive advantage of restaurants with healthier items, changes in consumer demand, etc. Second, we obtained information on menu offerings from Technomic's MenuMonitor, which collects data from nationally representative non-urban restaurant locations, but these

menu offerings can vary by locality and season<sup>140</sup>. Therefore, the items listed in this database are likely not indicative of the options available to every customer during every time point. Still, the menu offerings evaluated here represent what was available to children on average, and this database allows us to evaluate meal bundles as they were listed on menu boards<sup>140</sup>. Third, while we were able to evaluate changes in the availability of non-sugary beverages and FV sides, we do not know how many children are actually ordering or consuming these items. Yet based on the limited space available for new offerings on restaurant menus, it is unlikely that FV sides and non-sugary beverages would be offered if they did not positively contribute to overall profit either through direct orders of healthy sides and beverages or by eliciting a "health halo" effect that attracts a wider variety of health-conscious consumers<sup>186</sup>. Finally, while children's meals tend to be lower in calories and higher in overall nutrition quality when entrées are paired with both non-sugary beverages and FV sides, some substitutions (e.g. low-fat flavored milk for soda) may not necessarily result in a meal that is  $\leq 600$  calories<sup>39</sup>. Additional changes to existing items that reduce the overall calories of entrée, sides, and beverages may be necessary to ensure that these meals do not exceed the calorie recommendations for children's meals in this setting<sup>187</sup>.

## CONCLUSIONS

These findings indicate that the top QSRs have made improvements in the quality of sides and beverages offered on children's menus between 2004 and 2015, and that these healthy menu changes occurred in the largest QSR chains in or before 2004 and during periods of greater policy activity. Consistent with findings from previous research and childhood obesity prevention strategies outlined by the Health and Medicine Division of the National Academies of Science Engineering and Medicine<sup>188</sup>, this research supports public health

efforts to improve the quality of children's meals available in restaurants using a multi-pronged approach, including establishing partnerships with leading chains and simultaneously advocating for policy efforts that impact restaurant menus. Ongoing efforts to improve the nutrition quality of sides, beverages, and entrées available on children's menus in the QSR setting are needed, and have the potential to impact the millions of children that eat food from QSRs every day.

## **ACKNOWLEDGEMENTS**

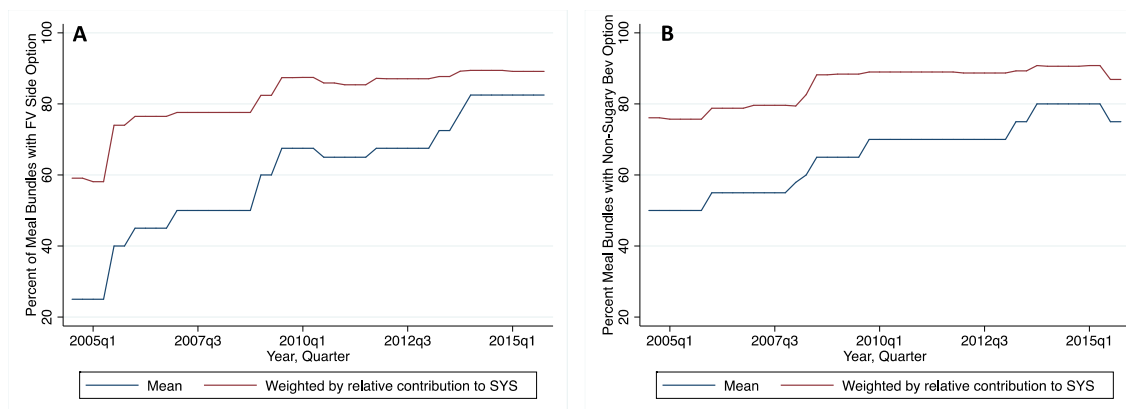
The authors would like to acknowledge the staff at Technomic's Inc. for their support in constructing the database, Danielle Krobath for her assistance with the quality review procedures and the JPB Foundation and Robert Wood Johnson Foundation for the funding to make this work possible. MPM, PW, SCF, SAF, and CDE conceptualized and designed the research study. MPM led all data coding, analyses, and writing. All authors have reviewed the manuscript and have approved the final version.



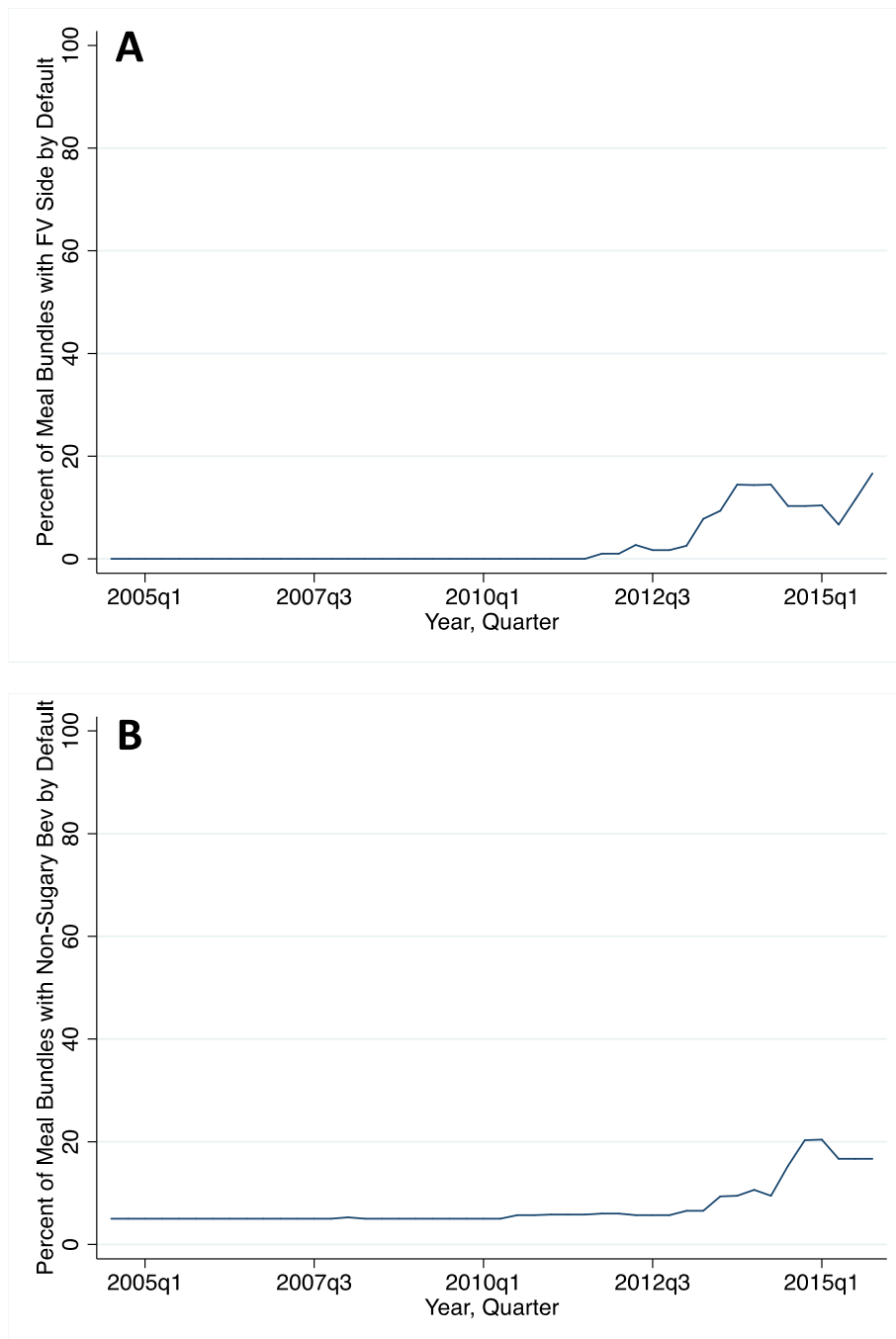
**Table 6 1 Average number of á la carte and bundled healthy and non-healthy side and beverage offerings in 2004 and 2015**

	2004		2015	
	<i>Mean ± sd</i>	<i>Range</i>	<i>Mean ± sd</i>	<i>Range</i>
<i>Healthy Sides and Beverages</i>				
FV Side Options	0.6 ± 1.6	0-7	1.6 ± 1.7	0-7
Non-Sugary Beverage Options	0.9 ± 1.2	0-3	1.8 ± 1.4	0-4
Meal Bundles with FV Sides by Default	0.0 ± 0.0	0	0.6 ± 1.3	0-5
Meal Bundles with Non-Sugary Beverages by Default	0.1 ± 0.2	0-1	0.6 ± 1.4	0-5
<i>Non-Healthy Sides and Beverages</i>				
Non-FV Side Options	1.3 ± 0.6	1-3	1.6 ± 1.1	0-4
Sugary Beverages Options	1.0 ± 0.3	0-2	1.0 ± 0.5	0-2
Meal Bundles with Non-FV Sides by Default	2.4 ± 2.1	0-8	0.8 ± 1.5	0-4.5
Meal Bundles with Sugary Beverages by Default	1.6 ± 2.0	0-8	1.2 ± 2.0	0-5

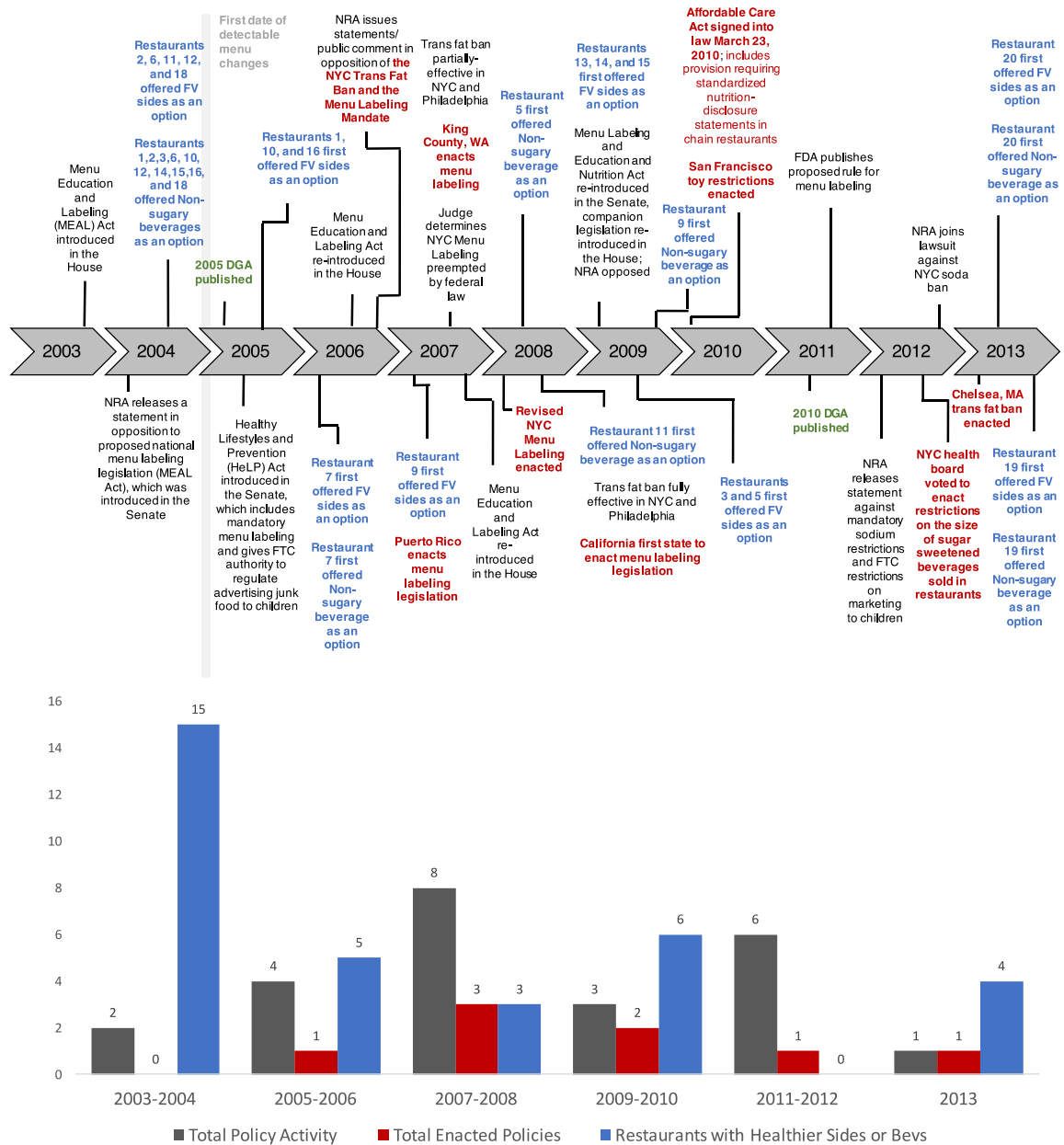
Notes: FV=fruit or vegetable. Values for the average number of FV sides, non-FV sides, non-sugary beverage options, and sugary beverage options represent the relative availability of each as a fraction of the average number of sides/beverages offered across all restaurants and time points. Values for the average number of meal bundles with FV sides, non-FV sides, non-sugary beverage options, and sugary beverage options represent the relative availability of each as a fraction of the average number of meal bundles offered across all restaurants and time points.



**Figure 6 1** A) The average percentage of meal bundles with fruit or vegetable (FV) sides included as a side option (2A, shown in blue) and the average percentage of meal bundles with fruit or vegetable sides included as a side option weighted by each restaurant's relative contribution to the system wide sales (SYS) each year (2A, shown in red). B) The average percentage of meal bundles with non-sugary beverages (Bev) included as a beverage option (2B, shown in blue) and the average percentage of meal bundles with non-sugary beverages included as a beverage option weighted by each restaurant's relative contribution to the system wide sales (SYS) each year (2B, shown in red). Multiple chains started offering FV sides in 2005 Q3 (n=3), 2009 Q1 (n=3), and 2009 Q3 (n=2). FV sides were defined as fruit and non-fried vegetable sides (FV) using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>, which identified sides as FV based on the Dietary Guidelines for Americans and MyPlate<sup>142</sup>. Non-sugary beverages were defined as beverages that were not a sugar sweetened carbonated, fruit flavored, coffee, or other sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were considered non-sugary beverages based on the Dietary Guidelines for Americans, MyPlate, and the National School Meals Program<sup>142</sup>. The relative contribution to SYS of each chain during each year was determined by each chain's SYS as a fraction of the total SYS of the sample chains during each year<sup>141</sup>. Results shown here are presented across all restaurant chains from the third quarter of 2004 to the fourth quarter of 2015.



**Figure 6 2** A) The average percentage of meal bundles with a fruit or non-fried vegetable (FV) sides included by default (S1A) and B) the average percentage of meal bundles with a non-sugary drink included by default (S1B). FV sides were defined as those that were not identified using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>. Sugary beverages were defined as beverage that were a sugar sweetened carbonated, fruit flavored, coffee, or other sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were considered non-sugary beverages based on the Dietary Guidelines for Americans, MyPlate, and the National School Meals Program<sup>142</sup> and were not included here. Results shown here are presented across all restaurant chains from the third quarter of 2004 to the fourth quarter of 2015.



**Figure 6.3** A timeline and histogram of policy efforts and healthy menu changes between 2003 and 2013. The year 2003 was included to inform our discussion during the earlier part of our timeframe. Our timeline ends at 2013 because that was the last year that any restaurants began to offer healthier sides or beverages. We cannot be certain whether menu offerings in 2004 were new or were offered prior to 2004, since Technomics MenuMonitor only included data on offerings between 2004-2015. All events in red are enacted policies; other policy activity is shown in black. All events in green indicate a change in dietary guidance. All events in blue indicate the first time (a) chain(s) offered at least one fruit or vegetable (FV) side and/or non-sugary beverage. The histogram shows the number of policy activities occurring (in grey), the number of enacted policies (in red), and the number of

restaurants that started offering (between 2005 and 2013)/already offered (in 2004) FV sides or non-sugary beverages. Restaurants that offered both non-sugary beverages and FV sides (n=16) are double counted. FV sides were defined as fruit and non-fried vegetable sides (FV) using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>, which identified sides as FV based on the Dietary Guidelines for Americans (DGA) and MyPlate<sup>142</sup>. Non-sugary beverages were defined as beverage that were not a sugar sweetened carbonated, fruit flavored, coffee, or other sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were considered non-sugary beverages based on the DGA, MyPlate, and the National School Meals Program<sup>142</sup>. Policy efforts shown here were noted under the policy and advocacy section on archived versions of the National Restaurant Association's webpage for a given year and quarter. To be included in our analyses, the noted policy effort had to specifically mention a nutrition-related change to restaurant menus. Efforts targeting food safety and efforts that were related to nutrition, but did not directly propose to legislate menus/menu offerings (i.e. the Improved Nutrition and Physical Activity Act of 2003) were omitted. Additionally, the Dietary Guidelines for Americans (DGA) were included because the quinquennial release of updated dietary guidance is mandated by federal policy<sup>147</sup> and industry publications have previously indicated the importance of the DGAs in restaurateurs decisions around menu offerings<sup>148</sup>. Policies issues at the local, state, and national level were considered relevant, since localized policy efforts have resulted in national menu changes in the past and were included in the NRA website as policy issues of concern<sup>44,61,63,81,149-152</sup>. NRA= National Restaurant Association, FTC=Federal Trade Commission, NYC=New York City, NYC DOHMH=New York City Department of Health and Mental Hygiene, MA=Massachusetts

## CHAPTER 7: SUMMARY AND DISCUSSION

Restaurants represent a critical target environment for childhood obesity prevention efforts. Meals at restaurants contribute substantially to excess calorie intake in children and adults<sup>1,7,189</sup>, a third of children eat out at quick service restaurants daily<sup>6</sup>, and approximately half of the US food dollar is spent on food outside of the home<sup>34</sup>. Although there is some evidence that restaurant menus have become healthier over time, these findings tend to be focused on certain menu items (i.e. sides, beverages, new menu items) over short periods of time<sup>18-20,63</sup>. There is also limited understanding of how children respond to healthier menus<sup>13-15,106,190</sup>, and whether interventions aimed at improving the nutrition quality of child meal orders have any impact on parent orders.

This dissertation examines healthy menu changes and/or healthy menu promotions at the three distinct levels: the individual child, the parent, and the restaurant unit to address these gaps in the evidence base. We utilized latent variable approaches to uncover differences in how individual children respond to a new, healthier children's menu at a regional restaurant chain<sup>132</sup>. We also evaluated whether a campaign aimed at empowering moms to select healthier items for their children in restaurants had any spillover effects on parent orders. Finally, we described industry trends in the availability of healthy sides and beverages on children's menus along with co-occurring nutrition policy efforts over the past 11 years.

Throughout this body of research, we found that efforts to improve the quality of children's meals in restaurants should consider how healthy menu changes occur over time (Aim 3), heterogeneity in how children respond to healthy menu changes (Aim 1), and strategies that

target parents' own ordering behavior (Aim 2). Below we summarize and briefly discuss the findings from this work as they relate to these three themes. A more detailed discussion of the implications of these findings for research, policy, and practice is described in the following section.

### **How healthy menu changes occur over time**

Changes to restaurant menus that help mitigate the negative dietary impacts of restaurant meals are needed<sup>1,3,7,45,46</sup>. This dissertation research focused on trends in the availability of healthy, FV sides and non-sugary beverages (à la carte and bundled) on children's menus in leading QSRs, and found that percentage of meal bundles with the healthy sides as options increased from 25.0 to 82.5% and the percentage of meal bundles with healthy beverage options increased from 50.0 to 75.0% between 2004 and 2015. Concurrently, we observed that there were many policy efforts underway at the local, state, and national level that captured the attention of the National Restaurant Association (as demonstrated on archived versions of their webpages). Although we cannot assess causality between these policy discussions and the specific menu changes made by the restaurants in our sample, the co-occurrence of these many policy efforts and healthy menu changes speaks to the complex landscape in which businesses are making decisions. We also evaluated trends in the availability of healthier sides and beverages by individual chain and restaurant size, since restaurants tend to adhere to the "fast follower" business strategy, where firms aim to quickly adopt the latest trends in menu offerings. We cannot say for certain which chains led these trends, since many of the QSRs in this sample offered healthier sides and beverages in or prior to 2004. Still, the largest chains based on system wide sales (SYS) were among those chains that offered healthier items in or prior to 2004 and appeared to be driving change.

Moreover, while the majority of restaurants offered at least one FV side and/or non-sugary beverage, we also found that these items were less frequently offered by default—only 16.7% of meal bundles included FV sides or non-sugary beverages by default in 2015, whereas between 0 and 5% included healthy sides and beverages by default in 2004. Previous research suggests that including healthier items by default increases orders of these items<sup>13-15,191</sup>. Including healthier items by default may help increase children’s familiarity of these items as well<sup>184,192</sup>, and can help them appear more normative in the restaurant setting. Therefore, identifying strategies that encourage restaurants to not only offer healthier side and beverage items, but to also offer them automatically with meal bundles, can help increase the acceptance, ordering, and intake of these healthier options.

### **Heterogeneity in children’s responses to healthy menus**

In addition to considering how menu offerings are changing over time, it’s also imperative that we gain a better understanding of how children respond to healthier menus, and whether healthy menu changes result in positive changes in ordering behavior. Here, we focused on individual differences in patron responses to a new, healthier children’s menu by evaluating ordering data from a random sample of restaurant receipts between September 2012 and March 2013 (5 months after the new menu was implemented). Previous research indicates that efforts to make the healthier options more prevalent and/or to offer them by default can help increase the selection of these items<sup>14,15,106,190,191</sup>. We observed similar findings when evaluating overall trends in child meal orders, with increases in the relative orders of fruit or vegetable sides, non-sugary beverages, and healthier meal bundles. We found decreases in the calories of orders that included the default options from before to



after the healthy menu was implemented<sup>13</sup>. However, our latent class analysis also uncovered variability in the degree of acceptance of this menu by individuals. Six distinct classes of ordering patterns in meal orders were identified: “healthy meals” (27.0% of orders), “healthy meals, add-ons” (9.6% of orders), “unhealthy sides” (9.1% of orders), “healthy substitutions” (30.9% orders), “healthy substitutions, add-ons” (1.0% of orders), and “unhealthy substitutions” (22.4% of orders). Classes differentiated based on whether they included the default healthy sides and/or whether they included additional items that were not a part of the meal bundles (add-ons); and substitutions and add-ons contributed to the total calorie content of meal orders. Classes denoted as “healthy” were likely to contain meals with KLW items; and orders in the healthy meals class contained fewer calories than orders in all other classes. Moreover, the majority of orders meeting calorie recommendations were in the healthy meals and healthy substitutions classes.

Taken together, these findings suggest that, even when exposed to a healthier children’s menu, not all children will respond to that menu the same way. While the majority of meal orders were in the “healthy” classes, these differential responses have implications for the effectiveness of healthier menu changes in reducing excess calories in restaurant meals. Moreover, there may be certain groups of children that may be more receptive to healthier menus than others. There is some evidence that individuals differ in their susceptibility to both positive and negative environmental exposures based on individual traits<sup>193</sup> and that certain demographics of children, including boys, infrequent restaurant goers, and frequent take-out diners, may be less receptive to healthy, fruit and vegetable sides in the restaurant setting<sup>22</sup>. Differences in parental ordering behaviors and food parenting practices can also impact the quality of children’s restaurant meals<sup>24,60,90</sup>; and contextual factors like advertising,

variety, and hunger may also contribute to differences in how individual children respond to healthier menus<sup>94</sup>. Additionally, the availability of healthier offerings in the broader restaurant environment may also influence children's responses to healthy menus. If healthier items are widely available on children's menus, they may seem more normative to children and families who dine out, which has implications for children's acceptance of healthier items in this setting<sup>192,194</sup>.

These findings also suggest children who do not accept the healthier entrées and sides may benefit from additional modifications to popular entrée items that reduce the overall calories of the meal without substantial changes to the menu itself. For example, reducing the size of the children's serving of French fries, which in the time period studied here was an adult-sized portion, would reduce the overall calorie content of these meals. Previous research has demonstrated that small changes to existing popular menu items do not negatively impact consumers' perceptions of these items or restaurant profit<sup>185</sup>. Offering healthier side and beverage items by default (like they were on all children's meals at this regional restaurant chain) can help increase the selection of these items<sup>14,15,102,106,132,190,191</sup>, but additional promotions of healthier items may be needed to ensure even more children are selecting them. Menu changes that involve increases in the availability of healthy items (especially breakfast items), promotions of healthier side and beverage that are offered by default, and healthy modifications to existing items would be more likely to have widespread reach, impacting all subgroups of children and having a broader impact on the overall quality of children's restaurant meals.

### Strategies that target parents' own ordering behavior

Parents can impact the quality of children's restaurant meals either through food parenting practices and/or role modeling<sup>24,26,195</sup>. Yet adults, like children, tend to consume meals that are higher in calories, saturated fat, added sugar, and salt when dining out<sup>1</sup>. Therefore, research should consider ways to improve the quality of parent meal orders as well as child meal orders in restaurants. Community-wide communication campaigns can be used to promote healthier options for children in restaurants, and have the potential to impact the quality of parent orders via spillover effects. In this dissertation, we evaluated the *You're the Mom* campaign which aimed to empower moms to select healthier items for their children in quick service restaurants (QSRs) via simple, actionable messages that are centered around healthy changes that can be made to the child's meal. The priority audience for the campaign was mothers of children who were low socio-economic status (SES), African American or Hispanic, and who frequently ( $\geq 2$ -3 times/month) dine out at QSRs, since children in these sociodemographic groups are at a higher risk of obesity<sup>11</sup>, are more likely to be exposed to targeted advertising from fast food companies<sup>125,126</sup>, are more likely to consume excess calories and fat from QSRs<sup>3,127</sup>, and tend to have higher rates of frequent fast food consumption<sup>10,12</sup> compared to higher-income, Non-Hispanic White youth. This study utilized a community randomized design in two communities in Massachusetts at two time points: before the campaign was implemented (PRE; April 1-May 21, 2016) and while the campaign was being implemented (POST; August 11-October 8, 2016). A convenience sample of parents from both communities at PRE and POST was evaluated. While this campaign was developed with the intention to improve the quality of child meal orders (Economos et al., in prep), we hypothesized that parents would be positively impacted by the campaign as well through two possible mechanisms. First, parents may be influenced by the campaign via

priming, where cues or stimuli activate salient subconscious associations and affect subsequent behavior<sup>94,95</sup>. Second, parents may also decide to order a healthier meal when dining out based on their desire to serve as a positive role model for their children<sup>26</sup>.

Contrary to our hypothesis, we found no significant spillover effects of the *You're the Mom* campaign on parent orders. Specifically, we found that the changes in order calories over time were not significantly different in parents in the intervention community compared to the control. At PRE, parents in the intervention community ordered 65 fewer calories on average, but there were no significant differences in the change in calories ordered between the two communities over time ( $\beta=37.7$  CI: -32.7, 108.2). When evaluating the campaign's impact on all moms, moms exposed to the campaign, and moms in the priority population (low-income, African American or Hispanic, and frequent fast food consumers), we also found that the change in the order calories over time was not significantly different in the intervention community compared to the control ( $\beta=-9.6$  CI: -63.6, 44.4;  $\beta=-15.4$  CI: -81.3, 50.4;  $\beta=7.5$  CI: -54.7, 69.7; respectively).

While the null findings do not support our initial hypothesis, the directionality of the findings among moms and moms exposed to the campaign are consistent with our hypothesized effect, with moms in the exposed to the campaign having the largest estimated decrease in calories. Given that this analysis was part of a larger study that was not powered to detect an effect in parent meal orders, it is possible that our findings would differ if we were to repeat the study with a larger sample size. Still, even if the estimated magnitude of effect were significant, the calorie reductions observed here would not result in a clinically meaningful difference in the calorie content of parent orders. The largest estimated decline

in order calories from the campaign was only 14 calories; and adults eat on average about 200 extra calories on days when they eat out<sup>189</sup>. Additional intervention strategies are likely needed to substantially influence the calorie content of parent orders. For example, a recent systematic review identified that interventions that provide information regarding which menu items were healthier at the point-of-purchase in combination with increases in the availability of healthier options may be particularly effective at improving the quality of adults restaurant meals<sup>196</sup>.

It is also possible that there are no meaningful spillover effects from the campaign. Since the messaging was specifically around improvements that could be made to child meal orders, parents may not have internalized these messages with regard to their own orders. It is also possible that the *You're the Mom* campaign may not have resonated with consumers bombarded by other advertising messages. The food industry is the second largest advertising segment in the US after the automobile industry<sup>173</sup>, and almost 70% of food advertising is for convenience foods, candy and snacks, alcoholic beverages, soft drinks, and desserts<sup>173</sup>. Previous research has demonstrated that advertising for these unhealthy foods is effective—both adults and children report stronger preferences for and intake of unhealthy, advertised foods<sup>197-199</sup>. In markets highly saturated with advertisements promoting unhealthy foods, the effects of healthy menu promotional campaigns could be attenuated. In fact, other promotional campaigns in the restaurant setting have found non-significant results<sup>174,175</sup>, suggesting that competing factors including habitual ordering<sup>48,159</sup>, pre-conceived expectations around what restaurant meals should come with, and/or other contextual factors<sup>94</sup> may interfere with these types of campaigns. Moreover, though our study was informed by previous research that observed spillover effects in other contexts<sup>91,92</sup>, it's

possible that these interventions engaged parents in ways that were more effective. For example, both *Shape Up Somerville*<sup>91</sup> and the *Delicious and Nutritious Garden*<sup>92</sup> interventions utilized activities that engaged parents directly in intervention components. These more direct-to-parent modes of engagement may be imperative to spillover effects in the restaurant setting. Together, these findings suggest a need to find a way to encourage parents to consider making healthier changes to their own orders in interventions aimed at improving the quality of children's restaurant meals.

## **Discussion**

The three chapters in this dissertation highlight the complex nature of the mechanisms by which restaurants can impact child health. We investigated industry trends in healthy children's menus and co-occurring policy efforts, individual children's responses to a healthy menu, and whether a promotional campaign aimed at improving child meal orders had any impact on the quality of parent meal orders. This work demonstrated that healthier side and beverage options have become more prevalent features of children's menus in the leading QSRs over time, that healthy side and beverage changes co-occurred with many policy activities, and that the largest chains based on SYS made up the majority of chains that offered healthy side and beverage in the beginning of our time series. In a regional restaurant that revamped its children menu, we found that most children had meals that were consistent with the healthier children's menu, but that there were also individuals that made modifications to meals that made them less healthy. We also showed that the calorie content of parent orders was not significantly impacted by a campaign aimed at empowering parents to choose healthier meals for their children in restaurants.

### **Implications for research, practice, and policy**

Overall, the findings from this dissertation point to the need to consider the changing restaurant food environment, to identify and incorporate variability in individual responses to healthy menus in intervention strategies, and to identify strategies for simultaneously targeting parent ordering behavior in concert with child ordering behavior in efforts to further improve the quality of families' meals in restaurants.

#### *Consider the changing restaurant food environment*

The findings presented here demonstrate the inadequacy of considering restaurants as a uniform, unchanging risk factor for obesity or poor dietary quality; instead, restaurants are an interactive and dynamic component of the food environment, with different implications for health across restaurants and over time. Specifically, we found that the top QSRs differed in whether they offered healthier sides and beverages, and the extent to which these items were offered—both in terms of quantity of healthier items and in terms of whether these items were offered by default. A better understanding of trends in the availability of healthier items, in the reformulation of existing products, and in the availability of less healthy options can help elucidate how restaurant environments are changing over time. At the same time, a consideration of factors both internal (e.g. competition) and external to the industry (e.g. media coverage and policy efforts) that may be influencing menu trends could help inform public health efforts aimed at improving restaurant menus.

Additionally, a concerted research effort is needed to consider what menu items are being offered, which items are being promoted, and what children are ordering in restaurants.

While the results from this dissertation show promise regarding the increasing availability of healthier sides and beverages on children's menus in the leading QSRs, we cannot speak to the restaurant setting more broadly, in these QSRs before 2004 or after 2015, or the extent to which availability of healthier items maps onto orders of these items. We were also unable to evaluate simultaneous trends in the quality of entrées, which would impact the overall quality and calorie content of children's restaurant meals. Moreover, offering healthier sides and beverages by default was still relatively uncommon, yet has been previously shown to increase the selection of healthier items<sup>14,15,85,102,106,132,190,191</sup>. Therefore, additional efforts are needed to understand what factors promote the adoption of healthy defaults and to encourage restaurants to offer healthier items automatically with all meals. Descriptive studies that consider earlier trends in the availability of healthier sides and beverages (prior to 2004), trends in the availability of healthy sides and beverages in other restaurant segments (FSR and fast casual), and trends in the availability of healthy entrées are also needed. Studies evaluating what constitutes "kids' food" on children's menus over longer periods of time could shed light on how normative expectations and industry trends in this setting have changed in this setting over time. Cross-cultural comparisons of kid's menu offerings could also highlight cultural differences in perceptions of what children should eat in the restaurant setting.

Future research is also needed to evaluate ordering and intake behavior in concert with evaluations of healthy menu changes, as healthy changes are only successful if children are choosing to order and consume healthier items. Previous studies highlight potential promise in menu-based changes in reducing overall meal calories and in increasing orders of FV sides and non-sugary beverages<sup>13-15,84</sup>. However, many of these studies only observed these effects



when healthy side and beverage options were included by default<sup>13-15,190</sup>. In our analysis of QSR trends, including healthier sides and beverages by default was still relatively uncommon (only in  $\leq 20\%$  of meal bundles). Research also suggests that there have been limited reductions in calories, sodium, and saturated fat of children's entrées, sides, and beverages in the more recent years<sup>38,39</sup>. Given that some children do not seem to accept new healthy menu choices, as we saw from our research on the healthy menu in the regional restaurant chain, additional efforts are likely needed to improve the nutritional quality of popular, less-healthy items. These changes could include reducing the portion size; reducing the amount of salt, added sugar, and saturated fat added to prepared foods; and adding fruits or vegetables to existing dishes<sup>103,185</sup>.

A better understanding of upstream factors that promote healthy menu changes in the restaurant industry is also warranted. Previous research has highlighted the importance of perceived demand, the cost of raw materials, cost of labor, profitability of healthier items, availability of healthier items, the skill level of the staff needed, and/or space and equipment requirements for menu planning<sup>72,77,79</sup>. Interventions aimed at training restaurant staff to prepare healthier menu items, improving the infrastructure in restaurant kitchens to facilitate incorporating healthier items, and identifying supply chain solutions that increase restaurants' access to and the affordability of healthier items could be effective in increasing the availability of healthy sides, beverages, and entrées on children's menus. Similar efforts have been successfully conducted in schools, and could help create a template for these same type of interventions in the restaurant setting<sup>200</sup>. For example, the Modifying Eating And Lifestyles at School (MEALS) study included staff trainings with professional chefs and a choice architecture intervention to promote whole grains, produce, and healthier mono- and

polyunsaturated fats and resulted in increases in fruit and vegetable selection among elementary and middle school students<sup>200</sup>. Strategies used in the MEALS intervention such as collaborations between menu planners and study chefs to design new, healthier menu items or making healthier items more prominent on menus may be effective in promoting children's orders of fruits and vegetables in restaurants as well. Additionally, identifying case studies, like the Silver Diner, where the restaurant made significant improvements in the types of offerings on children's menus can help demonstrate feasible strategies for other restaurants to make healthy changes to their menus<sup>102,106,132</sup>. Efforts to evaluate whether these healthy menu change case studies improve children's orders, while also considering the impacts of healthy menu changes on outcomes of importance to restaurants such as profit, total sales, etc. could help encourage other restaurants to adopt healthier menu changes.

Policy changes can also influence what is offered on children's menus. For example, the menu labeling requirements included in the Affordable Care Act in 2010, have been associated with decreases in the calorie content of new menu items<sup>18</sup>, children's meals in fast food restaurants<sup>63</sup>, and entrées<sup>151</sup>. As we described above, although it's unclear if policy efforts identified via the National Restaurant Association webpages impacted restaurateurs' decisions to include healthier sides and beverages on their menus, the co-occurrence of healthy menu changes and policy efforts is worth noting and, based on previous research, may have had some influence on these healthy changes.

In addition to exploring menu-related policy efforts between 2004 and 2015, we also aimed to evaluate business strategies that may have influenced these healthy side and beverage changes. For example, since the QSR industry has adopted a "fast follower" business

strategy, where firms aim to quickly adopt the latest trends in menu offerings, insight into which firms lead trends within the restaurant industry can demonstrate restaurant partners that may have a wide-reaching impact on menu offerings<sup>80</sup>. We found that a fraction of QSRs offered healthy sides or beverages for our whole analysis period (2004-2015), and that the largest QSRs based on SYS offered healthy sides and beverages at or before 2004. However, there was no clear indication that any one chain led these trends, and the results do not seem to indicate that a fast follower pattern occurred for healthier side and beverage options in these QSRs during this timeframe. Nevertheless, it is possible that there was a clear trend leader earlier (prior to 2004), and that the fast follower business strategy would still apply. Quantitative research evaluating healthier side and beverage offerings prior to 2004 would help clarify whether the “fast follower” model applies to side and beverage offerings in this sample of QSRs. Additionally, qualitative research evaluating restaurant executives’ perceptions around why menu changes occurred would help elucidate whether these trends were in response to policy activity, the competitive advantage of restaurants with healthier items, changes in consumer demand, etc.

Together the findings from this dissertation point to the potential benefits of using a multipronged approach to improve the quality of children’s meals available in restaurants, including establishing partnerships with leading chains and simultaneously advocating for policy efforts that impact restaurant menus, and is consistent with findings from previous research and childhood obesity prevention strategies outlined by the Health and Medicine Division of the National Academies of Science Engineering and Medicine<sup>188</sup>. Ongoing efforts to improve the nutrition quality of sides, beverages, and entrées available a la carte

and by default on children's menus in the QSR setting are also needed, and have the potential to impact the millions of children that eat out in QSRs every day.

*Identify and incorporate variability in individual responses to healthy menus in intervention strategies*

The research presented here highlights the benefits of considering interactive feedbacks between individual children and the restaurant environment when designing interventions aimed at improving the quality of children's restaurant meals.

Our results show the heterogeneity in responses to healthy menu items, yet additional studies are needed to understand the factors that contribute to children's decisions to order healthier meals, how these decisions vary among restaurant contexts, and what additional modifications could be made to existing menu items to ensure more children are reached by interventions targeting healthy menu changes. More specifically, observational and experimental studies that explore associations between demographic and behavioral factors and the likelihood of accepting healthy menu items could help elucidate which children accept healthier items, and which children make order modifications that increase overall meal calories. Additionally, given the attention to healthy defaults in the public health literature<sup>46,150,162,201,202</sup> and disparities around which children are most negatively impacted by restaurant meals<sup>112,127,203-205</sup>, research evaluating whether healthy defaults are differentially accepted by populations least at risk are needed. Controlled intervention studies evaluating healthy meal promotions in restaurants already offering healthy sides and beverages by default could also help uncover the combined portfolio of factors that could encourage more children to order healthier options. Research evaluating the impact of these types of interventions on children most at risk for obesity or negative health outcomes are also

needed to help ensure these type of interventions are not negatively impacting those at greatest risk.

Previous research suggests that contextual factors such as where healthier items are placed on menus relative to less healthy items<sup>94</sup>, the variety of food choices offered<sup>206-208</sup>, and which items restaurants are promoting can influence choice<sup>175,209-212</sup>, but none have evaluated these factors as they relate to children's orders. When considering the heterogeneity in how children respond to healthy menu changes, these types of contextual differences may be important. Future experimental studies evaluating the variability in the healthfulness of children's meal orders based on the variety of items offered, whether healthier items are being promoted, and where healthier items are placed on menus could help elucidate whether these types of contextual differences have an impact on the quality of meal orders.

Variability in children's responses must also be considered when creating policies and interventions aimed at changing the food environment. This dissertation and previous research suggest menu-based interventions that increase the prevalence and prominence of healthier menu items<sup>13,106,132</sup>, include healthier sides and beverages by default<sup>13-15,106,132,190,191</sup>, reduce the portion size of existing popular less healthy menu items<sup>187</sup>, and/or reformulate existing menu items so that they are healthier<sup>81</sup> are likely to have broader impact than interventions that involve only one of the above strategies. A concerted effort between public health interventions and existing policies and programs could make these combined healthy menu changes a reality on children's menus. Intervention strategies and partnerships between public health organizations and restaurants have previously encouraged restaurants to offer more fresh fruit and vegetable sides, non-sugary beverages, and healthier

entrées<sup>64,70,74,105,174,182,183,196,213</sup>; to promote these healthier items<sup>196,209</sup>; and to reformulate existing items<sup>150,185</sup>. When combined with policies, like menu labeling, these efforts can influence the types and composition of foods offered on restaurant menus, and these healthy menu shifts may present a mechanism to reach consumers who are not responsive to calorie information<sup>18,23</sup>. While changes in menu offerings represents a promising mechanism of influence (especially given the mixed body of evidence around consumer responses to menu labeling<sup>214-216</sup>), our results highlight that these supply-side changes may not reach all restaurant consumers, and again demonstrate the need to consider who is impacted by these types of interventions, programs, and policies; how they respond; and what other contextual factors may promote or interfere with environmental change strategies.

Despite the potential benefits of menu change interventions on meal quality<sup>13-15,190,191</sup>, changes to the menu environment alone may not result in behavior change<sup>217</sup>, and it is worth acknowledging that our ability to influence health outcomes through interventions and existing policies is still limited. Unhealthy options on children's menus are still ubiquitous and often promoted<sup>166,68,125,218-220</sup>. Numerous studies have highlighted the benefits of repeated exposure and familiarity for food acceptance in children<sup>158,164</sup>, indicating that collective and widespread changes to restaurant children's menus, in concert with changes to meals offered to children in schools<sup>165</sup> and other settings, are likely to help make healthy entrées, sides, and beverages more normative and acceptable overall. Yet it's also possible that, as more children order healthier items, these items become more available. Perceived demand for healthier items and profitability have been identified as factors that can help promote the inclusion of these types of items on restaurant menus<sup>72,79</sup>. If children are ordering healthier items because they are more prevalent on the menu, restaurants may simultaneously be

offering more healthy items because of higher perceived demand; feedback interactions between the demand and supply of healthier menu items warrant further investigation.

Future research should evaluate what children are consuming after the implementation of healthy menu changes as well. Our previous research in the restaurant setting indicates that sharing is common in families (Economos et al, unpublished), and that children generally do not consume all of what they order<sup>221</sup>. Therefore, a better understanding of whether children are preferentially eating certain ordered items is warranted. If children are ordering healthier items after the implementation of healthier menus, but are not eating those items that has implications for future intervention strategies. Interventions may need to focus more on increasing the acceptance and consumption of healthier menu items if children are not eating them.

*Identify strategies for simultaneously targeting parent ordering behavior in concert with child ordering behavior*

Interactions between parents and children in the restaurant setting have the potential to enhance the intended effects of interventions, and improve the quality of children's restaurant meals. If parents are reached by restaurant interventions like *You're the Mom*, there is the potential for a positive feedback loop where 1) parents are simultaneously influencing their children through parenting practices informed intervention components and/or messaging campaigns, and 2) parents are further influencing their children when they change their own behavior (via role modeling). While we did not detect any statistically significant spillover effects from *You're the Mom* on parent orders, the potential benefits of spillover effects have been demonstrated in other interventions, such as a multicomponent child-centered obesity prevention intervention<sup>91</sup> and a farm to school intervention<sup>92</sup>. As such, they

merit continued investigation. Additional research should focus on uncovering mechanisms that may be driving or inhibiting spillover effects in interventions aimed at improving the nutrition quality of child meal orders in the restaurant setting. To further evaluate campaigns like *You're the Mom*, comparative observational studies that capture parent-child interactions in both the intervention and control communities at both time points could help identify whether there are potential differences in parent-child interactions that may be related to campaigns and/or menu-based interventions. Experimental studies to evaluate potential priming effects that result from intervention components would also help elucidate whether parents are making healthier decisions based on subconscious associations from these interventions.

Future research evaluating the impact of interventions aimed at improving the quality of children's restaurant meals should also consider the broader advertising environment. It is possible that any impact the *You're the Mom* campaign had on parent orders was attenuated by competing messages in other advertisements. Additional studies that compare the relative number of restaurant ads promoting healthier vs. less healthy options in and around the intervention communities would help describe the overall physical advertising environment that community members were exposed to and the types of competing messages that parents may have encountered. Experimental studies evaluating interactive effects between various advertising doses and interventions like *You're the Mom* could also help identify if advertising moderates the impact of these interventions on parent orders. If these future studies are suggestive of moderating effects from advertising, they would have implications for policies regulating advertising of unhealthy items.



It's also possible that restaurant interventions that target improvements in children's meals are limited in their effectiveness in achieving spillover effects in parent populations. Despite the fact that our analysis was informed by previous research that observed spillover effects in other contexts<sup>91,92</sup>, more direct-to-parent intervention components may be necessary to achieve spillover effects in restaurant interventions. Future multi-armed intervention studies should evaluate whether parent-specific intervention components have a differential impact on the nutrition quality of child meal orders as well as parent orders.

Alternatively, it may be that restaurant meal behaviors in parents and children preclude any potential of spillover in this setting. Studies evaluating parent and child orders in restaurants have found that children (especially older children) often order for themselves, and most children know what they want to order prior to even patronizing the restaurant<sup>25,60,79</sup>. Parents have also reported being more lenient with their children in restaurants, and often view restaurant meals as a treat<sup>25</sup>. It is possible that parents aren't as involved with their children's food-related behaviors in restaurants as they may normally be, since they do not view restaurant meals as standard meal occasions and family members are more likely to make autonomous meal decisions in restaurants. In qualitative research, parents identified that they prioritized parenting their children's social behavior (noise levels, sitting down, etc.) in restaurants over food-related parenting practices<sup>24</sup>. Parents also felt that offering healthier items by default would make it easier for them to get their children to eat healthier when eating out<sup>24,25,85</sup>. Parents may benefit from educational efforts that provide them with strategies to establish behavioral expectations prior for the restaurant setting and to encourage strategies like establishing family food rules prior to entering the restaurant<sup>24</sup>. Intervention efforts that elicit parents' desire to be a positive role model for their children<sup>26</sup>,

and emphasize the positive or negative modeling that parents' may be doing in the restaurant space could also help motivate parents to make positive changes to their own meal orders. Simultaneous healthy changes to the standard menus and to the children's menu (offering more healthy entrées, automatically bundling healthy sides and beverages with all meals, etc.) may also improve the quality of meal orders for the whole family<sup>15,60,106,132,190,191,201,202</sup>. Moreover, since many parents are determining where, when, and how often children eat out<sup>12,59</sup>, parent-centered interventions that target family eating out behaviors (i.e. where they eat out and how often they eat out) may be particularly effective at improving the quality of children's meals.

#### *Normative expectations around children's meals in the restaurant setting*

Across all three studies presented in this dissertation, an important emergent theme was normative expectations around what kids and families should eat in restaurants. Restaurant meals continue to be longitudinally associated with excess intakes of kcal, total fat, saturated fat, cholesterol and sodium<sup>27-29</sup>, despite positive trends in the availability of healthier items over time<sup>18,19,22,129,182,183</sup>. This discordance between the availability in healthy options and overall consumption patterns may be due in part to norms around what foods parents, children, and restaurateurs think should be offered and consumed in the restaurant setting. Historically restaurant meals were a treat and eaten only occasionally, but they are now highly prevalent in the diets of American children<sup>6,32</sup>. Unhealthy options on children's menus are also still ubiquitous and often promoted<sup>66,68,125,218-220</sup>, which may be due in part to restaurateurs' perspectives around what consumers want<sup>77,79</sup>. Moreover, many children already know what they are going to order prior to entering the restaurant<sup>79</sup>, which is consistent with previous research suggesting that associations between different restaurant

brands and the types of foods that are offered are already well ingrained<sup>222-224</sup>. Numerous studies have highlights the benefits of repeated exposure and familiarity for food acceptance in children<sup>158,164</sup>, indicating that collective and widespread changes to restaurant children's menu are likely to help make healthy entrées, sides, and beverages more normative and acceptable overall. Yet parents show little understanding of what their children should consume in terms of calories in restaurants<sup>131</sup>, and often view restaurant meals as a treat for their children as well<sup>24</sup>. The *You're the Mom* campaign tried to shift what parents viewed as normal for their children's restaurant meals, but this did not appear to have an impact on the quality of their own orders. Furthermore, the variability in individual children's responses to a healthy menu suggests that healthy menu changes alone won't reach all children<sup>132</sup>, and may be further limited by children's expectations of what constitutes a "kids' meal". Nevertheless, these current norms could shift as restaurants begin to promote and offer more and more healthier options<sup>18,22,102,174,209-211,225</sup>, as more restaurants offer healthy sides and beverages automatically with meals, as policy makers continue to push for policies that improve the nutrition quality of restaurant meals<sup>18,23,81,152,202</sup>, as parents continue to advocate for healthier options on restaurant children's menus<sup>226</sup>, and as more and more children order these healthier items<sup>13-15,22,85,132,227</sup>.

Additional research is needed to better understand normative expectations in the restaurant space. Although parents may view restaurant meals as a treat<sup>24,25</sup>, there is also evidence that parents are supportive of healthy defaults<sup>22,85,227</sup>. More qualitative research exploring normative perceptions among parents, children, and restaurateurs could help uncover what other underlying biases or associations these individuals have regarding children's meals. For example, both parents and children may have expectations that are consistent with what is

offered on children's menus, and the most commonly offered menu entrées included fried chicken entrées, pasta, burgers, and grilled cheese sandwiches<sup>89</sup>. A deeper understanding of the expectations of parents and children around the types of entrées, sides, and beverages that they believe should be offered on children's meals in various restaurant contexts would inform which healthy menu changes they would be most willing to accept. Interviews with restauranteurs around the types of foods they view as belonging on children's menus would also shed light on whether internal biases exist within the industry, and may also provide information on whether/how those biases have changed over time. An evaluation of children's menus available in databases like the New York City library's menu collection, which dates back to the 1840s, and an exploration of the co-occurring food policy efforts could also help demonstrate how children's menus have changed over time along with the policy climate. Finally, observational research evaluating perceived norms around restaurant meals in children and parents and associations with the quality of restaurant meals could help shed light on whether interventions aimed at shifting norms in the restaurant space would be effective.

## **Conclusions**

This research provides insight into the complexities of efforts to improve restaurant meals for children. We demonstrate promising trends towards increases in the availability of healthier sides and beverages on children's menus in the leading QSRs, but are unable to show if these changes directly correspond with any specific policy activities between 2004 and 2015. We also demonstrate substantial variability in how children respond to a healthier children's menu in a regional FSR chain, which may have implications for the potential impact of the aforementioned healthy menu changes in the QSR setting. Finally, we find that

a promotional campaign empowering parents to choose healthier meals for their children in QSRs has no significant spillover impact on the calorie content of parent orders.

There are still significant gaps in our understanding of how children and parents make food-related decisions in the restaurant setting, how healthy children's menu changes impact the quality of children's orders, and successful modes of intervention for both children and parents. This dissertation and previous research suggest menu-based interventions that include healthier sides and beverages by default<sup>13-15,106,132,190</sup>, increase the prominence of healthier menu items<sup>64,94,209,210,212,228</sup>, reduce the portion size of existing popular less healthy menu items<sup>70,128,187</sup>, and/or reformulate existing menu items so that they are healthier<sup>185</sup> are likely to improve the quality of restaurant meals for children and parents. Additional research is needed to determine whether interventions strategies that elicit parents desire to serve as a positive role model for their children<sup>26</sup> or that encourage families to make healthier meal decisions before entering the restaurant<sup>24</sup> also help improve the nutrition quality of parent meal orders. Finally, policy and advocacy efforts may be an effective catalyst for healthy menu changes in restaurants, since they have been associated with healthy menu changes<sup>18,23,44,61,81</sup>, and co-occurred with healthy menu children's menu changes over the last decade in our analyses. Additional studies are also needed to identify whether menu-based strategies are disproportionately positively affecting those children who are already healthy, to identify ways to engage parents in interventions aimed at improving the quality of children's restaurant meals, and to uncover what other factors drive healthy menu changes in the industry. In the short term, future research should identify underlying factors associated with accepting healthier menu items in children and parents as well as factors influencing healthy menu changes in the top quick service restaurants. In the long term, future research should

utilize approaches that explicitly evaluate feedbacks and interactions at multiple levels (individual child, parent, and restaurant), and could help provide additional insight into the policy and intervention strategies that would be most effective at improving the overall quality of and reducing the excess calories in restaurant meals.

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## Appendix 1 Silver Diner's Healthier Kid's Menu



# KID'S MENU

## COMPLETE MEALS & HEALTHIER CHOICES

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**ALL ENTRÉES SERVED WITH  
FRUIT OR VEGETABLE AND  
MILK OR JUICE**  
Available for Kids 12 and Under

Our KID APPROVED menu is based on comments from parents and taste tests with kids.

**50% of Meals are Healthier**

- Kids LiveWell/Under 600 calories
- Lower in Fat and Calories
- Gluten-Free
- Vegetarian
- Hormone and Antibiotic-Free Meats
- Nitrate-Free Bacon

**60% of Meals are Local**

- Farm-Fresh Eggs
- Local Bison
- Sustainable Turkey



**Kids LiveWell**

Silver Diner is proud to be an inaugural leader of the Kids LiveWell program. Learn more at [HealthyDiningFinder.com](http://HealthyDiningFinder.com)

Prices subject to change without notice. We are not a Gluten Free Environment. LiveWell and Kids LiveWell are service marks of the National Restaurant Association. Nutritional information based on KID's menu and includes side/s, side and beverage. © 2012

### BREAKFAST

- **Champion Breakfast - 4.99**  
One egg, strawberries and multigrain toast.  
• Cal 400, Fat 10g, Sat. Fat 2.5g, Chol. 185mg, Fiber 4g
- **Berry Good Cakes & Egg - 4.99**  
One egg and strawberries.  
• Cal 520, Fat 13g, Sat. Fat 2.5g, Chol. 185mg, Fiber 3g
- **Challah French Toast - 4.99**  
With maple sugar, one egg and strawberries.
- **Gluten-Free or Belgian Waffle - 4.99**  
With maple sugar, one egg and strawberries.

### SLIDERS & SANDWICHES

**Slider with American Cheese - 4.79 (Bison Slider 5.79)**  
With mixed veggies.

- For a heartier appetite add an extra slider - .99/extra 1.39
- **Beef - Grass Fed, Antibiotic-Free**  
• Cal 460, Fat 18g, Sat. Fat 5g, Chol. 95mg, Fiber 4g
- **Turkey**  
• Cal 430, Fat 14g, Sat. Fat 3g, Chol. 55mg, Fiber 4g
- **Bison - From Grasspowered Farms (MD)**  
• Cal 400, Fat 10g, Sat. Fat 2.5g, Chol. 55mg, Fiber 4g
- **Black Bean Veggie**  
• Cal 440, Fat 12g, Sat. Fat 2.5g, Chol. 10mg, Fiber 8g

**Grilled Nitrate-Free All Beef Hot Dog - 4.79**  
With strawberries or veggie.

**Grilled Cheese - 4.79**  
Choice of white or multigrain bread with strawberries or veggie.  
Add item - .49

- **Chicken Pizza Quesadilla - 5.99**  
Multigrain tortilla, chicken, marinara, low fat cheddar, mixed peppers, tomatoes and basil with side salad.  
• Cal 280, Fat 8g, Sat. Fat 2.5g, Chol. 30mg, Fiber 6g

### KIDS CLASSICS

- **Teriyaki Salmon - 5.99**  
Reduced sodium with brown rice, mixed veggies.  
• Cal 580, Fat 22g, Sat. Fat 4g, Chol. 65mg, Fiber 4g
- **Teriyaki Grilled Chicken Breast - 4.99**  
Reduced sodium with brown rice and mixed veggies.  
• Cal 420, Fat 12g, Sat. Fat 3.5g, Chol. 55mg, Fiber 4g
- **Spaghetti with Mixed Veggies - 4.99**  
100% whole grain wheat or angel hair pasta with butter or tomato sauce.  
• Cal 440, Fat 2.5g, Sat. Fat 0g, Chol. 5mg, Fiber 12g
- **Chicken Tenders - 4.99**  
Antibiotic and hormone-free, served with strawberries or veggie.
- **Macaroni & Cheese - 4.99**  
With a side salad.
- **Turkey-Style Dinner - Koch's Farm (PA) - 5.99**  
Sustainable turkey with gravy, cranberry orange ginger sauce, mashed potatoes and mixed veggies.

### AWESOME EXTRAS

Substitute any of these as a side for no charge or add as an extra for \$1.09

**FRUITS**

- Fresh Strawberries
- Organic Apple Sauce

**VEGGIES**

- Mixed Veggies
- Steamed Edamame
- Garden Salad
- Sweet Buttered Corn

**OTHER SIDES**

- Brown Rice
- Mashed Potatoes
- Nitrate-Free Bacon
- Turkey Bacon
- Chicken Maple Sausage
- Gluten-Free Local Pork Sausage

### DYNAMITE DRINKS

Milk, Soy Milk or Juice is included with kids entrees (Refills - .99)

**All Natural Milk from Kreider's Farm (PA)**

- Skim or Whole, Chocolate Milk
- Soy Milk
- 100% Juice

*All Natural Simply Orange Juice, Apple Juice, or Grape Juice*

### SHAKES & DESSERTS

♥ **Very Berry Yogurt Shake - 2.59**  
Breyer's fat free milk ice cream, wheat germ, strawberry sauce, blueberries, raspberry sauce.  
• Cal 165, Fat 1g, Sat. Fat 1g, Chol. 0mg, Fiber 4g

♥ **Pomegranate Shake - 2.59**  
Pomegranate juice, banana, yogurt, wheat germ.  
• Cal 251, Fat 6g, Sat. Fat 0g, Chol. 0mg, Fiber 4g

♥ **Health Shake - 2.59**  
Breyer's fat free vanilla ice cream, bananas, strawberries, skim milk, honey, wheat germ.  
• Cal 290, Fat 2g, Sat. Fat 0g, Chol. 0mg, Fiber 8g

● **Gluten Free Brownie Sundae - 2.59**  
House made brownie topped with all natural Breyer's fat free vanilla topped with chocolate sauce, whipped cream.

♥ **Single Scoop of Ice Cream - 1.49**  
Choice from vanilla, chocolate or strawberry Breyer's ice cream or Breyer's fat free vanilla ice cream.

♥ **Low Fat Strawberry Angel Cake - 2.59**  
Fat free vanilla ice cream, agave sweetened strawberry sauce.  
• Cal 252, Fat 0g, Sat. Fat 0g, Chol. 0mg, Fiber 4g

**Healthier Options**

- Kids LiveWell Approved (KLW)
- ♥ Lower in Fat & Cholesterol
- Gluten Free

Kids LiveWell Guidelines available upon request

**Appendix 2 Recruitment materials and surveys for the evaluation of the *You're the Mom* campaign**

## 2A. Recruitment script for data collection before and after the campaign was implemented (PRE)

### Recruitment Script

#### [ Initial Approach ]

Hi, are you interested in a \$10 gift card?

#### [ When a potential participant wants to learn more ]

Here's some info about the study. If you fill out a quick survey and give us your receipt you'll get a \$10 gift card to [store]. Are you interested?

[IF NO] No problem, thanks for your time!

#### [ Eligibility Screening ]

[IF YES] Great, I just have a few questions to make sure you qualify:

Have you participated in this study before?

- [IF YES] Unfortunately, you can't participate a second time. Thanks anyway, and enjoy your meal.

Are you 18 years or older?

- [IF NO] Unfortunately, you have to be 18 or older. Thanks for your time, and enjoy your meal.

Are you here with a child who is between 4 and 12 years old?

- [IF NO] Unfortunately, we're only looking for parents with kids ages 4 to 12. Thanks for your time, and enjoy your meal.

Are you the child's parent or legal guardian?

- [IF NO] Unfortunately, we're only looking for parents or legal guardians. Thanks for your time, and enjoy your meal.

[ SPRINGFIELD ONLY ] Do you live in, work in, or frequently travel to Springfield?

- [IF NO] Unfortunately, we're only looking for Springfield residents. Thanks for your time, and enjoy your meal.

Great, you qualify! Let me tell you a little more about what you'll have to do.

To get the \$10 gift card, you'll have to give us your receipt, tell us what you and your child ordered, and fill out a quick survey. Does that sound ok?

[IF NO] No problem, thanks for your time!

[IF YES] Great! Are you staying here to eat?

[IF NO skip to *Do you have any questions?*]

[IF YES] Great, and you could get a \$20 gift card if you do both of those things and give us any leftovers from your child's meal. How does that sound?

Do you have any questions?

[ If multiple children ] I see you have more than one child here. Are they both between 4 and 12 years old?

[IF YES] For the study, we ask that you answer questions about just one child. Which one had the most recent birthday? *[wait for answer]* Great, please refer to them when we ask about "your child".

[IF NO] For the study, just refer to the child between 4 and 12.

Here's an info sheet to read over. Let me know if you have any questions.

**2B. Recruitment script for data collection before and after the campaign was implemented (POST)**

**[ Eligibility Screening ]**

[IF YES] Great, I just have a few questions to make sure you qualify:

Have you participated in this study before?

- [IF YES] Unfortunately, you can't participate a second time. Thanks anyway, and enjoy your meal.

Are you 18 years or older?

- [IF NO] Unfortunately, you have to be 18 or older. Thanks for your time, and enjoy your meal.

Are you here with a child who is between 4 and 12 years old?

- [IF NO] Unfortunately, we're only looking for parents with kids ages 4 to 12. Thanks for your time, and enjoy your meal.

Are you the child's parent or legal guardian?

- [IF NO] Unfortunately, we're only looking for parents or legal guardians. Thanks for your time, and enjoy your meal.

**[ SPRINGFIELD ONLY ]** Do you live in, work in, or frequently travel to Springfield?

- [IF NO] Unfortunately, we're only looking for Springfield residents. Thanks for your time, and enjoy your meal.

Great, you qualify! Let me tell you a little more about what you'll have to do.

2C. Survey for the control and intervention community before the campaign was implemented (PRE)

### Restaurant Study Survey

Please answer the following questions about yourself and your child.



1. What is your participant ID number (the 4-digit number on the receipt)?  
\_\_\_\_\_
2. Do you consider the food you bought in this restaurant today to be:  
☐ Lunch  
☐ Dinner  
☐ Snack
3. Is the food bought today what your child usually eats at this restaurant chain?  
☐ No  
☐ Yes  
☐ I'm not sure  
☐ This is my child's first time eating here
4. Who decided what to order for your child today?  
☐ I did  
☐ My child did  
☐ My child and I decided together  
☐ Another person did. (Who?):  
\_\_\_\_\_
5. Did your child share any foods or drinks with anyone during the meal?  
☐ No  
☐ Yes
6. Did your child drink water with the meal?  
☐ No  
☐ Yes
7. How often does your child eat at any fast food restaurants (such as Burger King, Taco Bell, and KFC), including this one?  
☐ A few times a year  
☐ 1 time a month  
☐ 2-3 times a month  
☐ 1-3 times a week  
☐ 4 or more times a week
8. What two things were most important when choosing foods for your child today?  
☐ Taste  
☐ Price  
☐ Health/Nutrition  
☐ Easy/quick  
☐ What I'm used to  
☐ Other: \_\_\_\_\_

GO TO THE NEXT PAGE



## Restaurant Study Survey

Please answer the following questions about yourself and your child.



9. Did you see any calorie information in the restaurant?

- ☐ No → [SKIP TO QUESTION 14](#)
- ☐ Yes → [GO TO THE NEXT QUESTION](#)

10. Did the calorie information affect what you bought for yourself?

- ☐ No → [SKIP TO QUESTION 12](#)
- ☐ Yes → [GO TO THE NEXT QUESTION](#)

11. How did the calorie information affect what you bought for yourself?

- ☐ I bought food that was lower in calories
- ☐ I bought food that was higher in calories
- ☐ Other: \_\_\_\_\_

12. Did the calorie information affect what you bought for your child?

- ☐ No → [SKIP TO QUESTION 14](#)
- ☐ Yes → [GO TO THE NEXT QUESTION](#)

13. How did the calorie information affect what you bought for your child?

- ☐ I bought food that was lower in calories
- ☐ I bought food that was higher in calories
- ☐ Other: \_\_\_\_\_

14. Is today's meal a special occasion?

- ☐ No → [SKIP TO THE NEXT PAGE](#)
- ☐ Yes → [GO TO THE NEXT QUESTION](#)

15. What is the special occasion?

---

[GO TO THE NEXT PAGE](#)

## Restaurant Study Survey

Please answer the following questions about yourself and your child.



16. What is your child's birthday?

MONTH:      YEAR: \_\_\_\_\_

- ☐ January
- ☐ February
- ☐ March
- ☐ April
- ☐ May
- ☐ June
- ☐ July
- ☐ August
- ☐ September
- ☐ October
- ☐ November
- ☐ December

17. What is your child's sex?

- ☐ Male
- ☐ Female

18. Is your child Hispanic or Latino?

- ☐ No
- ☐ Yes
- ☐ Prefer not to answer

19. What is your child's race?

(Please select all that apply.)

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Black or African American
- ☐ White/Caucasian
- ☐ Multiracial
- ☐ Some other race (please specify): \_\_\_\_\_
- ☐ Prefer not to answer

20. What is your child's height and weight without shoes?

HEIGHT \_\_\_\_\_ Feet      \_\_\_\_\_ Inches

OR

\_\_\_\_\_ Meters      \_\_\_\_\_ Centimeters

WEIGHT \_\_\_\_\_ Pounds OR \_\_\_\_\_ Kilograms

21. What is your sex?

- ☐ Male
- ☐ Female

22. What is your age?

\_\_\_\_\_ Years

23. What is the highest level of education that you completed?

- ☐ Less than 8th grade
- ☐ Some high school (Grades 9 to 11)
- ☐ High school graduate (finished 12th grade) or GED
- ☐ Job-specific training program(s) after high school
- ☐ Some college but no degree
- ☐ Associate's degree
- ☐ Bachelor's degree (BA, BS, AB, etc.)
- ☐ Graduate degree (Master's degree, professional degree such as MD or JD, or doctorate degree)

THANK YOU FOR YOUR TIME.

2D. Survey for the control community after the campaign was implemented (POST)

Restaurant Study Survey



1. How many children do you have between the ages of 4 and 12? \_\_\_\_\_

*We want you to think about only one of your kids who is between the ages of 4 and 12 for this survey. Please think about the child with the most recent birthday.*

2. What month and year was this child born?

MONTH:	YEAR:
<input type="checkbox"/> January	<input type="checkbox"/> 2003
<input type="checkbox"/> February	<input type="checkbox"/> 2004
<input type="checkbox"/> March	<input type="checkbox"/> 2005
<input type="checkbox"/> April	<input type="checkbox"/> 2006
<input type="checkbox"/> May	<input type="checkbox"/> 2007
<input type="checkbox"/> June	<input type="checkbox"/> 2008
<input type="checkbox"/> July	<input type="checkbox"/> 2009
<input type="checkbox"/> August	<input type="checkbox"/> 2010
<input type="checkbox"/> September	<input type="checkbox"/> 2011
<input type="checkbox"/> October	<input type="checkbox"/> 2012
<input type="checkbox"/> November	
<input type="checkbox"/> December	

*Please think about this child while you complete the survey.*

3. Is the food you bought today what your child usually eats at this restaurant chain?

☐ No  
☐ Yes  
☐ I'm not sure.  
☐ This is my child's first time eating here.

4. Do you consider the food you bought in this restaurant today to be:

☐ Lunch  
☐ Dinner  
☐ Snack

5. Who decided what to order for your child today?

☐ I did.  
☐ My child did.  
☐ My child and I decided together.  
☐ Another person did. → *Who?*

\_\_\_\_\_

6. Did your child drink water with the meal?

☐ No  
☐ Yes

7. Is today's meal a special occasion?

☐ No  
☐ Yes

8. Did your child share any of their food or drinks with anyone else during the meal?

☐ No  
☐ Yes

9. Did anyone else share any of their food or drinks with your child during the meal?

☐ No  
☐ Yes

10. How often does your child eat at any fast food restaurants (such as Burger King, Taco Bell, and KFC), including this one?

☐ A few times a year  
☐ 1 time a month  
☐ 2-3 times a month  
☐ 1-3 times a week  
☐ 4 or more times a week

*Go to the next page.*

11. What two things were most important when choosing foods for your child today?

☐ Taste  
☐ Price  
☐ Health/Nutrition  
☐ Easy/quick  
☐ What my child is used to/our routine  
☐ Other: \_\_\_\_\_

12. Did you see any calorie information in the restaurant?

☐ No → Go to Question 15.  
☐ Yes

13. Did the calorie information affect what you bought for yourself?

☐ No  
☐ Yes → How did it affect what you bought?  
☐ I bought food that was lower in calories.  
☐ I bought food that was higher in calories.  
☐ Other: \_\_\_\_\_  
\_\_\_\_\_

14. Did the calorie information affect what you bought for your child?

☐ No  
☐ Yes → How did it affect what you bought?  
☐ I bought food that was lower in calories.  
☐ I bought food that was higher in calories.  
☐ Other: \_\_\_\_\_  
\_\_\_\_\_

15. How sure are you that you could limit your child's drink choices to water, milk, or 100% juice (like orange juice or apple juice) at fast-food restaurants?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

16. How important is it to you to limit your child's drink choices to water, milk, or 100% juice at fast-food restaurants?

☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

17. How sure are you that you could limit your child's side choices to fruit, vegetables or yogurt at fast-food restaurants?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

18. How important is it to you to limit your child's side choices to fruit, vegetables or yogurt at fast-food restaurants?

☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

Go to the next page.

19. How sure are you that you could limit your child's choices at fast-food restaurants to items from the kids' menu?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

20. How important is it to you to limit your child's choices at fast-food restaurants to items from the kids' menu ?

☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

21. In the last few months, have you made any changes to what your child orders at fast-food restaurants?

☐ No  
☐ Yes → *What changed?*

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22. Have you seen, read, or heard any slogans or advertising for moms to get their kids to eat healthier when they go to a restaurant?

☐ No  
☐ Yes → *What was the name of the slogan or advertising?*

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23. There are many ads on the radio, on billboards, in magazines or on social media such as Facebook with slogans you may or may not remember.

Have you heard, read, or seen any ads with these slogans?

Got Milk?		<input type="checkbox"/> No	<input type="checkbox"/> Yes
5 a Day		<input type="checkbox"/> No	<input type="checkbox"/> Yes
You're the Mom		<input type="checkbox"/> No	<input type="checkbox"/> Yes
Broccoli Power!		<input type="checkbox"/> No	<input type="checkbox"/> Yes

Go to the next page.



**Questions about your child:**

24. What is your child's height and weight without shoes?

HEIGHT: \_\_\_\_\_ Feet \_\_\_\_\_ Inches

WEIGHT: \_\_\_\_\_ Pounds

25. What is your child's sex?

- ☐ Male  
☐ Female

26. Is your child Hispanic or Latino?

- ☐ No  
☐ Yes  
☐ Prefer not to answer

27. What is your child's race? (Check all that apply.)

- ☐ American Indian or Alaska Native  
☐ Asian  
☐ Native Hawaiian or Other Pacific Islander  
☐ Black or African American  
☐ White/Caucasian  
☐ Multiracial  
☐ Some other race: \_\_\_\_\_  
☐ Prefer not to answer

**Questions about you:**

28. What is your sex?

- ☐ Male  
☐ Female

29. What is your age?

\_\_\_\_\_ Years

30. What is the highest level of education that you completed?

- ☐ Less than 8th grade  
☐ Some high school (Grades 9 to 11)  
☐ High school graduate (finished 12th grade) or GED  
☐ Job-specific training program(s) after high school  
☐ Some college but no degree  
☐ Associate's degree  
☐ Bachelor's degree (BA, BS, AB, etc.)  
☐ Graduate degree (Master's degree, professional degree such as MD or JD, or doctorate degree)

**THANK YOU!**

2E. Survey for the intervention community after the campaign was implemented (POST)

Restaurant Study Survey



1. How many children do you have between the ages of 4 and 12? \_\_\_\_\_

*We want you to think about only one of your kids who is between the ages of 4 and 12 for this survey. Please think about the child with the most recent birthday.*

2. What month and year was this child born?

MONTH:	YEAR:
<input type="checkbox"/> January	<input type="checkbox"/> 2003
<input type="checkbox"/> February	<input type="checkbox"/> 2004
<input type="checkbox"/> March	<input type="checkbox"/> 2005
<input type="checkbox"/> April	<input type="checkbox"/> 2006
<input type="checkbox"/> May	<input type="checkbox"/> 2007
<input type="checkbox"/> June	<input type="checkbox"/> 2008
<input type="checkbox"/> July	<input type="checkbox"/> 2009
<input type="checkbox"/> August	<input type="checkbox"/> 2010
<input type="checkbox"/> September	<input type="checkbox"/> 2011
<input type="checkbox"/> October	<input type="checkbox"/> 2012
<input type="checkbox"/> November	
<input type="checkbox"/> December	

*Please think about this child while you complete the survey.*

3. Is the food you bought today what your child usually eats at this restaurant chain?

☐ No  
☐ Yes  
☐ I'm not sure.  
☐ This is my child's first time eating here.

4. Do you consider the food you bought in this restaurant today to be:

☐ Lunch  
☐ Dinner  
☐ Snack

5. Who decided what to order for your child today?

☐ I did.  
☐ My child did.  
☐ My child and I decided together.  
☐ Another person did. → *Who?*  
\_\_\_\_\_

6. Did your child drink water with the meal?

☐ No  
☐ Yes

7. Is today's meal a special occasion?

☐ No  
☐ Yes

8. Did your child share any of their food or drinks with anyone else during the meal?

☐ No  
☐ Yes

9. Did anyone else share any of their food or drinks with your child during the meal?

☐ No  
☐ Yes

10. How often does your child eat at any fast food restaurants (such as Burger King, Taco Bell, and KFC), including this one?

☐ A few times a year  
☐ 1 time a month  
☐ 2-3 times a month  
☐ 1-3 times a week  
☐ 4 or more times a week

*Go to the next page.*

11. What two things were most important when choosing foods for your child today?

☐ Taste  
☐ Price  
☐ Health/Nutrition  
☐ Easy/quick  
☐ What my child is used to/our routine  
☐ Other: \_\_\_\_\_

12. Did you see any calorie information in the restaurant?

☐ No → *Go to Question 15.*  
☐ Yes

13. Did the calorie information affect what you bought for yourself?

☐ No  
☐ Yes → *How did it affect what you bought?*  
☐ *I bought food that was lower in calories.*  
☐ *I bought food that was higher in calories.*  
☐ Other: \_\_\_\_\_  
\_\_\_\_\_

14. Did the calorie information affect what you bought for your child?

☐ No  
☐ Yes → *How did it affect what you bought?*  
☐ *I bought food that was lower in calories.*  
☐ *I bought food that was higher in calories.*  
☐ Other: \_\_\_\_\_  
\_\_\_\_\_

15. How sure are you that you could limit your child's drink choices to water, milk, or 100% juice (like orange juice or apple juice) at fast-food restaurants?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

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☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

17. How sure are you that you could limit your child's side choices to fruit, vegetables or yogurt at fast-food restaurants?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

18. How important is it to you to limit your child's side choices to fruit, vegetables or yogurt at fast-food restaurants?

☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

*Go to the next page.*



19. How sure are you that you could limit your child's choices at fast-food restaurants to items from the kids' menu?

☐ Maybe I can.  
☐ I am sure that I can.  
☐ I am sure that I cannot.

20. How important is it to you to limit your child's choices at fast-food restaurants to items from the kids' menu ?

☐ Not at all important.  
☐ A little/somewhat important.  
☐ Very important.

21. In the last few months, have you made any changes to what your child orders at fast-food restaurants?

☐ No  
☐ Yes → *What changed?*

---



---



---

22. Have you seen, read, or heard any slogans or advertising for moms to get their kids to eat healthier when they go to a restaurant?

☐ No  
☐ Yes → *What was the name of the slogan or advertising?*

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23. There are many ads on the radio, on billboards, in magazines or on social media such as Facebook with slogans you may or may not remember.

Have you heard, read, or seen any ads with these slogans?

Got Milk?		<input type="checkbox"/> No	<input type="checkbox"/> Yes
5 a Day		<input type="checkbox"/> No	<input type="checkbox"/> Yes
You're the Mom		<input type="checkbox"/> No	<input type="checkbox"/> Yes
Broccoli Power!		<input type="checkbox"/> No	<input type="checkbox"/> Yes

Go to the next page.





24. Have you seen either of the ads shown above?

- ☐ No  
☐ Yes

25. Where have you seen, read, or heard about ads with the "You're the Mom" slogan?

(Check all that apply.)

- ☐ Have not seen it  
☐ Billboard, or posters in buses  
☐ Radio  
☐ Outdoor mural  
☐ Facebook, Twitter, or other social media  
☐ YouretheMom.org website  
☐ News (TV, newspaper, magazine, newsletter)  
☐ From a friend, family member, or someone else  
☐ Painted utility box or banner  
☐ I don't remember  
☐ Other: \_\_\_\_\_

*Go to the next page.*

**Questions about your child:**

26. What is your child's height and weight without shoes?

HEIGHT: \_\_\_\_\_ Feet \_\_\_\_\_ Inches

WEIGHT: \_\_\_\_\_ Pounds

27. What is your child's sex?

- ☐ Male  
☐ Female

28. Is your child Hispanic or Latino?

- ☐ No  
☐ Yes  
☐ Prefer not to answer

29. What is your child's race? (Check all that apply.)

- ☐ American Indian or Alaska Native  
☐ Asian  
☐ Native Hawaiian or Other Pacific Islander  
☐ Black or African American  
☐ White/Caucasian  
☐ Multiracial  
☐ Some other race: \_\_\_\_\_  
☐ Prefer not to answer

**Questions about you:**

30. What is your sex?

- ☐ Male  
☐ Female

31. What is your age?

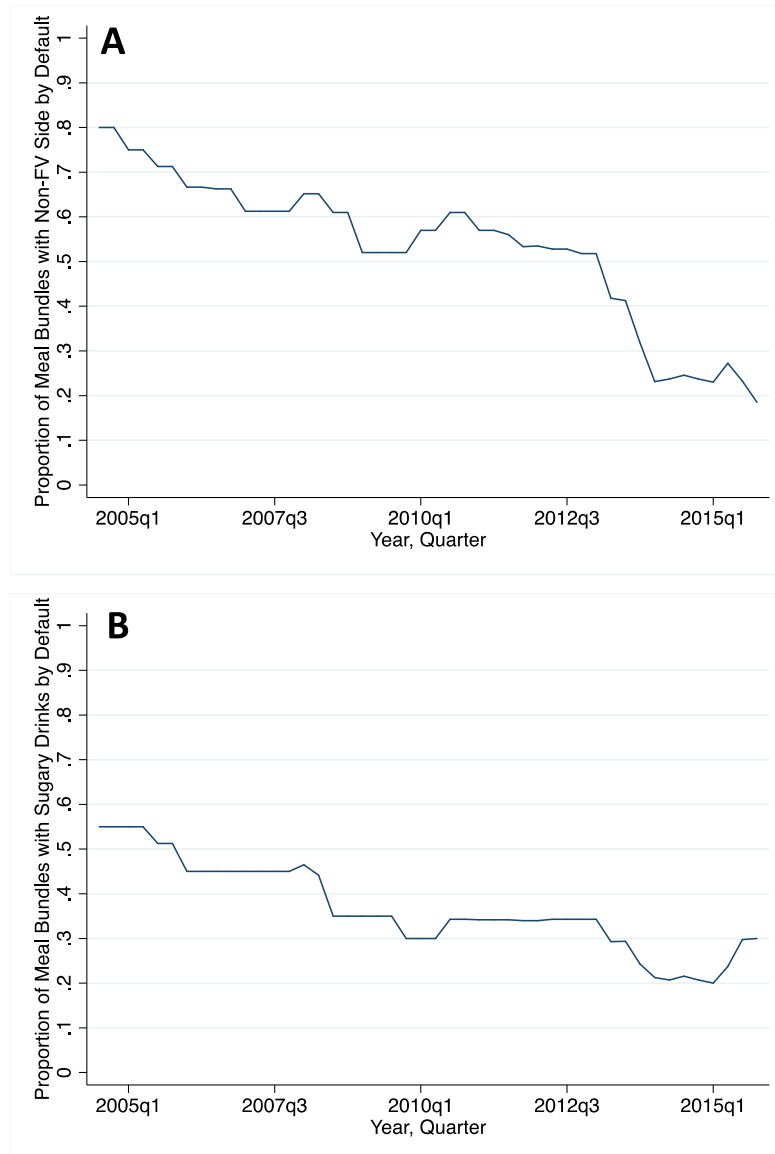
\_\_\_\_\_ Years

32. What is the highest level of education that you completed?

- ☐ Less than 8th grade  
☐ Some high school (Grades 9 to 11)  
☐ High school graduate (finished 12th grade) or GED  
☐ Job-specific training program(s) after high school  
☐ Some college but no degree  
☐ Associate's degree  
☐ Bachelor's degree (BA, BS, AB, etc.)  
☐ Graduate degree (Master's degree, professional degree such as MD or JD, or doctorate degree)

**THANK YOU!**

### Appendix 3 Chapter 6 Supplementary Figures



**Supplementary Figure 6 1** A) The average percentage of meal bundles with non-fruit or vegetable (non-FV) sides included by default (S1A) and B) the average percentage of meal bundles with a sugary drink included by default (S1B). Non-FV sides were defined as those that were not identified as a fruit and non-fried vegetable sides (FV) using the procedure outlined in Anzman-Frasca S et. al. (2014)<sup>22</sup>. Sugary beverages were defined as beverage that were a sugar sweetened carbonated, fruit flavored, coffee, or other sugar-sweetened drink<sup>28,144</sup>. Low-fat flavored milk and 100% fruit juices were considered non-sugary beverages based on the Dietary Guidelines for Americans, MyPlate, and the National School Meals Program<sup>142</sup> and were not included here. Results shown here are presented across all restaurant chains from the third quarter of 2004 to the fourth quarter of 2015.

**Supplementary Table 6 1 Nutrition-related policy efforts that were omitted from this analysis because they did not legislate menus or menu offerings**

Year	Policy Activity Omitted
2003	The Improved Nutrition and Physical Activity Act (IMPACT) was passed in the Senate, which aims to provide health services for nutrition, physical activity, and obesity prevention
2004	The Personal Responsibility in Food Consumption Act passed in the house (did not pass in the Senate), which protects the food industry from litigations attributing obesity to the food industry
2005	IMPACT Act introduced in the House The Personal Responsibility in Food Consumption Act (aka the Commonsense Consumption Act) introduced in the House and Senate, and passed in the House
2007	IMPACT Act re-introduced in the Senate House and Senate re-introduce the Personal Responsibility in Food Consumption Act (aka the Commonsense Consumption Act)

Notes: Policy efforts shown here were noted under the policy and advocacy section on archived versions of the National Restaurant Association's webpage for a given year. These policies were omitted for our analysis because they did not directly propose to legislate menus/menu offerings.

