Community-based nutrition education:
Documentation and evaluation of effectiveness

by

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ABSTRACT</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHAPTER 1. INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>Thesis Goals</td>
<td>1</td>
</tr>
<tr>
<td>Thesis Organization</td>
<td>2</td>
</tr>
<tr>
<td><strong>CHAPTER 2. REVIEW OF LITERATURE</strong></td>
<td>3</td>
</tr>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Need for Health Promotion</td>
<td>3</td>
</tr>
<tr>
<td>General Health Promotion Recommendations</td>
<td>4</td>
</tr>
<tr>
<td>Traditional Nutrition Education</td>
<td>5</td>
</tr>
<tr>
<td>Theoretical Models</td>
<td>5</td>
</tr>
<tr>
<td>Mode of Delivery – Traditional</td>
<td>11</td>
</tr>
<tr>
<td>Mode of Delivery – Technology</td>
<td>13</td>
</tr>
<tr>
<td>Locations and Context of Nutrition Education</td>
<td>16</td>
</tr>
<tr>
<td>Retail Grocery Strategies</td>
<td>18</td>
</tr>
<tr>
<td>Sales Data</td>
<td>20</td>
</tr>
<tr>
<td>Food Access and Availability</td>
<td>21</td>
</tr>
<tr>
<td>Consumer Knowledge</td>
<td>22</td>
</tr>
<tr>
<td>Consumer Interest in Retail Nutrition Education</td>
<td>23</td>
</tr>
<tr>
<td>Traditional Grocery Education Mode</td>
<td>24</td>
</tr>
<tr>
<td>Technology-based Nutrition Education Retail Opportunities</td>
<td>26</td>
</tr>
<tr>
<td>Summary and Implications</td>
<td>27</td>
</tr>
<tr>
<td><strong>CHAPTER 3. METHODS</strong></td>
<td>30</td>
</tr>
<tr>
<td>Introduction</td>
<td>30</td>
</tr>
<tr>
<td>Study 1—Extension Evaluation</td>
<td>30</td>
</tr>
<tr>
<td>Study 2—Grocery Education Modes</td>
<td>36</td>
</tr>
<tr>
<td><strong>CHAPTER 4. EVALUATING NUTRITION EDUCATION PROGRAMS WITH A DIETARY SCREENER</strong></td>
<td>45</td>
</tr>
<tr>
<td>Abstract</td>
<td>45</td>
</tr>
<tr>
<td>Introduction</td>
<td>45</td>
</tr>
<tr>
<td>Methods</td>
<td>48</td>
</tr>
<tr>
<td>Results</td>
<td>51</td>
</tr>
<tr>
<td>Discussion</td>
<td>52</td>
</tr>
<tr>
<td>References</td>
<td>62</td>
</tr>
<tr>
<td><strong>CHAPTER 5. EVALUATION OF TRADITIONAL AND TECHNOLOGY-BASED GROCERY STORE NUTRITION EDUCATION</strong></td>
<td>65</td>
</tr>
<tr>
<td>Abstract</td>
<td>65</td>
</tr>
</tbody>
</table>
ABSTRACT

Background: The obesity epidemic and associated chronic conditions pressure the importance of nutrition education, and showcase a need for collaborative efforts. The evaluation and documentation of nutrition education is essential to improve impacts and outcomes of efforts.

Methods: Three interventions are described within this thesis. The first reviews traditional nutrition education provided by Extension, and the need for objective evaluation measures. The second project compares traditional and technology-based education modes in the grocery store setting. The third project is a technology-based iPhone application and mobile website developed for the Iowa State Fair to provide just-in-time nutrition information on the available fare.

Results: The objective evaluation measure implemented was successful for documentation of effectiveness of Extension education efforts, and improved dietary intake of participants. The second project found equivalent awareness of intervention materials. However, significantly higher engagement occurred with the traditional education mode when compared with the technology-based efforts. The third project was a success at the Iowa State Fair, with many page views for both vendor, foods, and nutrition information.

Conclusions: Nutrition education efforts provide the most impact when strategic, with collaborative efforts achieving greater reach. Education efforts appear to be additive in nature with regard to impact, thus increased promotional activities and interactions are most likely to find engagement and subsequent behavior change.
CHAPTER 1. INTRODUCTION

The evaluation and documentation of nutrition education is essential to improve impacts and outcomes of efforts.\textsuperscript{3} The obesity epidemic and associated chronic conditions pressure the importance of nutrition education, and showcase a need for collaborative efforts.\textsuperscript{1,2} The Social-ecological Model (SEM) provides a rich context for guidance of nutrition education.\textsuperscript{4}

Primary prevention with “a life course approach” to encourage health behaviors is fundamental.\textsuperscript{5,6} The World Health Organization reports deaths from premature diseases such as heart, stroke and type II diabetes could be prevented by at least 80\% and cancer by 40\%.\textsuperscript{5} Preventable chronic diseases have important modifiable risk-factors to target for education efforts. Diet is a vital component to modify, as low fruit and vegetable consumption is attributed to 2.7 million deaths yearly.\textsuperscript{5}

Best practices suggest change in dietary quality is a key evaluation measure for nutrition education.\textsuperscript{7} Collaborative efforts at the various spheres of influence within the framework of the SEM are necessary to make an impact. Many education efforts have found mixed results in the literature. Additional testing to determine best focus for strategic efforts is necessary.

**Thesis Goals**

This thesis serves the overall goal to describe documentation and evaluation of nutrition education, for guidance on strategy of future nutrition education efforts.
Goal 1: To assess traditional education efforts by implementation of a new evaluation tool for the Loving Your Family program provided by Extension.

Goal 2: To compare nutrition education modes, traditional with an equivalent technology-based, in the grocery store setting.

Goal 3: To provide just-in-time information at the Iowa State Fair to increase consumer knowledge of nutrition fare (published article appears in Appendix A).

Thesis Organization

The focus of this thesis is to evaluate methods of nutrition education and interventions. A review of literature will set the stage for the research described in the contained manuscripts. The literature discussed begins with establishing the need for general nutrition education, and associated efforts. Extension program evaluation methods are discussed, and the literature review has focus on grocery store intervention research. Three manuscripts are contained, each describes one of the above goals, and was written for journal publication by the graduate student and major professor. The thesis will close with a summary and overall conclusions, followed by appendices and then references.
CHAPTER 2. REVIEW OF LITERATURE

Introduction

Health promotion is an increasingly important field of research. Chronic health conditions are associated with increasing obesity rates, which remain at high prevalence.\textsuperscript{1,2} Chronic conditions account for greater than 75% of health care costs, and are for the most part preventable.\textsuperscript{8} Obesity-related chronic conditions are the leading causes of preventable death.\textsuperscript{9} Obesity, metabolic syndrome, type 2 diabetes, cardiovascular disease and other chronic conditions have dietary strategies for prevention and management.\textsuperscript{10,11} Significant improvements in health can be achieved with modest reductions of 5 to 10% of weight.\textsuperscript{2} Improved dietary choices and physical activity are the best strategy for weight loss. Collectively, these factors increase the need to establish effective health promotion strategies.\textsuperscript{2,12} Collaborative efforts are necessary to achieve widespread reach and sustainability, while creating healthy communities.\textsuperscript{13}

Need for Health Promotion

Obesity afflicts all age groups in the U.S. with high prevalence. Among children, aged 2-19 years, 16.9% are obese and another 14.9% overweight.\textsuperscript{1} Over two-thirds of adults in the U.S. are overweight or obese, included are 34.9% obese and 6.4% extremely obese. Overweight and obesity affects 67% of adult Iowans by self-report Body Mass Index (BMI).\textsuperscript{14}

Obesity is frequently associated with the diagnostic criterion of metabolic syndrome, a cluster of risk factors which elevate development likelihood of chronic conditions such as
cardiovascular disease, type 2 diabetes and increased mortality. The prevalence of metabolic syndrome in the U.S. was estimated at 21-24%, using data from the National Health and Nutrition Examination Survey (NHANES). High metabolic syndrome prevalence has substantial implications for healthcare. Treatment of metabolic syndrome may reduce associated chronic conditions.

Increased healthcare costs are associated with obesity and related morbidity/mortality. One study suggests obesity increases spending by 42% compared with those of normal weight, across U.S. payers (government and private insurances). Direct medical costs associated with overweight and obesity are estimated at $266 and $1,723 per year, per person, respectively. For adults in the U.S., overweight and obesity are responsible for 5-10% of national healthcare expenditures annually, by direct cost estimates.

A number of risk factors for preventable deaths are associated with dietary, lifestyle and metabolic disorders. Overweight and obesity, lack of physical activity and elevated blood glucose were each responsible for one in ten deaths. Deaths caused by specific diseases have been intertwined with additional metabolic conditions, such that interventions for health promotion may target multiple risk factors. Preventable causes of death in the U.S. have (by definition) effective intervention options, but remain elevated with many deaths due to lifestyle factors.

**General Health Promotion Recommendations**

Public health consensus shows primary prevention is the best practice against the battle and burden of chronic conditions. Health promotion for prevention of chronic condition should use “a life course approach” to reduce risk accumulation in early life.
Collaborative and integrative efforts are needed to create wide adoption of health promotion to increase “health and nutrition literacy.” Community-based collaborations are necessary to create sustainable chronic condition prevention efforts.

**Traditional Nutrition Education**

Nutrition education has emerged and evolved along with the science of understanding nutritional needs for health, followed by government recommendations. The prescription of diet has early origins, but the understanding of nutrition began in the 1700s with a desire to cure disease. The macronutrients were conceptualized in the late 1800s, with the discoveries of the first vitamins shortly following. The first U.S. dietary recommendations in 1917 were prescribed for purposes of nutritional adequacy.

Health recommendations evolved with dietary behaviors, and by the 1970s concerns of chronic conditions were prominent. The Dietary Guidelines for Americans were adopted in 1980. The first edition of the Guidelines was created to provide basic and consistent guidance for healthy populations. Brief, simple messages were the foundation of the Guidelines. Original guidance was based in the notion that consumers only needed nutrition information to make appropriate health decisions.

**Theoretical Models**

Health and nutrition interventions have generally been created within the context and understanding of various psychology-based theories. Generally, these behavioral science theories are person-centered and useful for their intended purpose, patient-focused education. Notable person-centered theories which have stood the test of time include: Health Belief
Model, Theory of Planned Behavior and Stages of Change. Yet, these models do not account for the social and environmental context in which obesity prevalence has risen to epidemic proportions. Person-centered models also do not account for obesity’s associated influences upon health and disease. Social Cognitive Theory (SCT) takes an all-encompassing view of human behavior within social contexts. Certain constructs identified within SCT have been widely adopted, like self-efficacy and observational learning. However, the SCT neglects the influence of additional environmental factors including physical surroundings, organizational structures and policies. Many theories have been used for various types of health interventions over the years. Health behavior theories tend to learn from, build upon each other and adapt with a deeper understanding of human behavior and the environment in which we live.

**Social-ecological model**

The social-ecological model (SEM) (visual depiction, Appendix B) has received increased interest due to the comprehensive and widespread nature of the theory, which provides guidance for systematic interventions to influence population wide behavior change. The SEM suggests multiple influences connect in a dynamic way to influence behavior change. Thus, human behavior does not occur in a vacuum. Human behavior involves a complex array of interactions of an intrapersonal, interpersonal, organizational/institutional, community and public policy/societal nature. The SEM suggests these multiple spheres or ecologies interact to influence and affect behaviors. Additionally, a reciprocal determinism occurs—many factors of personal and social origins feedback and intermingle with decisions to affect future outcomes and decisions.
Origins of the model

The understanding of ecologies, social impact and behaviors has early beginnings in psychology\textsuperscript{25-27}—as theory for human development, which proposed that many intertwined influences culminate to affect behaviors. The SEM aligns with a systems approach to understand and view the world, social interactions and persons.\textsuperscript{25} The basic premise of the systems model suggests that true understanding includes a comprehension of relationships, and how those parts interact to create a whole. The complexity of this theory has logically transitioned into guidance on applications of health promotion and interventions.\textsuperscript{22,28}

In the 1970s, Bronfenbrenner contended the scientific community must use various perspectives, thus approaches, for research to gain a true understanding of human development in context.\textsuperscript{25} This called for a further understanding of ecology and utilizing a systems framework. Bronfenbrenner utilized terminology coined by Brim, while describing social indicators for child development.\textsuperscript{25,27} Brim identified and described the components/spheres of the ecological model as microsystem, mesosystem, exosystem, and macrosystem. The purpose of using an ecological viewpoint is to understand human development with the aim to improve society, by raising of our children in a just world.\textsuperscript{25} The ecological model was inspiration, and was further focused, for the purposes of health promotion.\textsuperscript{22} The ecological model for health promotion is generally synonymous with the social-ecological model (SEM).

Description of the SEM

The SEM has been described with four or five spheres of ecological influence. The original SEM consists of four spheres.\textsuperscript{25} The ecological model for health promotion included
The most prominent SEM consists of four spheres, which can be described as follows:

- Individual factors (intrapersonal) are a person’s attitudes, beliefs and cognitions which affect their behaviors and lifestyle. This includes any biological or demographic characteristics which may interact upon their outlook.

- Social environment describes the interpersonal network of family, friends and peers.

- Physical environments are settings in which daily life and behaviors occur. The physical locations include the home, work/school, retail and neighborhood contexts.

- Macro-level environments are sectors of society and culture, which impact norms and values. Macro-level sectors include government policies, food distribution networks, economies and health care systems.

The framework of social ecology was “conceived topologically as a nested arrangement of structures, each contained within the next.” The various ecological spheres intertwine, as reciprocal determinism. The outer most spheres (macro and physical environments) dictate much of the networks within the inner spheres by providing structure; while the inner spheres (intra- and interpersonal) create the climate which fulfill the outer ecologies.

**Implications**

Interventions should be developed within the context of the SEM and its components—to ignite behavior change from all possible angles. Health promotion and
behavior change should be presented as convenient and easy by using various strategies within context of the SEM. The SEM views health as a “resource for everyday life, not the objective of living.” The SEM was created within this understanding, and the SEM model provides context and direction for implementing interventions by creating environments which encourage healthy behaviors. The SEM suggests interventions at all ecological spheres of influence are important and research needs to target behavior change at each particular ecology. Within the SEM, various ecological targets for interventions are intended to support other efforts, and not act as stand-alone interventions.

**Use of theory**

A 1991 review of nutrition education articles set to determine best practices for nutrition education effectiveness by assessing usage of theory and measured improvement of knowledge, attitude and/or behavior. Researchers noted learning theory application or principles were found in 71% of articles reviewed, and 29% of articles reviewed explicitly applied theory. No significant associations between usage of a theory and intervention outcomes were noted by chi square test of independence. Specific theories were not assessed for effectiveness, as available literature limited analyses to use of theory.

A review of health promotion research assessing usage of theory, from 2000 through 2005, found discussion of a theoretical model occurred in 36% of articles. Only 12% of articles reviewed conducted research informed by theory. Of those using theory, 55% used multiple theories. The theoretical models most utilized were: The Transtheoretical Model, Social Cognitive Theory, and the Health Belief Model. This review did not assess correct application of theory or effectiveness of theory on intervention outcomes.
Richard and colleagues\textsuperscript{33} conducted a review of literature to assess usage of ecological models over time in health research, focus was on behavior change for physical activity, fruit and vegetable interventions. The search covered a 20-year span for interventions, results suggest the SEM as an increasingly used model for interventions, with more recent interventions targeting multiple ecological spheres. The SEM has received much attention and usage due to its robust implications for interventions.\textsuperscript{33,34}

A review of one journal, \textit{Health Education and Behavior}, for primary interventions over a 20 year timespan, 1989 through 2008,\textsuperscript{35} reported most interventions were nutrition or physical activity related interventions. Many manuscripts described interventions of a person-centered (95\%) or an interpersonal (67\%) nature. One-third of the articles discussed no model or theoretical basis, and less than 10\% of all interventions described utilization of the SEM. More frequently, interventions which targeted multiple and/or outer ecological spheres, were discussed in terms of the SEM. Analyses found no interactions with timespan or ecological target of intervention planned. They concluded health promotion interventions have ignored long standing calls for application of the SEM, and future interventions should target outer spheres of the SEM.\textsuperscript{35}

The Center for Disease Control and Prevention’s (CDC) programming for chronic disease prevention has shifted to an integrated community-based approach that believes characteristics of a healthy community are interdependent.\textsuperscript{28} The CDC’s official Steps Model uses a specific variation of the SEM. The Steps Model recommends widespread Policy, System, and Environment (PSE) Strategies with sustainable implementation.\textsuperscript{28} The SEM has also been adopted by the Healthy People initiative and the Institute of Medicine.\textsuperscript{33} Nutrition education programming provided by United States Department of Agriculture (USDA) funds
is developed within a social-ecological framework and community nutrition education model.\textsuperscript{36}

Theory is implicated to drive intervention development and thus, drive desirable outcomes more so than interventions which do not utilize theory. Available literature suggests theory is not frequently utilized; reviews consistently suggest one-third of interventions use theory. Richard and colleagues\textsuperscript{33} noted much use of the SEM is within the field of nutrition education research, more so than other promotions areas. Golden and Earp\textsuperscript{35} noted lower usage of the SEM in the available literature on health promotion, but more usage in nutrition or physical activity interventions. The literature over the years has had less usage of applied theory for interventions and limited results with regard to usage of theory, measured outcomes and intervention effectiveness. There is a need for intervention strategies to utilize the spectrum of engagement for application of the SEM.\textsuperscript{18}

**Mode of Delivery – Traditional**

As the beginnings of health promotion and nutrition education originated in psychology,\textsuperscript{22} it logically follows that most interventions have been created within the context of person-centered applications. Intervention mode of delivery has been associated with program outcomes, by a review of nutrition articles.\textsuperscript{31} This particular review noted interpersonal contact with a captive audience was significantly related to program outcomes.

A 1991 nationally representative survey reported 8% of Americans were aware of dietary recommendations to consume five servings of fruits and vegetables per day.\textsuperscript{37} The national Five A Day for Better Health campaign launched 1992. In 1997, a nationally representative follow-up survey reported 19.7% knew they should consume Five A Day.
Throughout the program, awareness was gauged yearly, with a steady positive slope, awareness peaked at 39% during the campaign.\textsuperscript{37}

Nutrition education delivered remotely (i.e. news media and billboards) has been evaluated in rural communities.\textsuperscript{38} A two-month community-wide intervention for low-fat milk was compared with an advertising only mass media campaign with one which also utilized educational activities in various settings, including grocery stores, schools, worksites, hospitals and Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinics. Both communities had a significant increase in low-fat milk consumption compared with a control community, collected by pre- and post-telephone surveys. Sales data were also collected from all 21 grocers in the three communities, but no significant shifts were observed for purchasing of milk in either intervention or control communities.\textsuperscript{38}

Interventions for increasing fruit and vegetable consumption were systematically reviewed using the following criterion: 1. healthy community living adult subjects; 2. outcomes measured by dietary intake; 3. minimum of a three-month follow-up, and 4. included a control group.\textsuperscript{39} Forty-four interventions were assessed, most were large scale with a six-month follow-up, and approximately 500 participants. The review suggests the greatest benefit in dietary intake occurred with personal counseling and education in a face-to-face interaction. They also noted technology tailored for participants appears to be a promising alternative. Though only three studies with computer tailored information were reviewed, two had no significant findings to support the tailored information was better than standard. The third study\textsuperscript{40} reviewed by Pomerleau and colleagues\textsuperscript{39} significantly increased fruit consumption by a serving per day, but reported no significant findings for vegetable consumption changes. This study used SCT to guide behavior change with a tailored
computer telephone program which questioned, then provided feedback for behavior change by weekly phone calls over six months.  

**Extension**

The Expanded Food and Nutrition Education Program (EFNEP) provides nutrition education programming for families with low-income, as limited income increases nutritional risk. Extension programming has traditionally been conducted within the context of traditional face-to-face nutrition education, utilizing both one-on-one and group settings. Programs through EFNEP are taught by paraprofessional aides whom are invested in the community and are thus better able to build rapport with clients. The Extension Committee on Organization & Policy (ECOP) has adopted the SEM as the national framework for health and wellness. Extension has implemented a Community Nutrition Education Logic Model which integrates the SEM. The Logic Model explains levels of focus, planning and expected outcomes for enacting change to promote positive behavior changes consistent with the current Dietary Guidelines.

**Mode of Delivery – Technology**

The current environment has changed with increasing technology usage and social media now considered commonplace. Cell phones are owned by 91% of the adult population, with 61% owning a smartphone. Further, 71% of all adults online, 18 years and older, use Facebook. As social media usage increases, new opportunities for reaching the consumer become clear. Nutrition education faces a challenge to continuously stay relevant and engage people within their current environment.
Technology-based nutrition education has received much attention for possible convenience and wide audience reach for many years. Qualitative research of food agencies’ and public organizations’ usage with social media suggests technology is a good communication channel for interactions with the public.\textsuperscript{44} It was cited as a tool for learning about the target audience, and receiving feedback about services. An ability to learn about the audience is key, as the SEM calls for reaching the community and individuals, at multiple ecological spheres of influence.\textsuperscript{22,45} This recommendation lays the foundation and need for continuous adaptation of nutrition education modes utilized.\textsuperscript{18} As the popularity of technology-based nutrition education and consumer messaging rises, importance of evaluating this mode of education becomes more prominent.

A randomized controlled trial compared web-based tailored nutrition education to a control brochure to assess immediate impact of awareness and intentions.\textsuperscript{46} The intervention was delivered and evaluated on the same day to assess immediate awareness. Questionnaires were completed pre- and post-education to assess awareness of dietary intake, which included stages of change and self-efficacy, usefulness of information provided, and a food frequency questionnaire (FFQ). The FFQ was only completed before the intervention, for the purpose of assessing stage of change. The web-based program provided tailored feedback based on the FFQ and stage of change, then the post-questionnaires were administered. Researchers found significant improvements of dietary intake awareness and intentions in the web-based group compared with the control. As awareness is a first step for initiating behavior change; conclusions suggest the tailored web-based program was beneficial by creating immediate awareness.\textsuperscript{46}
In a study of adults with low-income, researchers compared mode of community-based nutrition education. Three equivalent half-hour lessons were provided by either person-centered or web-based mode, each designed with the experiential learning model. Dietary intake was measured pre- and post-education by a validated FFQ. Both groups showed significant improvement from pre- to post-education, but the magnitude of change was not significantly different by group. It was concluded web-based lessons can provide significant dietary improvement, equivalent to traditional person-centered education modes.

In a study comparing modes of nutrition education, Silk and colleagues assessed knowledge and preference for education provided by a pamphlet, website or video game format. Subjects learned significantly less with the game, compared with the pamphlet or website, based on questions selected from the EFNEP evaluation list. No differences were found with knowledge retention after two weeks, but participants enjoyed the website significantly more than the other two modes (as reported on a Likert scale). The researchers did not include an equivalent in-person component for comparison (all three modes were remotely delivered education).

Nutrition education delivered with technology is very heterogeneous in scope. Internet-based interventions, for weight-loss and weight-maintenance with obese adults, suggest tailored feedback with self-monitoring is necessary for best impact, when compared with education only online interventions. Workplace nutrition research has shown effective with computer-tailored education. With the variety of nutrition education in the literature, it is difficult to draw conclusions. However, it appears technology-based interventions are commonly able to match traditional education.
Locations and Context of Nutrition Education

Health promotion audiences and settings have varied greatly due to interests in determining effective health promotion strategies that can achieve widespread reach at multiple ecological spheres. Established venues for nutrition education include: schools, worksites, health care settings, homes, communities, consumer marketplace, and the communications environment. Nutrition education opportunities are still being explored, as our ever-changing, progressive society presents additional venues and contexts.

The SEM identifies applicability of nutrition education in all niches of a community’s ecology, which begins with the outermost sphere at the level policy. Identification of the target audience is necessary to tailor interventions appropriately with regard to socioeconomic status (SES), ethnicity/race, life stage, risk status/disease and so on. Successful interventions of nutrition education involve adapting the environment into a support system for healthy behaviors, which involves change to policies and practices. A review spanning a decade of state level policy changes was conducted to assess nutrition education intervention outcomes. This review suggests implemented policies had the intended impact, as observed decreases in BMI. However, not all audiences were uniformly reached by the state funded interventions and policy changes enacted. Beneficial reductions of overweight and obesity were achieved for those in households with the very lowest annual income, and those from higher level income households. Implemented policies had a gap in reach for those with lower income and lower education levels. This demonstrates a need to further assess and apply the SEM to affect appropriate policy changes which will target these harder to reach audiences.
A study funded by Supplemental Nutrition Assistance Program (SNAP) examined school-based nutrition education with direct and indirect education modes, and with or without social marketing. The intervention conducted two demonstrations per month in the grocery store setting, over seven months, as part of a larger social marketing campaign in a metro county. The demonstrations provided over 10,000 food tastings in the grocery store. Though in a follow-up survey with parents at the school, only 2-3% reported knowledge of the grocery-based portion of the intervention. Results suggest nutrition behaviors can be improved, but consumption at home is most difficult to modify. Recommendations for children include addressing family concerns and barriers to implementation, as well as increasing communication and methods to maximize parental engagement.

Seymour and colleagues reviewed environmental interventions over a 30 year period (1970 – 2003), seeking best practices for implications of policy changes. Search inclusion criterion included environmental interventions with documented behavior change by sales data, dietary assessment and/or physiological data. Thirty-eight interventions were analyzed, with nearly an even split of grocery, restaurants, worksites and universities. While most interventions reported significant outcomes, worksite and university settings were the most promising context for environmental control of the food environment to influence dietary patterns. Environmental changes which impacted the availability and access to healthy options, with less availability of undesirable food choices, was suggested to have most impact to influence dietary behaviors.

Of the various intervention types reviewed by Seymour and colleagues, grocery store interventions were the least effective environmental intervention locale. This conclusion was made because only half of the grocery interventions reviewed reported
significant increases in sales for desired items. Though, it should be noted the literature meeting inclusion criteria for grocery interventions produced older studies, published in the seventies through mid-nineties. The ten grocery-based studies reviewed were all informational in nature at the point-of-purchase (POP), some with additional incentives, media or post-intervention surveys. Only one of the interventions involved engagement of shoppers within the community retail setting. The few studies lasting longer than two years showed most promising results by sales data. Interestingly, the reviewed long-term studies all occurred within one retail chain.\(^5\)

Environmental interventions which change the physical environment appear to indirectly increase desired behaviors by decreasing availability of undesirable food options. Changing availability of less-desirable options is inherently difficult within the retail context. Because individuals do not exist in controlled settings such as worksites and universities indefinitely, it is crucial to examine grocery settings where most will engage in nutrition related health behaviors.

**Retail Grocery Strategies**

The purpose of retail promotions serve within the retail setting are to increase sales of targeted items.\(^5\) In-store marketing at the point-of-purchase (POP) is more persuasive than traditional advertising.\(^5\) Display has been found most the important in-store marketing tool to affect consumer purchasing.\(^5\) End of aisle displays, merchandising displays, and department signage are most frequently noticed.\(^5\) Shoppers under 50 years of age are more likely to notice shelf signage (shelf strips and blades). Research on POP and planned purchasing habits has produced discrepancies in the literature. Industry reports suggest
planned purchases tend to be cost conscious, with 65% of shoppers using a list, but merchandising displays and promotions often influence purchasing. Other researchers estimate suggest 65-80% of purchasing decisions are unplanned and occur at the POP. The grocery industry has likely done additional studies on promotion strategies to increase sales, but this has not been translated for health promotion research.

Researchers in Great Britain have concluded promotions increase sales of calorically dense less-desirable foods more so than of similar promotions for nutrient-dense foods. Hierarchical regression analyzed purchases of 11,000 products from 26,000 households whom documented purchases and receipts for one-year. A nutrient profiling metric determined healthfulness by product barcode. Analyses compared product healthfulness with purchasing by socioeconomic status (SES), which was determined by job classification on government record for the head of household, and not by household income. Subjects with higher SES more frequently purchased more-desirable nutrient-dense foods regardless of promotional sales price. Purchases made by higher SES were also more likely to be promotionally priced, in comparison to lower SES, regardless of the products’ nutritional value. Regular priced less-desirable foods were significantly purchased more frequently by those of lower SES.

A grocery store tool for evaluating POP marketing was tested for effectiveness in large chain stores of the urban U.S. (n=40), where primary shopping is likely. The GroPromo tool checklist included assessment of seven products and nine locations within the store. Displays near the register were most influential, and were associated with purchase of the less-desirable items displayed there. Similarly, Nakamura and colleagues, noted when purchasing from calorically-dense prominent displays, shoppers diverted funds which
resulted in decreased fruit and vegetable purchases. It is possible items may have increased in sales when located near the register due to time spent in proximity, as well as promotions increasing products’ awareness. Alternatively, persons making unplanned purchases may be less likely to plan for eating fruits and vegetables. Additional psychological factors may interplay with decision making as well, getting a “deal” could provide room for compensation by “splurging” on calories.

**Sales Data**

Sales data have been identified as a discreet tool for assessing intervention effectiveness and monitoring nutrition at the population level. However, little published research exists for sales data monitoring at the population level. Sales data are highly sensitive to the retail industry and claimed as proprietary information, which explains few studies reporting sales data. A middle ground must exist within the supply chain to document population level data. In recent years, improvements have been made in the USDA Loss-Adjusted Food Availability calculations. By working with industry partners, at a supply chain midpoint, the USDA has improved abilities to document food availability. With collaborative efforts, perhaps grocery based interventions could gain access to supplier level data by area, prior to the sale.

Some researchers have reported sales data as an effective means of evaluation, for intervention purposes. Interpretation of sales data has been questioned, as well as reliability and validity of sales data. Percentages (units/total sales) have frequently been used for interpretation, in attempt to control for variability with customers and store size. This technique still presents mathematical issues with interpretation, as total sales will have a
substantial impact on portrayal of a promoted item. Utility of direct sales (units) has also been assessed in comparison with proportional sales (sales as a percentage of a group). Proportional sales were shown to provide the most stability, and thus utility for interpretation. A feasibility study to match grocery store food purchasing data with EBT cardholders has been implemented. Proof of concept was demonstrated, however due to the many obstacles experienced, wide-implementation of EBT tracking will likely not occur in the near future. Reported grocery intervention research utilizing sales data has found inconsistent results, likely due to the variability in the form of the data and interpretation. Additional documentation of analytical methodology is necessary to properly utilize sales data as an intervention evaluation tool.

**Food Access and Availability**

As perceived access to healthy foods dwindles there are direct effects on weight, and an indirect effect on healthy eating. Consumption of fruits and vegetables increase with grocery store availability, and diet intake of residents is associated with availability. Distances traveled to food stores are greater in some rural areas which makes food shopping a challenge, without ease of use for public transportation services. Proximity of food store destinations has influence on dietary intakes. A study assessing fresh produce in rural Iowa, using the Nutrition Environment Measures Survey for 20 fruits and vegetables, found less availability and higher prices in smaller communities. Increasing access to grocery stores and promotion of seasonal availability may be a promising approach to combat obesity.
**Consumer Knowledge**

In a U.S. representative cross-sectional survey, it was reported 53% of primary household shoppers regularly viewed the nutrition facts panel. Recent reports have similar findings, American consumers look at the nutrition facts panel (65%) and ingredient list (52%) when making food consumption decisions, by self-report. Generally, those who use the nutrition facts panel more often are: females, persons who are married and those with higher education.

Respondents who reported using the nutrition facts panel were more likely to believe that obesity is due to limited knowledge of healthy body weight maintenance. Importance of nutrition should be a key focus for education efforts, to create motivation for usage of the nutrition facts panel. Assessing consumers’ nutrition literacy is a necessary step to increase value of dietary nutrition for consumers. Appropriately educating consumers to understand the linkage between meal planning and weight maintenance, as well as obesity and chronic conditions, would increase motivation for usage of the nutrition facts panel.

Reported usage of nutrition labeling is high, but actual use during food purchasing may be much lower. Generally lab-based research findings are positive, however, studies in the natural environment do not suggest any changes in calorie intake. Consumers may find product health info difficult, and generally lack understanding of the nutrition label. Consumers who look at the label understand some of the terms, but are confused by other information.

Some consumers prefer directives for choosing foods and others prefer to make nutritional assessments themselves. Directive labeling provides the consumer with aggregated nutrition information, such that the decision has been made for them. Shoppers
from four countries were provided with a variety of nutrition labels (22) to sort into groups, and subjects spoke out loud while sorting to explain how they interpreted and sorted the labels. This lab-based research suggested healthy labeling in the supermarket with directives aided in the consumer purchasing process, but was reserved for thehealthiest of foods. Shoppers also responded to simple messaging better when under time pressure. Generally, consumers in various countries utilize and categorize nutritional labels in similar ways, which suggests possibility of creating a universally friendly nutritional label. A universal nutrition label would maximize utility by combing directive and non-directive information to reach most consumer types.\(^{75}\)

By making the nutrition facts label readily available and user friendly, the physical environment would be conducive to influence health behaviors.\(^{72}\) The proposed changes to the Nutrition Facts label\(^{76}\) should increase consumer usability and understanding of food information/choices. Use of the nutrition facts panel tends to increase with consumer value and skill level to assess nutrition information presented.\(^{70}\) Research suggests those who place importance on nutrition will have a higher diet quality, regardless of SES.\(^{77}\) Other research has shown, self-efficacy and household food inventories had direct effects on dietary behaviors.\(^{64}\)

**Consumer Interest in Retail Nutrition Education**

Only half of shoppers believe their grocery store promotes healthy living, but 72% agree healthy options are available for purchase.\(^{78}\) Over 60% of shoppers’ state they are receptive to programming which would offer suggestions for healthier food choices while shopping. Shoppers report an interest for grocery stores to provide opportunities for taste-
testing healthy recipes. In-store POP product health information may promote food purchasing. The grocery store setting provides a promising venue for promoting canned and frozen options of fruits and vegetables, which have received limited attention in past public health efforts.

**Traditional Grocery Education Mode**

Grocery store nutrition education efforts have reported success for quite some time. Grocery store POP nutrition education has utilized banners, posters, brochures and hosted information tables for customer inquiries. However, the recent rise in obesity and chronic conditions has renewed interest in grocery stores as an intermediary factor.

A post-intervention intercept survey in a large scale grocery study found only 5.8% of shoppers noticed signs, and 3.6% read signs. Unfortunately, the convenience sample selection consisted of only persons whom at the time were purchasing one of the targeted items. This may have provided a skewed view of actual intervention awareness.

An eight-month grocery store intervention was conducted in rural Iowa during the early nineties. The intervention included food demonstrations and flyers with coupons distributed by a researcher dressed in a vegetable costume. A pre- and post-survey to intercept shoppers suggested 36% awareness and usage of the coupons. No significant differences were noted between control and intervention stores for stages of change or dietary intake by food frequency questionnaire (FFQ). Analysis of sales data was planned, but implementation obstacles prevented proper documentation.

Research on POP nutrition education in 2005 suggests interactive education modes with educators and samples can achieve short-term knowledge. Over three-fourths of
participants of the interactive education were able to identify the number of recommended fruit and vegetable servings, compared with 13.7% with brochures. Unfortunately, retention was not achieved; after three months recognition among both groups dropped to 21.6% and 12.9%, respectively.\textsuperscript{83}

Research on nutrient profiling metrics at the POP has shown promising results. Healthy Eating Index scores have been shown to improve (baseline to eight-week follow-up) when shoppers participated in a one-hour intervention group education session for using the Nutrient Rich Foods shelf tags, a grocery store nutrient profiling metric (similar to the locally used NuVal system), at the POP.\textsuperscript{84} In a study assessing immediate change, a ten-minute storefront nutrition intervention about the EatSmart shelf tags was provided by a nutrition educator\textsuperscript{85}. The intervention included information the EatSmart healthful shopping program with sample shopping lists, helpful tips and signage. The intervention was randomized with shoppers receiving nutrition education upon recruitment, and providing grocery receipts when leaving the store. The EatSmart treatment significantly increased purchase of fruit and dark-green/yellow vegetables, compared to the control group. No differences were noted for fat or overall vegetable purchasing with the storefront intervention.\textsuperscript{85}

Grocery interventions have most success when duration is greater than a year, they are accompanied by additional promotional activities, and when they target the absence of unhealthy nutrients (compared with presence of nutrients with health benefits).\textsuperscript{74} Usefulness of product health information to effect sales data has shown inconsistent results. Interventions that reported sole promotion of product health information have generally found mixed results; with some promoted product increased, and other promoted products decreased sales data. When interventions use additional promotional components significant
increases in sales were more frequently reported. Additional components may aid in consumer understanding of health information presented.\textsuperscript{74} Alternatively, additional components may increase product sales simply by drawing additional attention to promoted products.

A review of grocery store interventions which categorized interventions based on study design, effectiveness, reach and availability of evidence (number of studies) found that interventions at the POP with promotion have most evidence of support.\textsuperscript{86} Current nutrition education research within the grocery store relies heavily on formal intervention techniques.\textsuperscript{87} Monetary incentives are frequently used, but only succeed in short-term increased product purchase of a more-desirable product. Additional studies applying short-term interactive interventions are needed to draw conclusions on impact of purchase and intake behaviors.\textsuperscript{87}

**Technology-based Nutrition Education Retail Opportunities**

Nutrition education efforts have been inventive through the years, and though technologies’ saturation of society has been more recent, technology-based education efforts have been documented for some time. A noteworthy early attempted occurred in 1987, with a color touch-screen display setup as a kiosk to interact with shoppers in a story format.\textsuperscript{88} Reach was five percent of the subject pool, mainly 20-35 year olds interacted with the display. The authors concluded the kiosks engaged a hard to reach demographic.\textsuperscript{88} The novelty of touch-screen displays may have influenced interaction with the kiosk in 1987; however this may not have as much of a favorable pull in today’s overstimulated society.
Kiosks, with audio and images, have been used more recently for self-directed interventions. The intervention treatment involved weekly visits to the kiosk, which provided tailored feedback within the grocery store. The kiosks were associated with improved dietary intake, self-efficacy, social and physical outcome expectations.

A recent grocery intervention utilizing technology chose podcasts as the mode of delivery for assessment of immediate. Grocery shoppers listened to a five-minute podcast describing omega-3 foods. The Theory of Reasoned Action guided creation of the podcast and self-efficacy question development, which was measured by two questions gauging consumer confidence and importance on a Likert scale. The convenience sample of consumers significantly increased self-efficacy and perceived importance of purchasing omega-3 foods. Omega-3 purchases were monitored; 30% of participants purchased the day of the podcast. Despite early technology-based grocery store interventions, few are available in the published literature. Most technology-based interventions have chosen different contexts for research, as described above.

**Summary and Implications**

Primary prevention with a life course approach is the best practice for chronic disease prevention and positive health outcomes. However, our population is obesogenic and ridden with chronic conditions. Fortunately, these conditions can be attenuated with dietary and lifestyle modifications. The battle to increase nutrition literacy of a whole population will require inventive, collaborative efforts that will reach and saturate our society. The SEM provides a rich context for guidance of these efforts at the individual, social, physical and macro-level environments.
Many research studies and reviews have assessed effectiveness of POP nutrition education. Most have found inconsistent results, in part due to the widely varying methodologies of interventions implemented and inclusion criterion for reviews. Meta-analysis of the POP literature is not feasible due to the vast range in methodologies. Many research studies have utilized a varying amount of “control” for comparison with experimental treatments. Intervention treatments reporting significant improvement have vastly different implications depending on juxtaposition with a control group of standard nutrition education (with behavior change) or a real control of zero. It is acknowledged that intervention implementation is resource intensive, and various degrees of control treatments would increase said burden. With the above in mind, interpretations of the literature should be taken with caution.

Nutrition education in the supermarket has been ongoing for decades, yet intervention strategies are still under investigation for effectiveness.\(^87,91-93\) Numerous calls to action for various intervention methodologies and research explanations have been inconsistently met. A 2004 review declared the absence of community-based interventions with promotional components, like taste testing.\(^65\) Since then, few studies have examined community-based interventions that provide an interactive nutrition education experience with a taste testing in multiple stores. This is due to inherent difficulties within collaborative research, both with partner agency recruitment and implementation. Pulls from other interests can make collaborative research difficult at times. The importance of communication with collaborative pilot interventions cannot be stressed enough.\(^94\)

The available literature remains inconclusive to an extent. Common themes have emerged from available research to suggest some strategies better than others. Most research
treatments appear additive in nature. Thus, something is better than nothing—generally speaking—applies to nutrition education. Treatments where the environment can be controlled are usually more effective. Environmental controls still require an educational and motivational component. In circumstances of retail, where vast variety of product is intrinsic, education, motivation and self-efficacy are critical for consumer implementation of positive behavior change. Yet, research remains inconclusive for much of the POP research, each with varying merits and weaknesses in methodologies. This is the status quo of nutrition education research; an ongoing quest of science and truth for the purpose of bettering society at large.

There is a need for nutrition education strategies, which have been proven in lab-based settings, to be tested within the natural environment to document ways to achieve sustainable behavior change.\(^9\) Current grocery store education literature/research does not have strong applicability for retail to utilize in practice with a realistic commitment of time, funding and resources. Research is warranted within chain stores to determine implementation strategies for nutrition education during the shopping experience that can be achieved with fewer required resources.\(^9\) Documentation of comparison with traditional and technology-based modes of nutrition education is lacking, and needed in our current environment. In this context, community-based testing with real-world application is necessary to document voluntary consumer engagement, in the absence of compensation and intense researcher engagement. This is necessary to assure health behaviors, and health improvements, can be achieved outside a controlled research context.
CHAPTER 3. METHODS

Introduction

This thesis focuses on two distinct projects which both evaluate nutrition education. The methods for Study 1 will describe implementation of an objective evaluation measure for the Loving Your Family (LYF) program provided by Iowa State University Extension and Outreach. The methods described for Study 2 compare traditional and technology-based education modes in the grocery store context. The Iowa State Fair Food Finder iPhone Application article has been published, and the methods are described within the article (Appendix A).

Study 1—Extension Evaluation

Program background

The LYF program is part of the Iowa State University Food Assistance Nutrition Education program funded through SNAP-Ed. The program delivers lessons through existing family support programs, such as county public health and Community Action Agencies, within the local community. The objective is to improve participants’ dietary intake and increase physical activity relative to recommendations. The LYF program targets families with low-income and children under 10 years of age.

The LYF curriculum (described in Table 1) consists of 10 possible lessons which range from 15 to 45 minutes. To graduate, participants must complete seven of the lessons. Completion timelines vary, as family support workers incorporate LYF within their other roles/duties. This also allows flexibility for the educator to tailor lesson selection for
participant needs and interests. Curriculum includes an interactive and self-teaching format that conveys MyPlate messages, with focus on planning nutrient-dense meals on a budget. The lessons provide parents practical solutions, in a non-judgmental way. This encourages parents to role model recommended behaviors, and in turn promotes improved child nutrition and healthy families.

By utilizing a trusted family support worker, the LYF program can begin with an established relationship. However, because program delivery is by paraprofessional aides, curriculum has been developed as a series of complete, concise, ready-to-go lessons with scripts for educators. Family support staff are taught LYF curriculum using a train-the-trainer model. Group training includes interactive demonstrations of the LYF lessons. The innovation behind LYF program delivery by family support workers has greatly broadened program reach, but makes implementation of intense evaluation tools and training for proper administration of evaluation measures a challenge.

**Evaluation method**

The Block Screener © NutritionQuest, for fruit, vegetable and fiber intake (BSFVF) was selected for evaluation of the LYF curriculum because these are the foods most frequently targeted for positive behavior change. Federal nutrition programming is informed by MyPlate and the Dietary Guidelines. Fruits and vegetables are most often lacking in the American diet, and are good to excellent sources of nutrients lacking in the American diet. Nutrients including dietary fiber, potassium, magnesium, Vitamins C, A, K and folate are targeted for increase; the BSFVF provides estimates of the former four nutrients.

The BSFVF (Figure 1) was implemented within the routine LYF programming. Family support workers attended routine training for delivering the educational program,
which was modified to include training on administration of the BSFVF. This included brief Human Subjects training, per the project receiving exempt status by the Human Subjects Institutional Review Board (Appendix C). To comply with exempt status, a unique random number was used to allow matching of pre- and post-intake data. Participants completed the BSFVF before starting LYF lessons and after finishing. Instructions for completion of the BSFVF ask participants to think about all foods consumed over the last month. Participants self-administered the BSFVF, interpretation of food items included in each of the ten questions was purposefully left to the participant. Frequency is reported as times consumed per week, without discrimination of quantity, six check-boxes range from less than once a week through twice a day or more.

**Analyses of data**

Data entry and analyses was completed using SPSS (Statistical Package for Social Sciences for Windows, version 22.0, 2014). Descriptive statistics were computed for demographic information. BSFVF computational algorithms were revised after initial publication and updated predictive equations were used (T. Block, personal communication, October 11, 2012; nutritionquest.com). Food item frequency was scored for each of the 10 foods, scores from 0 to 5 for each food. A total score was calculated from the BSFVF, which ranges from 0-50, based on frequency of reported consumption. Scores were used in a prediction equation specific for each nutrient, which adjusts for age and sex. Change in food frequency intake and nutrient intakes were analyzed by paired-samples t-tests. Age comparisons were made using two groups (determined by graduate age: mode 26, median 27), those 26 years of age and younger, and those 27 years of age and older. An independent-samples t-test compared mean intake change by age groups. Significance was determined at $P < .05$ for all analyses.
Think about your eating habits over the past month or so. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out.

Check one frequency box for each food.

<table>
<thead>
<tr>
<th>Fruits, Vegetables and Grains</th>
<th>Less than 1 a WEEK</th>
<th>Once a WEEK</th>
<th>2-3 times a WEEK</th>
<th>4-6 times a WEEK</th>
<th>Once a DAY</th>
<th>2+ times a DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice, like orange, apple, grape, fresh, frozen or canned (Not sodas or other drinks)</td>
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<tr>
<td>How often do you eat any fruit, fresh or canned? (Not counting juice)</td>
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<tr>
<td>Vegetable juice, like tomato juice, V-8, carrot</td>
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<tr>
<td>Green salad</td>
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<tr>
<td>Potatoes, any kind, including baked, mashed or French fries</td>
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<tr>
<td>Vegetable soup, or stew with vegetables</td>
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<tr>
<td>Any other vegetables, including string beans, peas, corn, broccoli or any other kind</td>
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<tr>
<td>Fiber cereals like bran, shredded wheat or Fruit-n-Fiber</td>
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<td></td>
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<tr>
<td>Beans such as baked beans, pinto, kidney, or lentils (not green beans)</td>
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<td></td>
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<tr>
<td>Dark bread such as whole wheat or rye</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Extension SNAP-Ed evaluation for Loving Your Family, Block Screener 98
Table 1. Lesson content for Loving Your Family program, provided by Extension with SNAP-Ed funds

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Key Messages</th>
<th>Activities</th>
<th>Behavioral Objectives</th>
</tr>
</thead>
</table>
| Family Meals – Easy, Tasty & Healthy | • Cook & eat together; mealtime is family-time  
• Identify ways for kids to help in the kitchen  
• Parent and child share feeding responsibilities | • Play make a meal – use available ingredients  
• Feeding responsibilities – division between parent and child; parent provides & presents regular meals; child chooses what & how much to eat | • Identify ≥ 2 time or low-cost meal ideas  
• Identify ≥ 2 ways for kids to help  
• Share feeding responsibilities with kids |
| How Much? Food and Physical Activity | • Appropriate amount for each food group, but not too much  
• Importance of food groups for kids  
• Ability to measure foods/portion size  
• Allow multiple attempts for tying new foods  
• Importance of physical activity | • MyPlate meal – recall last 24 hours dietary intake and compare to recommendations  
• How much food – practice portion measurement | • Identify amounts needed by women & kids for each food group  
• Commit to at least one improvement action towards recommendations for both, MyPlate & physical activity |
| Vegetables and Fruits – Simple Solutions | • Families need to eat a variety of fruits and vegetables daily  
• Most families need more dark green & orange vegetables  
• Meals and snacks should focus on fruits and vegetables  
• Kids learn from watching parents eat | • A colorful plate – put colors on a plate to show color of yesterday’s intake  
• Strategize ways to prepare and increase vegetable intake | • Commit to try vegetables and fruits, 2 of each over the week; with 1 as dark green or orange  
• Commit to try an activity which encourages kids to eat fruits and vegetables daily  
• Recognize 1 cup serving of fruits or vegetables |
| Reading Labels | • Food labels help us determine food choices to balance intake | • Reading labels – compare labels of various products to help with selection; i.e. compare several breakfast cereals | • Identify main parts of nutrition facts label |
Table 1. Continued

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Key Messages</th>
<th>Activities</th>
<th>Behavioral Objectives</th>
</tr>
</thead>
</table>
| Make Half Your Grains Whole | • Eating whole grains is importance for health  
• Good source of fiber | • Finding whole grains – review ingredient lists for whole grains as the first ingredient; look for whole or 100% whole | • Identify whole grain foods  
• Plan how to include at each meal |
| Calcium-rich Foods – Build Strong Bones | • Dairy foods are best for calcium; find non-dairy alternatives when appropriate  
• Choose low-fat & non-fat dairy foods | • Milk label detective – identify dairy fat types with names, grams of fat and Calories | • Identify low-fat & non-fat foods which are good sources of calcium  
• Plan how to include in meals and snacks |
| Snacks               | • Choose snacks from each food group for good health  
• Young children have small stomachs, offer meals and snacks regularly | • Snacking by MyPlate – identify foods eaten regularly, and which food groups should be increased; identify ways to increase variety of snack foods | • Choose a variety of snacks from MyPlate; snacks are a great way to increase variety  
• Understand importance to offer snacks to young children |
| Fast Food            | • Choose health by eating less fat, sugar and salt  
• This may help prevent heart disease, diabetes & some cancers | • My fast food meal – review nutrition facts for restaurants of client preference; compare foods usually eaten; visualize grams of fat vs. daily recommendations; select alternatives to try | • Read nutrition facts for fast food & identify high fat foods  
• Choose lower fat foods when eating fast food |
| Food Safety – Keep Food Safe | • Clean, separate, cook and chill are key with food safety  
• Wash hands frequently | • Finding food safety concerns – discuss food safety issues and consequences; identify problems in example kitchen picture | • Keep food safe  
• Wash hands correctly |
| Healthy Pregnancy    | • Talk to healthcare provider for questions  
• Appropriate weight gain and activity is important during pregnancy  
• Variety of foods is important during pregnancy  
• Know which foods & behaviors to avoid | • Stoplight behaviors – review appropriate weight gain & distribution of weight; review pregnancy nutrient needs; identify red, yellow and green behaviors | • Identify behaviors to increase, limit and avoid during pregnancy  
• Choose foods with extra calcium, protein and iron |

*Graduates must complete at least 2 of 3 45-minute and 5 of 7 15-minute lessons; 7 out of 10 offered*
Study 2—Grocery Education Modes

Introduction

The Strategic Initiative intervention was a pilot project using a quasi-experimental design to examine consumer purchasing behavior in response to two different modes of nutrition education, both delivering equivalent information; the traditional grocery store aisle demonstration and technology-based education. A four-month intervention was implemented in six rural stores; three each of traditional and technology-based education modes. Rural stores were selected as rural counties are an underserved area, and thus an at-risk group. Sales data was collected for targeted food items among nine stores including the six intervention and three control stores, which received neither mode of nutrition education. A survey was conducted post-intervention to intercept shoppers at each of the six intervention stores. The survey assessed awareness of the nutrition education, as well as nutrition knowledge and behavior. The project was funded through a grant from the Iowa State University (ISU) Vice President for Extension and Outreach Strategic Initiative.

Development

A collaborative effort between ISU Extension and Outreach and a regionally-based grocery store chain formed in 2012. Store locations for the six intervention and three control stores were identified and recruited by the corporate offices of the grocery chain. The intervention took place January through April 2014 and included eight bi-monthly nutrition education lessons. Lesson topics were identified collaboratively by corporate dietitians of the grocery chain and ISU Extension and Outreach faculty. The post-intervention intercept survey was administered in May 2014.
Procedures/implementation

The ISU Extension and Outreach research team was introduced to store management and dietitians at each of the six intervention stores through corporate communication. A member of the research team contacted individual stores to discuss the project timeline, training and implementation. The research team visited each aisle demonstration store during the fall of 2013 to introduce and provide details of the pilot project. Communication with technology-based stores was primarily by phone and email, as the majority of the technology-based intervention components were online. The research team maintained contact with the point person at each intervention store throughout the project to monitor progress and provide troubleshooting assistance.

Nutrition content

All lessons and recipes highlighted tasteful, convenient, cost-effective, nutrient-dense food. The nutrition education focused on the key messages of MyPlate and the 2010 Dietary Guidelines for Americans (Table 1). Providing nutrition information in terms of nutrients is generally unfamiliar for consumers, which adds hurdles for behavior implementation.99 Intervention recipes strategically included ingredients to increase consumption of the Dietary Guidelines nutrients of concern (dietary fiber, calcium, Vitamin D and potassium). Nutrition information was provided in terms of whole foods, as it is best understood and utilized by the public.99

As poor dietary choices affect health outcomes over time, it is suggested dietary information and consumer directives should be presented as long-term.99 Lessons concentrated on how to purchase, how to prepare and how to eat. Recipes were created or adapted with the goal of the “dump and go” concept, keeping nutrition, convenience, and
budget in mind. Price was promoted by promoting store brands, teaching seasonal shopping and price comparison. This practice is sustainable, rather than incentivizing with coupons that target a specific item and provide a temporary solution.

Social marketing strategies\textsuperscript{55,65} were incorporated into the lessons. Action oriented lesson messages were utilized to promote behavior change (i.e. Make half your grains whole). Taste and ease of the featured recipe were elements to encourage consumer tasting and purchase. These two factors are important,\textsuperscript{54} since taste has been reported to have the biggest impact on food purchasing decisions, and convenience has a large impact for about half of American consumers.\textsuperscript{71}

**Nutrition education modes**

Once lesson content was developed, each lesson was tailored by treatment such that both aisle demonstration and technology-based delivered equivalent nutrition education (Table 2). The nutrition education was developed purposefully to evaluate traditional aisle demonstration and technology-based modes (example protocol and materials for one lesson of both education modes, traditional aisle demonstration and technology, appear in Appendix D and E, respectively). Components of aisle demonstrations previously used by the grocery store chain were enhanced and standardized for nutrition education purposes and facilitate documentation for data collection. Participation in the nutrition education was designed as a brief educational moment, while being minimally invasive to the customer and store, to resemble a normal grocery shopping experience.

**Traditional education**

Stores implementing the traditional treatment advertised and conducted one aisle demonstration over a three-hour period, for each of the eight lessons. Advertising was done
with a free standing poster near the entry of the store and the demonstration cart was strategically located near the featured recipe ingredient. Aisle demonstrations were scheduled during one of two weekly peak volume sales times to maximize visibility. Generally, the aisle demonstrations occurred on Saturday mornings and Thursday/Friday early evenings. This aligns with national data suggesting grocery shopping takes place on Fridays and weekends.100

Prior to the intervention, store dietitians were provided with an aisle demonstration best practices training video and follow-up phone call to address questions and concerns. The dietitians conducted the demonstrations with a lesson plan and talking points. Each lesson included color educational publications and seven of the eight featured a recipe with complimentary sample. The store café coordinated sample preparation from the quantity recipe provided. As an incentive for customers to attend at least five of eight demonstrations, a punch card gained entry into a raffle for a chance to win a $50 grocery gift card. The dietitian recorded the number of engaged customers, samples, and publications distributed at each aisle demonstration.

Technology-based education

The technology-based treatment included brief video-based lessons,101 which highlighted the product, recipe, and key messages. Video-based nutrition messaging is best received when using simple messaging in short segments.101 The video could be accessed through Quick Read (QR) codes posted in the grocery store, grocery store website, and Facebook page. Additional resources available electronically included printable recipe and educational publications for each of the eight lessons. The electronic materials were posted at the corporate level, while individual stores were responsible for advertising within the store
(Table 2). In-store materials included a free standing poster near the store entrance and six shelf tags (moved bi-monthly with the lesson, displaying “Recipes & Tips” messaging/QR code). The shelf tags were posted perpendicular to the shelving unit next to the featured product (for which sales were monitored), as well as next to remaining recipe ingredients.

Stores received email communication with a document including instructional guidelines for implementation and reminders throughout the project.

Technology components were integrated for customer ease and monitoring purposes (Table 3). Upon scanning the QR code with a cell phone, customers were redirected to educational resources on the store website. A unique QR code image was created for each store with the-qrcode-generator.com (free service for creating two-dimensional barcodes, a.k.a. QR code). As the QR codes were permanently embedded, an additional service to redirect was used to accommodate any unforeseen circumstances. Redirects were provided by bitly.com (a free service which provides short attractive URLs to redirect links, subsequently tracking usage for analytics). Posted materials were hosted and monitored by CyBox, an online file storage and sharing system. Vimeo.com hosted videos with a unique link for each video at each store. Each lesson included four Facebook status posts, including video lesson with replay within the Facebook page, recipe pictures with link, and brief key messages. Updates were added at the same time for each store with a pre-determined schedule, dividing the posts among the bi-monthly period to provide uniformity. The corporate grocery office initially updated Facebook, but assumed by the research team at the request of the corporate grocery office due to time constraints. Facebook Page Insights was used for documentation of Facebook activity.
Post-intervention survey

The intercept survey, a brief evaluation of customer awareness and subsequent behavior change, was conducted using Qualtrics (Research Suite 2013; Provo, Utah). Questions assessed: intervention recognition/participation, nutrition knowledge, nutrition behaviors/intentions and demographics (survey available in Appendix F). Specific questions were developed to assess awareness of the intervention. Follow up questions, for consumers recognizing the materials, explored their interaction and engagement with the intervention. Knowledge questions encompassed concepts emphasized by the lessons and additional questions assessed dietary behaviors/intentions. The International Food Information Council Foundation’s 2013 Food and Health survey questions were utilized and/or adapted to facilitate comparison of the intervention subjects to a broader audience, the American population.102

The intercept survey was conducted for a three-hour period at each store, scheduled similarly to the aisle demonstrations during peak sales times to maximize visibility and participation. Surveys were administered on touch-screen tablets; participants had the choice to complete the survey independently or with assistance. Generally, the researcher and customer viewed the tablet simultaneously with the researcher reading questions and selecting answers as provided.

Survey subjects

The subject pool for the intercept survey included adult patrons in each of the six intervention stores in May 2014. A goal of 180 subjects (30 per intervention store) was established by power analysis with a sample size calculator. Subjects were recruited with verbal engagement by a graduate student in nutritional sciences at ISU or the store dietitian.
A reusable shopping bag with ISU logo and/or a food safety thermometer was provided as compensation. Over half of Americans report they would use a thermometer if they were given a free one. Customers were informed of the intervention details by request. The project was determined exempt by the Iowa State University Institutional Review Board (Appendix C).

Sales data

Sales data were documented by the grocery chain for a month timeframe beginning with the start of the bi-monthly promotion. The promotional period sales were compared to the month prior the promotional period and the year prior in same month of the promotional period. As sales data are considered proprietary information, negotiations on the format of sales data continued throughout the project. A confidentiality agreement was attempted to gain access to units sold, but without success. The research team was provided sales as a percentage change of increase or decrease over a previous timeframe.

Data analysis

Intervention data was entered into SPSS (Statistical Package for Social Sciences for Windows, version 22.0, 2014) for aggregation and analysis. Intercept survey data was exported from Qualtrics for upload to SPSS. Descriptive statistics were conducted for preliminary results of intervention engagement and intercept survey frequencies. The Pearson chi square and Mann-Whitney U tests determined possibility of observed distributions occurring by chance. Relationships between variables of multiple part questions were analyzed with hierarchical log-linear model selection. The log-linear model (Appendix G) was fitted to number of respondents in each category which permits the prediction of odds
ratios. Odds ratios were calculated from the model equation to compare the effect of treatment, food component and intentions/outcome. Significance was determined at $P \leq 0.05$.

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Recipe</th>
<th>Key Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison Shopping</td>
<td>Unit pricing</td>
<td>How to calculate unit prices</td>
</tr>
<tr>
<td></td>
<td>(activity for aisles &amp;</td>
<td>How to read a nutrition label</td>
</tr>
<tr>
<td></td>
<td>demonstrated in video)</td>
<td>Proper portion sizes</td>
</tr>
<tr>
<td>Dairy: Get your calcium-rich foods</td>
<td>Fruit and Yogurt Parfait</td>
<td>Eat 3 cups of dairy every day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose low fat (over age 2)</td>
</tr>
<tr>
<td>Beans: Magical growing power</td>
<td>Lentil Tacos</td>
<td>Eat 1.5 cups of beans every week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beans can be a vegetable or a protein</td>
</tr>
<tr>
<td>Seafood: Twice is nice</td>
<td>Salmon Patties</td>
<td>Eat seafood twice a week</td>
</tr>
<tr>
<td>Seafood: Twice is nice</td>
<td>Salmon Patties</td>
<td>Beans can be a vegetable or a protein</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canned fish counts (eating fish can be easy)</td>
</tr>
<tr>
<td>Focus on fruits</td>
<td>Raspberry Mango Spinach</td>
<td>Eat 2 cups of fruit every day</td>
</tr>
<tr>
<td></td>
<td>Smoothie</td>
<td>Focus on whole fruits, which provide fiber (rather than juice)</td>
</tr>
<tr>
<td>Vary your veggies</td>
<td>Squash soup</td>
<td>Eat 3 cups of veggies every day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Season with herbs and spices (skip the salt)</td>
</tr>
<tr>
<td>Find the whole grain</td>
<td>Chicken avocado salad</td>
<td>Look for “whole” as first ingredient</td>
</tr>
<tr>
<td></td>
<td>wrap</td>
<td>Whole Grains Council Stamp</td>
</tr>
<tr>
<td>Make half your grains whole</td>
<td>Quinoa and Arugula Salad</td>
<td>Recognize a 1 ounce equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ounce equivalent visual examples</td>
</tr>
</tbody>
</table>
Table 2. Intervention Implementation by Mode of Education

<table>
<thead>
<tr>
<th>Advertising</th>
<th>Traditional Aisle Demonstration</th>
<th>Technology-Based Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Color Poster a</td>
<td>Demonstration dates/times (i.e. Whole Grains April 10th 4-7pm)</td>
<td>Lesson schedule, announced QR code image (i.e. Whole Grains, April 1-14)</td>
</tr>
<tr>
<td>Other</td>
<td>Demonstration scheduled during peak volume sales for increased visibility</td>
<td>Shelf tags, 6 spread through the store b</td>
</tr>
<tr>
<td>Lesson Format</td>
<td>Registered Dietitian (RD) conducted bi-monthly demonstration over 3-hour period</td>
<td>Posted video of comparable demonstration advertised for bi-monthly lesson period</td>
</tr>
<tr>
<td>Key messages</td>
<td>Taught by RD while providing sample some interactive</td>
<td>Taught in video</td>
</tr>
<tr>
<td>Recipe</td>
<td>Sample of recipe provided</td>
<td>Mobile friendly pdf/printable recipe</td>
</tr>
<tr>
<td>Educational Publications</td>
<td>Provided at demonstration</td>
<td>Posted on grocer’s website</td>
</tr>
</tbody>
</table>

a Displayed at store entry with recipe photos, 22 x 28”; b QR code image with “Recipes & Tips” messaging, 4.25 x 5.5”

Table 3. Monitoring of technology-based materials

<table>
<thead>
<tr>
<th>Technology monitoring methods</th>
<th>Technology monitoring methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR Codes</td>
<td>the-qrcode-generator.com provided number of QR scans</td>
</tr>
<tr>
<td>Grocery store website</td>
<td>Corporate provided counts</td>
</tr>
<tr>
<td>Facebook</td>
<td>Facebook Page Insights documents: Reach, Post Clicks &amp; Comments/Likes/Shares</td>
</tr>
<tr>
<td>Recipes &amp; Handouts</td>
<td>CyBox (file sharing website from box.com) hosted and provided counts for each store</td>
</tr>
<tr>
<td>Videos</td>
<td>Vimeo.com hosted videos, only available via special URL for each store</td>
</tr>
</tbody>
</table>
CHAPTER 4.
EVALUATING NUTRITION EDUCATION PROGRAMS
WITH A DIETARY SCREENER

A paper for submission to The Journal of Extension

Abstract

Nutrition screeners have untapped potential for evaluation of routine SNAP-ED programming, as a tool to measure intake change with low-administration requirements. By providing objective dietary intake data, screeners show impacts toward program goals and can be administered in a few minutes by family support workers, which lessens administrative time, training requirements and costs. This article reports the implementation and outcome measures achieved using the Block Screener for fruits, vegetables and fiber (BSFVF) as a pre- and post-education evaluation tool for the Loving Your Family (LYF) Extension program. Graduate intake significantly increased for fruits, vegetables, fiber, Vitamin C, potassium and magnesium. The BSFVF has implications for use to evaluate routine Extension programming.

Introduction

The evaluation of nutrition education programming is necessary to improve impacts and outcomes, and as a means for documentation of effectiveness (U.S. Department of Agriculture & National Institute of Food and Agriculture, 2015). Cooperative Extension offers multiple nutrition education programs/services of varying intensity for families with
limited resources (U.S. Department of Agriculture & Food and Nutrition Service, 2012). Many differences exist between states with regard to program delivery, administration and evaluation measures (Schneider, 2014).

In Iowa, prominent Extension nutrition programs include the Supplemental Nutrition Assistance Program Education (SNAP-Ed) and Expanded Food and Nutrition Education Program (EFNEP). The Family Nutrition Program (FNP) and Loving Your Family, Feeding Their Future – Iowa (LYF) are both delivered using SNAP-Ed funds. Education intensity varies by program, EFNEP and FNP are delivered by a trained nutrition educator, whereas LYF utilizes a family support worker. The EFNEP and FNP programs consist of at least eight hours of direct nutrition education, whereas the LYF is less than three hours. All programs are delivered as a series of lessons over a few months. The LYF program is provided as a less-intense program, offered only in rural counties where programming is challenging to implement relative to limited staff. Proper evaluation is needed for all programming, as public funds are allocated to serve those in most need.

Accordingly, change in dietary quality among participants is a key evaluation measure, and serves as a determinant for program assessment with most states (Sexton, 2013). Though current SNAP-Ed programming suggests improved dietary quality, there is lack of system-wide evaluation and outcome reporting methods (Schneider, 2014). Developing evaluation measures has been set as a call for action by program leaders of Cooperative Extension. Common indicators are needed to properly document SNAP-Ed programming outcomes, which would allow data aggregation for more accurate national reporting (Schneider, 2014).
There is wide variability of evaluation measures between the EFNEP and SNAP-Ed programs. The 24-hour dietary recall is used by EFNEP and portions of SNAP-Ed programming (Baral, Davis, Serrano, You, & Blake, 2013). This tool’s validity relies on the training of the administrator, and analyses take approximately 30 minutes (Ma et al., 2009). The previous LYF evaluation in Iowa was retrospective, administered only at post-LYF. It consisted of 12 questions on a 4-point Likert scale, which queried behaviors before and after lessons. The delivery model using family support workers is a barrier for LYF program evaluation. There is a need for easy-to-administer validated evaluation tools, which require less administration time/training and offer more flexibility. With improved evaluation measures, LYF can provide better documentation of outcomes. This is important, as the LYF program in Iowa is a low-cost program, when compared with other more intense programs funded by SNAP-Ed and EFNEP.

One easy-to-administer tool is the Block Screener © NutritionQuest, for fruit, vegetable and fiber intake (BSFVF) (Block, Gillespie, Rosenbaum, & Jenson, 2000). The BSFVF is a food frequency questionnaire (FFQ), self-administered in approximately five minutes. This allows for flexibility, as it can be administered by non-professionals and in contexts of one-on-one or group nutrition education lessons. The BSFVF assesses diet history over the past month utilizing ten questions about frequency of foods consumed.

**Objective**

The objective of this project was to implement an easy-to-administer and fast, yet valid and reliable tool for quantifiable, objective evaluation of Extension nutrition education programming. This manuscript reports implementation of the Block Screener for fruits, vegetables and fiber (BSFVF) (Block et al., 2000) for evaluation of the LYF program, funded
by SNAP-Ed. To our knowledge, this is the first report of using a food frequency screener for routine pre- and post-nutrition education evaluation provided with SNAP-Ed funds.

Methods

Program background

The LYF program is part of the Iowa State University Food Assistance Nutrition Education program funded through SNAP-Ed (U.S. Department of Agriculture & Food and Nutrition Service, 2007). The program delivers lessons through existing family support programs, such as county public health and community action agencies, within the local community. The objective is to improve participants’ dietary intake and increase physical activity relative to recommendations (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). The LYF program targets families with low-income and children under ten years of age.

The LYF curriculum (Table 1) consists of ten possible lessons, which range from 15 to 45 minutes (U.S. Department of Agriculture & Food and Nutrition Service, 2007). To graduate, participants must complete seven of the lessons. Completion timelines vary, as family support workers incorporate LYF within their other roles/duties. This also allows flexibility for the educator to tailor lesson selection for participant needs and interests. Curriculum includes an interactive and self-teaching format that conveys MyPlate messages, with focus on planning nutrient-dense meals on a budget. The lessons provide parents practical solutions, in a non-judgmental way. This encourages parents to role model recommended behaviors, and in turn promotes improved child nutrition and healthy families.
By utilizing a trusted family support worker, the LYF program can begin with an established relationship. However, because program delivery is by family support workers, curriculum has been developed as a series of complete, concise, ready-to-go lessons with scripts. Family support staff are taught LYF curriculum using a train-the-trainer model. Group training includes interactive demonstrations of the LYF lessons. The innovation behind LYF program delivery by family support workers has broadened program reach, but makes implementation of intense evaluation tools and training for proper administration of evaluation measures a challenge.

**Evaluation method**

The Dietary Guidelines and My Plate are the fundamental basis for federal nutrition education programming (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). The foods most frequently targeted for positive behavior change are fruits and vegetables, which are good to excellent sources of nutrients lacking in the American diet. Nutrients including dietary fiber, potassium, magnesium, Vitamins C, A, K and folate are targeted for increase (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). The fruit, vegetable, and fiber screener was selected for evaluation of the LYF curriculum, as it provides intake estimates of the former four nutrients.

The BSFVF, as the name implies, was developed as a screener for triage flagging to provide additional nutrition assessment (Block et al., 2000). The BSFVF predicts fruit and vegetable intake well, even though program evaluation was not the intended use. The BSFVF was validated (n=208) against the Block 100-item FFQ, which was previously validated (n=11,658) against the Second National Health and Nutrition Examination Survey (NHANES) 24-hour recall intake data (Block et al., 2000). The seventeen nutrients reported
by NHANES are captured by the 100-FFQ, as the most likely sources in the American diet (Block et al., 1986). The BSFVF has performed well when compared with more recently developed screeners for determination of fruit and vegetable servings (Thompson et al., 2004). The Economic Research Service reviewed available evaluation measures of dietary intake, and compiled recommendations for use with adult SNAP audiences (Hartline-Grafton, Nyman, Briefel, & Cohen, 2004). The BSFVF components appear within this recommended list of questions.

The BSFVF (Figure 1) was implemented within routine LYF programming. Family support workers attended routine training for delivering the educational program, which was modified to include training on administration of the BSFVF. This included brief Human Subjects training, per the project receiving exempt status by the Human Subjects Institutional Review Board. To comply with exempt status, a unique random number was used to allow matching of pre- and post-intake data. Participants completed the BSFVF before starting LYF lessons and after finishing. Instructions for completion of the BSFVF ask participants to think about all foods consumed over the last month. Participants self-administer the BSFVF, interpretation of food items included in each of the ten questions is purposefully left to the participant. Frequency is reported as times consumed per week, without discrimination of quantity, six check-boxes range from less than once a week through twice a day or more.

**Analyses of data**

Data entry and analyses was completed using SPSS (Statistical Package for Social Sciences for Windows, version 22.0, 2014). Descriptive statistics were computed for demographic information. BSFVF computational algorithms were revised after initial publication (Block et al., 2000) and updated predictive equations were used (T. Block,
personal communication, October 11, 2012; nutritionquest.com). Food item frequency was scored for each of the 10 foods, scores from 0 to 5 for each food. A total score was calculated from the BSFVF, which ranges from 0-50, based on frequency of reported consumption. Scores were used in a prediction equation specific for each nutrient, which adjusts for age and sex. Change in food frequency intake and nutrient intakes were analyzed by paired-samples t-tests. Age comparisons were made using two groups (determined by graduate age: mode 26, median 27), those 26 years of age and younger, and those 27 years of age and older. An independent-samples t-test compared mean intake change by age groups. Significance was determined at P < .05 for all analyses.

**Results**

The final sample for this study included participants who began and completed the program in one calendar year. The majority of these participants (n=139) were female, with 61% under 30 years of age (Table 2). Intake of specific food groups included a significant increase in the mean frequency of intake for whole fruits, green salad, whole wheat bread, beans and potatoes (Table 3). Mean change in intake for foods is represented by the frequency reported on the BSFVF (Figure 1). The largest change in mean intake was for fruits (0.40), as reported pre-LYF (2.66) and post-LYF (3.06). This change represents three or four times per week pre-LYF, then five times per week post-LYF (a score of 2 represents 2-3 times per week, and a score of 3 represents 4-6 times per week). While non-significant, intake of vegetable juice, other vegetables, and cereal with fiber also increased. Conversely, intake of fruit juice and vegetable soup decreased. Using the BSFVF predictive equations,
dietary intake of fruits and vegetables, dietary fiber, Vitamin C, potassium and magnesium increased significantly from pre- to post-LYF among graduates (Table 3).

Further analysis by graduate age suggests younger graduates (≤ 26 years) had a significantly greater increase for intake of whole fruit, green salad, and potatoes (Table 4). In fact, LYF graduates under 26 years of age increased fruit and vegetable intake by almost a cup per day. Prediction equations found significantly greater change in dietary intake for fruits and vegetables, dietary fiber, Vitamin C, potassium, and magnesium for the younger graduates. Younger graduates also increased dietary intake of fruit juice, cereal with fiber, whole wheat bread, vegetable juice, beans/legumes, and other vegetables; however, these changes were not significantly different from those 27 years of age and older.

The LYF graduates 27 years and older did not exhibit any significant change in dietary intake for nutrients, nor food groups. Interestingly, while graduates in this age group decreased intake of cereal with fiber, those 26 years and younger decreased intake of vegetable soup – neither being significant.

**Discussion**

“The goal of SNAP-Ed is to improve the likelihood that persons eligible for SNAP will make healthy food and lifestyle choices that prevent obesity” (U.S. Department of Agriculture & Food and Nutrition Service, 2012). Whole grain bread and whole fruit consumption significantly increased and consumption of fruit juice showed a slight decline. Interestingly, consumption of potatoes also significantly increased. Although an increase due to sweet potato intake would be a positive change, this result is unclear as potato type is not distinguished by the BSFVF screener. The LYF curriculum specifically addresses increased
consumption of red/orange vegetables. Finally, the increase in beans/legumes intake observed in the LYF graduate is also noteworthy, this dietary recommendation is difficult for the majority of the population to achieve. The changes in food group intake among the LYF graduates in this study are consistent with goals of the SNAP-Ed program and the LYF curriculum.

The previous retrospective LYF program evaluation provided limited outcome data, such as 90% showed improvement in at least one nutrition practice (FY 2012). The data captured by the BSFVF objectively quantify dietary consumption for graduates pre- and post-LYF. The intake estimates consumption of specific foods and predicts nutrient intake, which serves as one outcome measure of nutrition education. Most importantly, improved dietary intake of fruit, vegetables and whole grains among program graduates align with SNAP-Ed goals of obesity prevention. Appropriate program evaluation, to show impacts which align with program goals, best justifies continued funding.

SNAP-Ed leaders have called for evidenced-based practice and published strategy recommendations (U.S. Department of Agriculture & Food and Nutrition Service, 2014b). Program responses have varied, but available evidence suggests utilization of a FFQ or screener as a routine evaluation measure of SNAP-Ed has not been explored. Other notable brief evaluation measures include various behavior checklists, which have received support from SNAP-Ed (Riesenberg, 2015; U.S. Department of Agriculture & Food and Nutrition Service, 2014b). A few Extension research projects have used screeners for comparison between treatments with program development and/or justification as the goal (Chipman & Litchfield, 2012; Frei, Frei, & Bobe, 2014). A worksite wellness research project with collaboration of Extension successfully documented significant improvements in dietary
intake of participants, with use of the Block Screeners for dietary fat and fruit, vegetable, fiber (Block et al., 2000; Chipman & Litchfield, 2012). A cross-sectional study of elementary school children used the Block Kids Food Screener to justify need of nutrition education within communities, even those with high educational attainment (Frei et al., 2014). A project to describe the development of theory-based programming and evaluation, developed a FFQ as a component of their evaluation, along with other qualitative measures (Brown & Kiernan, 1998). Other research projects have used Block Screeners for comparison of treatments (Baptiste-Roberts, Ghosh, & Nicholson, 2011; Mullan, Allom, Brogan, Kothe, & Todd, 2014; Packard, 2010), though none describe screeners for routine program evaluation.

The BSFVF allows for implementation of objective evaluation within the family support worker delivery model. Impacts identified with the screener suggest the LYF program, now revised and titled MyPlate for My Family (U.S. Department of Agriculture & Food and Nutrition Service, 2014a), is effective at changing dietary intake with use of family support workers (Table 3). The program is a low-cost mode of nutrition education with fewer direct education hours (LYF vs. EFNEP and FNP in Iowa). Use of the BSFVF helps contain program costs because of decreased time for administration (Coulston, Boushey, & Ferruzzi, 2013). The current data support the feasibility of using a brief screener as a tool for evaluation of routine nutrition programming.

**Limitations**

The BSFVF is a brief measure, which intuitively creates limitations by simplifying information. The screener only queries consumption of specific foods and forgoes portion size, whereas a 24-hour recall will account for any food choice and quantity reported.
Although, the BSFVF queries habits over a month, which may provide a better indication of overall intake.

The BSFVF was validated by comparison with NHANES 24-hour recall, and uses the reference serving size as reported by NHANES 24-hour recall protocol (Block et al., 2000). Both tools are limited in accuracy by the participant’s ability to recall intake. While the 24-hour recall is a widely used assessment tool (Coulston et al., 2013), screeners have demonstrated good correlation when ranking fruit and vegetable intake (Yaroch et al., 2012). Therefore, it is recommended screeners are used as a tool for ranking intake; as they are not credible for precise accuracy of portion sizes (Vandevijvere et al., 2013; Yaroch et al., 2012).

Finally, the Iowa LYF program demographics may not be representative of other areas. The majority of LYF participants in this sample were white females, which does not adequately represent the diversity of SNAP-Ed participants elsewhere.

Implications

It is widely agreed that evaluation is an essential component of nutrition education programming. The 24-hour recall is time intensive, and remains the preferred method of assessment for EFNEP and some of SNAP-Ed programing, though alternative measures are available and necessary for alternative program types. The BSFVF is easily administered by a non-nutrition-professional in just a few minutes to provide objective dietary intake data. Screeners have implications to highlight change in participant dietary intake, with routine nutrition programming for pre- and post-education assessment.
Figure 1. Loving Your Family SNAP-Ed Extension program evaluation, administered at pre- and post-education with Block Screener (Block et al., 2000) to document change in graduate intake.
<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Key Messages</th>
<th>Activities</th>
<th>Behavioral Objectives</th>
</tr>
</thead>
</table>
| Family Meals – Easy, Tasty & Healthy | • Cook & eat together; mealtime is family-time  
• Identify ways for kids to help in the kitchen  
• Parent and child share feeding responsibilities | • Play make a meal – use available ingredients  
• Feeding responsibilities – division between parent and child; parent provides & presents regular meals; child chooses what & how much to eat | • Identify ≥ 2 time or low-cost meal ideas  
• Identify ≥ 2 ways for kids to help  
• Share feeding responsibilities with kids |
| How Much? Food and Physical Activity | • Appropriate amount for each food group, but not too much  
• Importance of food groups for kids  
• Ability to measure foods/portion size  
• Allow multiple attempts for tying new foods  
• Importance of physical activity | • MyPlate meal – recall dietary intake for the previous day and compare to recommendations  
• How much food – practice portion measurement | • Identify amounts needed by women & kids for each food group  
• Commit to at least one improvement action towards recommendations for both, MyPlate & physical activity |
| Vegetables and Fruits – Simple Solutions | • Families need to eat a variety of fruits and vegetables daily  
• Most families need more dark green & orange vegetables  
• Meals and snacks should focus on fruits and vegetables  
• Kids learn from watching parents eat | • A colorful plate – put colors on a plate to show color of yesterday’s intake  
• Strategize ways to prepare and increase vegetable intake | • Commit to try vegetables and fruits, 2 of each over the week; with 1 as dark green or orange  
• Commit to try an activity which encourages kids to eat fruits and vegetables daily  
• Recognize 1 cup serving of fruits or vegetables |
| Reading Labels | • Food labels help us determine food choices to balance intake | • Reading labels – compare labels of various products to help with selection; ie. compare several breakfast cereals | • Identify main parts of nutrition facts label |
Table 1. Continued

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Key Messages</th>
<th>Activities</th>
<th>Behavioral Objectives</th>
</tr>
</thead>
</table>
| Make Half Your Grains Whole | • Eating whole grains is importance for health  
• Good source of fiber | • Finding whole grains – review ingredient lists for whole grains as the first ingredient; look for whole or 100% whole | • Identify whole grain foods  
• Plan how to include at each meal |
| Calcium-rich Foods – Build Strong Bones | • Dairy foods are best for calcium; find non-dairy alternatives when appropriate  
• Choose low-fat & non-fat dairy foods | • Milk label detective – identify dairy fat types with names, grams of fat and Calories | • Identify low-fat & non-fat foods which are good sources of calcium  
• Plan how to include in meals and snacks |
| Snacks               | • Choose snacks from each food group for good health  
• Young children have small stomachs, offer meals and snacks regularly | • Snacking by MyPlate – identify foods eaten regularly, and which food groups should be increased; identify ways to increase variety of snack foods | • Choose a variety of snacks from MyPlate; snacks are a great way to increase variety  
• Understand importance to offer snacks to young children |
| Fast Food            | • Choose health by eating less fat, sugar and salt  
• This may help prevent heart disease, diabetes & some cancers | • My fast food meal – review nutrition facts for restaurants of client preference; compare foods usually eaten; visualize grams of fat vs. daily recommendations; select alternatives to try | • Read nutrition facts for fast food & identify high fat foods  
• Choose lower fat foods when eating fast food |
| Food Safety – Keep Food Safe | • Clean, separate, cook and chill are key with food safety  
• Wash hands frequently | • Finding food safety concerns – discuss food safety issues and consequences; identify problems in example kitchen picture | • Keep food safe  
• Wash hands correctly |
| Healthy Pregnancy    | • Talk to healthcare provider for questions  
• Appropriate weight gain and activity is important during pregnancy  
• Variety of foods is important during pregnancy  
• Know which foods & behaviors to avoid | • Stoplight behaviors – review appropriate weight gain & distribution of weight; review pregnancy nutrient needs; identify red, yellow and green behaviors | • Identify behaviors to increase, limit and avoid during pregnancy  
• Choose foods with extra calcium, protein and iron |

* Graduates must complete at least 2 of 3 45-minute and 5 of 7 15-minute lessons; 7 out of 10 offered
Table 2. Participant demographics for Loving Your Family graduates (n=139)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 20</td>
<td>11</td>
<td>7.9</td>
</tr>
<tr>
<td>21-25</td>
<td>40</td>
<td>28.8</td>
</tr>
<tr>
<td>26-30</td>
<td>42</td>
<td>30.2</td>
</tr>
<tr>
<td>31-35</td>
<td>26</td>
<td>18.7</td>
</tr>
<tr>
<td>36-40</td>
<td>15</td>
<td>10.8</td>
</tr>
<tr>
<td>≥ 41</td>
<td>5</td>
<td>3.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>137</td>
<td>98.6</td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Table 3. Dietary intake change from pre- to post-education for Loving Your Family graduates (n=139), reported as mean (± standard error of the mean)

<table>
<thead>
<tr>
<th>Weekly intake frequency a</th>
<th>Pre-LYF</th>
<th>Post-LYF</th>
<th>Mean change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td>2.66 (.14)</td>
<td>2.62 (.12)</td>
<td>-.04</td>
</tr>
<tr>
<td>Fruit, whole</td>
<td>2.66 (.14)</td>
<td>3.06 (.12)</td>
<td>.40 *</td>
</tr>
<tr>
<td>Vegetable juice</td>
<td>.46 (.08)</td>
<td>.62 (.08)</td>
<td>.16</td>
</tr>
<tr>
<td>Green salad</td>
<td>1.47 (.10)</td>
<td>1.84 (.09)</td>
<td>.37 *</td>
</tr>
<tr>
<td>Potatoes, any kind</td>
<td>2.30 (.10)</td>
<td>2.52 (.09)</td>
<td>.22 *</td>
</tr>
<tr>
<td>Vegetable soup</td>
<td>.94 (.09)</td>
<td>.91 (.09)</td>
<td>-.03</td>
</tr>
<tr>
<td>Other vegetables (i.e. string beans)</td>
<td>2.76 (.12)</td>
<td>2.99 (.12)</td>
<td>.23</td>
</tr>
<tr>
<td>Beans, legumes</td>
<td>1.06 (.11)</td>
<td>1.32 (.10)</td>
<td>.25 *</td>
</tr>
<tr>
<td>Cereal with fiber</td>
<td>1.74 (.14)</td>
<td>1.91 (.13)</td>
<td>.17</td>
</tr>
<tr>
<td>Bread, whole wheat</td>
<td>2.09 (.14)</td>
<td>2.43 (.13)</td>
<td>.35 *</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Daily dietary intake (daily goal b)</th>
<th>Pre-LYF</th>
<th>Post-LYF</th>
<th>Mean change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit &amp; vegetable, cups (5)</td>
<td>4.05 (.14)</td>
<td>4.60 (.17)</td>
<td>.56 **</td>
</tr>
<tr>
<td>Total dietary fiber, g (25)</td>
<td>16.8 (.50)</td>
<td>18.51 (.40)</td>
<td>1.69 **</td>
</tr>
<tr>
<td>Vitamin C, mg (75)</td>
<td>135.70 (4.36)</td>
<td>150.45 (3.37)</td>
<td>14.74 **</td>
</tr>
<tr>
<td>Potassium, mg (4700)</td>
<td>3265.97 (75.47)</td>
<td>3519.41 (58.67)</td>
<td>253.44 **</td>
</tr>
<tr>
<td>Magnesium, mg (310)</td>
<td>340.71 (7.612)</td>
<td>366.16 (5.94)</td>
<td>25.45 **</td>
</tr>
</tbody>
</table>

* Food consumption as reported on Block Screener (Block et al., 2000), represented by frequency with 1 as once per week, 2 as two or three times per week, 3 as four to six times per week

* Intake calculated with prediction equations, goal intake for a 26 year old female (mode age for LYF participants), based on Dietary Guidelines (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010); Paired-samples t-test for difference of participant pre- and post-education mean score

* Significant at P < .05

** Significant at P < .0005.
Table 4. Dietary intake change from pre- to post-education by difference of age for Loving Your Family graduates (n=139), reported as mean (± standard error of the mean)

<table>
<thead>
<tr>
<th>Weekly intake frequency a</th>
<th>Mean change ≤ 26 years</th>
<th>Mean change ≥ 27 years</th>
<th>Difference of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice</td>
<td>.35 (.21)</td>
<td>.04 (.16)</td>
<td>.31</td>
</tr>
<tr>
<td>Fruit, whole</td>
<td>.68 (.16)</td>
<td>.17 (.16)</td>
<td>.51 *</td>
</tr>
<tr>
<td>Vegetable juice</td>
<td>.13 (.14)</td>
<td>.18 (.10)</td>
<td>-.06</td>
</tr>
<tr>
<td>Green salad</td>
<td>.64 (.15)</td>
<td>.14 (.11)</td>
<td>.49 *</td>
</tr>
<tr>
<td>Potatoes, any kind</td>
<td>.46 (.16)</td>
<td>.01 (.10)</td>
<td>.45 *</td>
</tr>
<tr>
<td>Vegetable soup</td>
<td>-.10 (.14)</td>
<td>.03 (.14)</td>
<td>-.12</td>
</tr>
<tr>
<td>Other vegetables (i.e. string beans)</td>
<td>.24 (.18)</td>
<td>.22 (.17)</td>
<td>.01</td>
</tr>
<tr>
<td>Beans, legumes</td>
<td>.33 (.14)</td>
<td>.18 (.11)</td>
<td>.15</td>
</tr>
<tr>
<td>Cereal with fiber</td>
<td>.43 (.18)</td>
<td>-.05 (.19)</td>
<td>.48</td>
</tr>
<tr>
<td>Bread, whole wheat</td>
<td>.46 (.20)</td>
<td>.25 (.16)</td>
<td>.21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Daily dietary intake (daily goal) b</th>
<th>Mean change ≤ 26 years</th>
<th>Mean change ≥ 27 years</th>
<th>Difference of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit &amp; vegetable, cups (5)</td>
<td>.89 (.25)</td>
<td>.28 (.19)</td>
<td>.61 *</td>
</tr>
<tr>
<td>Total dietary fiber, g (25)</td>
<td>2.74 (.69)</td>
<td>.82 (.56)</td>
<td>1.92 *</td>
</tr>
<tr>
<td>Vitamin C, mg (75)</td>
<td>23.75 (5.96)</td>
<td>7.28 (4.80)</td>
<td>16.47 *</td>
</tr>
<tr>
<td>Potassium, mg (4700)</td>
<td>411.30 (103.55)</td>
<td>122.58 (83.45)</td>
<td>288.73 *</td>
</tr>
<tr>
<td>Magnesium, mg (310)</td>
<td>41.47 (10.46)</td>
<td>12.17 (8.44)</td>
<td>29.30 *</td>
</tr>
</tbody>
</table>

a Food consumption as reported on Block Screener (Block et al., 2000), represented by frequency with zero being less than once per week and 1 being once per week

b Intake calculated with prediction equations, goal intake for a 26 year old female (mode age for LYF participants), based on Dietary Guidelines (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010); Independent-samples t-test for difference of mean change between age ≤ 26 years and ≥ 27 years

*Significant at P < .05.
References


CHAPTER 5. EVALUATION OF TRADITIONAL AND TECHNOLOGY-BASED GROCERY STORE NUTRITION EDUCATION

A paper for submission to The Journal of Nutrition Education and Behavior

Abstract

Objective: To compare nutrition education modes in the grocery context.

Methods: Quasi-experimental 4-month intervention in rural Iowa stores (n=6). Data collected at aisle demonstrations (AD), with technology-based (TB) implementation, and 1-month-post shopper survey.

Results: Total intervention touch (n=1302); 67% AD. Shopper awareness was the same by survey (n=133), 64% AD and 58% TB (P=.54). Engagement reports significantly differed, 90% AD vs. 13% TB (P<.001). In AD stores, engaged shoppers were 1.6 times as likely to report desired behaviors, compared with those unaware or not engaged.

Conclusions and implications: Both interventions elicited similar shopper awareness. Increased AD participation suggests consumer preference for tangible experience. Active learning and social interaction by AD mode may have dietary behavioral implications. An equivalent TB lesson may not provide an equivalent engagement experience. Despite ubiquitous technology usage, nutrition education modes warrant further research. Interventions may produce higher engagement/intentions with social interaction/experiences, such as AD.
Introduction

Effectiveness of nutrition education is essential to document, given the obesity epidemic and associated chronic conditions. The grocery store setting provides a promising venue for nutrition education. Grocery purchases drive food consumption, and the retail setting inherently offers a variety of more- and less-desirable choices.

Grocery shoppers report receptiveness to suggestions for healthier foods and taste-testing demonstrations. The majority of purchases tend to be planned and cost conscious, with 65% of shoppers using a list; however, merchandising displays and promotions also influence purchases. This creates an opportunity for in-store promotions to influence purchasing behaviors.

Consumers report using the nutrition facts panel (67%) and ingredient list (52%) when making food purchasing decisions. Yet, research suggests consumers may find health information difficult, and generally lack understanding of the nutrition label. Additionally, the grocery store context provides opportunity to challenge consumer perceptions by promoting canned/frozen options of fruits and vegetables, which have received limited attention.

Nutrition education in the supermarket has been ongoing for decades, yet intervention strategies are still under investigation for effectiveness. Incentive-based interventions often document significant sales for promoted items; however, research shows the incentive-based purchasing behavior frequently reverts when the item is full-price. Overall, the literature suggests interventions with multiple components and promotion efforts have most evidence of support at the point-of-purchase.
Technology and social media are now common place with 91% cell phone and 61% smartphone ownership, and 71% of adults online using Facebook. With ubiquitous technology and social media usage, new opportunities emerge for consumer messaging and technology-based nutrition education. These new opportunities necessitate evaluation of these intervention strategies.

Many novel approaches to reach the consumer with technology have been used. Yet, very little research of grocery store interventions with technology are reported. Kiosks have been used for self-directed interventions, where tailored feedback was provided by images/audio. The kiosks were associated with improved dietary intake, self-efficacy, social and physical outcome expectations. Another study engaged shoppers with a five-minute podcast on omega-3 foods; self-efficacy and perceived importance to purchase omega-3 foods increased significantly. Review of the literature has not produced research describing comparison of technology-based and traditional nutrition education modes within the grocery store context.

Currently there are gaps in the literature for grocery store interventions which are realistic, and implementable with reasonable time and resources. The literature also lacks grocery interventions conducted with technology as the mode of education, and none document a comparison with traditional face-to-face education. The current study fills this gap, as well as the need for rigorous community-based interventions, with multiple stores implementing an interactive nutrition experience. Further, it adds to nutrition education evidence for influencing dietary purchases and behaviors.
**Intervention objective**

The goal of this pilot study was to compare two modes of nutrition education in rural grocery stores, within the context of the social-ecological model (SEM). A traditional aisle demonstration (AD) was compared to an equivalent technology-based lesson (TB). Reach, engagement and self-reported health behavior were examined in a community-based environment.

**Methods**

This pilot project used a quasi-experimental design to examine consumer awareness, engagement, knowledge and purchasing relative to two different nutrition education treatment modes (AD and TB), with equivalent information delivered in the grocery store setting. A four-month intervention was implemented in six stores, three each of AD and TB education modes. Rural areas were selected, as these counties are most often underserved. Intervention stores were selected from a list of rural and non-metropolitan counties. Store C (AD) was an exception (in a metropolitan county, with the grocery store located in a town which is considered rural by RUCA); as the originally selected store was unable to participate. One month post-intervention, a survey was conducted at each of the six stores to assess awareness of and engagement with the nutrition education, as well as nutrition knowledge and behavior.

The intervention included eight bi-monthly nutrition education lessons (described in Supplemental Table). Lessons revolved around the key messages of MyPlate and the 2010 Dietary Guidelines for Americans. Each lesson focused on cost-comparison and highlighting one convenient, nutrient-dense recipe. Recipe ingredients promoted the store
brand, with an emphasis on comparison of fresh, frozen and canned. Action-oriented lessons utilized social marketing strategies\textsuperscript{23} to highlight the featured product and corresponding recipe as easy and tasteful to encourage shopper purchase.

**Theoretical foundation**

This project was developed purposefully within the framework of the SEM.\textsuperscript{24,25} Implementation was nested within the spheres of influence described by the SEM, with focus on individual factors, social and physical environments (Table 1).

**Nutrition education modes**

Each lesson was tailored by mode, such that equivalent information was provided to both AD and TB by direct and indirect mode of nutrition education (Table 1). Participation in the nutrition education was designed as a brief (2-3 minute) educational moment with active learning,\textsuperscript{26} while being minimally invasive to the customer and store. Stores which implemented the AD mode, advertised and conducted each of the eight lessons over a three-hour period. Stores implementing the TB mode utilized Quick Read (QR) codes, store website, and Facebook page to engage customers in TB resources including a video lesson, recipe and educational flyers for each of the eight lessons.

The AD was strategically located near an ingredient in the featured recipe. The educator was the store Registered Dietitian (RD), whom recorded the number of customers, samples, publications distributed at each AD. Lessons were scheduled during one of two weekly peak volume sales times to maximize visibility, occurring on Saturday mornings or Thursday/Friday early evenings. National data suggests grocery shopping typically takes place on Fridays and weekends.\textsuperscript{27} Training for RDs included lesson plans, AD best practices video and follow-up phone call.
The TB method included a brief 2-3 minute video lesson highlighting the product, recipe and key messages. The video showed an educator (graduate student) conducting a demonstration, an equivalent lesson in a conversational style. Electronic materials were posted at the corporate level, while individual stores advertised within the store (Table 2). In-store advertising included a free standing poster near the store entrance, six QR code shelf tags for each lesson, posted near the featured product and remaining recipe ingredients. Stores received instructions for implementation, with ongoing communication throughout the project.

The TB components were integrated for customer ease and monitoring purposes (Table 2). A unique QR code for each store redirected customers to educational resources on the store website, including video, recipe, publications and Facebook link. Posted materials were hosted and monitored by Box.com, an online file storage and sharing system. Vimeo.com hosted videos with a unique link for each store. Each lesson included four Facebook status posts, including video replay within the Facebook page, recipe pictures with link, and brief key messages. Updates were added at the same time for each store as scheduled, posts were divided among the bi-monthly period to provide uniformity. Facebook Page Insights documented activity.

**Intercept survey**

One-month after the intervention a brief ten question survey evaluated customer awareness and dietary behaviors. Specific questions were developed to assess awareness of and engagement with the intervention. Follow up questions, to those recognizing the materials, explored engagement with the intervention. Knowledge questions encompassed concepts emphasized by the lessons; commonly targeted dietary behavior changes were
captured by self-report intentions and behaviors. Questions from the Food and Health Survey\textsuperscript{28} were used and/or adapted to facilitate comparison of the intervention subjects to a broader audience.

The subject pool for the intercept survey included all adult patrons entering the six stores, recruitment was by verbal engagement. Scheduling was similar to the ADs, during peak sales times to maximize visibility and participation. A goal of 180 subjects (30 per store) was established by power analysis with a sample size calculator. Surveys were administered on touch-screen tablets using Qualtrics survey software (Research Suite 2013; Provo, Utah). Shoppers had the option to complete the survey independently or with assistance. Compensation was a reusable shopping bag with university logo and/or a food safety thermometer. The project was determined exempt by the University Institutional Review Board.

**Data analysis**

Intervention touch/engagement data was entered into SPSS (Statistical Package for Social Sciences for Windows, version 22.0, 2014) for aggregation and analysis. Intercept survey data was exported from Qualtrics in a SPSS file. Descriptive statistics were conducted for preliminary results of intervention touch and intercept survey frequencies. Pearson $X^2$ and Mann-Whitney U were used to examine observed distributions of categorical data. Relationships between variables of multiple part questions were analyzed with hierarchical log-linear model selection. The model was fitted to number of respondents in each category, which permits predictions. Odds ratios (OR) were calculated\textsuperscript{29} from the model equation to compare the effect of mode, food component and intentions/outcome. Significance was determined at $P<.05$ for all analyses.
Results

Demographics

County demographics, representative of the subject pool, appear in Table 3. The median county age\(^3\) differs between modes, with AD being slightly older. County demographics for both modes suggest approximately 20% residency of age 65 and older.\(^3\)

The shopper intercept survey response rate was approximately 50%. The participation goal was not met, as some rural stores had fewer shoppers available during peak hours. There was a significant difference in age between modes with AD being older (Table 3).

Intervention touch

Data collected during the intervention suggests engagement with the AD mode contributed 67% of total intervention touch (Table 4). Of the TB activity, the majority of activity occurred on Facebook, with few QR code scans (data not shown). An outlier existed with TB Store Y having a higher engagement/reach (n=389); largely due to one manager being very active on Facebook. The most popular lessons were Fruits and How to Identify a Whole Grain.

Shopper survey

Both education modes achieved similar consumer awareness (Table 5; 64% AD, 58% TB). Reach can be calculated with the RE-AIM\(^3\) method, as percentage of persons engaged out of the target audience.\(^1,3\) Intervention reach was 58% AD (46/80) and 21% TB (11/53) shoppers whom were engaged out of the total sample (Table 5). In fact, significantly more engagement was achieved with the AD; more shoppers took a sample (90%) than watched the brief video-lesson (13%; Table 5). Shoppers tended to be more likely to report purchasing
the product when exposed to the AD than TB. Among TB shoppers, 68% reported they did not interact with the QR code because they did not know what it was or did not have a reader (data not shown). Shoppers under 50 years of age were more likely to recognize the QR code shelf tag (data not shown; $X^2=3.8$, $P=.04$).

Responses to knowledge and lesson content questions appear in Table 6, with comparisons of AD vs. TB (left), and further comparison among the AD, those who engaged vs. those who did not (right). Frequencies suggest a higher percentage of AD shoppers provided the desired the response, compared to TB shoppers. Further, among AD shoppers, the desired response was provided more frequently if they had engaged with the lesson. Among TB shoppers, 45% of shoppers reported a fair amount of MyPlate knowledge or more, compared to 59% of AD shoppers. Significantly more knowledge of MyPlate was reported among shoppers who engaged with the AD (70%) than those who did not to engage (44%). The AD shoppers reported significantly more-desirable dietary behaviors (Table 7). Five or more dietary efforts were reported by 83% of AD, compared with 42% of TB shoppers (data not shown; $X^2=14.3$, $P=<.001$). Interestingly, the 42% of TB shoppers reported making five or more dietary efforts, is similar to those who reported a fair knowledge of MyPlate (45%). In contrast, 83% of AD shoppers reported making five or more dietary efforts where just 59% reported a fair knowledge of MyPlate.

Consuming more fruits and vegetables was the most frequently reported dietary effort among all shoppers, regardless of intervention mode. A comparison of AD shoppers by engagement suggests those who engaged with the demonstration were significantly more likely to report comparing sodium content and consuming smaller portions.
Log-linear modeling was used to examine multiple models of dietary behaviors. Models were fitted to the number of respondents in each category for comparison of effects, which permits prediction of OR. A three-factor model (mode, food choice and behavior) showed significant interactions between intervention mode and behaviors, as well as with food items and behavior. For any given food, AD shoppers were 2.8 times as likely to report the desired behavior compared to TB shoppers. Conversely, TB shoppers were 1.2 times as likely to report a lack of dietary effort for any given food item. The OR for the desired outcomes regardless of food item were in favor of AD shoppers reporting the desired behavior, with any selected food being approximately 2 times as likely. A four-factor model, which included age, suggested AD shoppers were 3.5 times as likely to report the desired behavior. AD shoppers consistently had greater odds of reporting the desired behaviors. An additional three-factor model (AD mode engagement or not, food choice and behavior) was fitted to further assess interactions of AD shoppers, comparing their dietary efforts with intervention engagement. Shoppers who engaged with the AD were 1.6 times as likely to report the desired behavior for any given food item.

**Discussion**

The current project achieved 58% and 21% reach in AD and TB stores, respectively. Review of grocery interventions suggest most achieve reach of less than 25% by the RE-AIM method. A SEM-based SNAP-Ed intervention with schools, grocers and billboards reported 50% awareness in the target audience, reach was not reported, though 27% of the audience reported influenced purchases. While AD reach exceeded mentioned norms, the TB was similar to previous reports. It is noteworthy the TB activity occurred mainly within
Facebook, highlighting the importance of modality used. Intervention awareness was not statistically different between modes; however, the significant difference in engagement suggests a shopper preference for the AD mode. This may explained by the SEM, where the AD has greater impact within the individual sphere of influence.

Surveyed shoppers reported recognition of the MyPlate graphic, more so than the American public. Approximately three-quarters of shoppers (74% AD, 81% TB [data not shown]) responded having seen and knowing a lot, having seen and knowing a fair, and having seen and knowing little about the MyPlate graphic. In contrast, 60% U.S. shoppers have indicated recognizing the MyPlate graphic. Further, shoppers in this study reported more MyPlate knowledge than the American public (59% AD, 45% TB vs. 40% U.S.). Finally, AD shoppers exhibited significantly more knowledge of MyPlate if they engaged with the intervention than those who did not. While more shoppers recognized MyPlate in TB than AD, TB responses suggest less knowledge.

Nutrition education using technology in other venues suggests web-based technology can provide significant improvement of dietary behavior, equivalent to traditional modes. The current data suggests the grocery store may not be a venue where TB can rival AD to entice voluntary shopper engagement. The literature suggests interactive interventions including additional promotional activities (i.e. employee interaction and/or samples) have most success. This may provide insight as to why AD shoppers chose to engage significantly more than TB shoppers. Although both modes utilized active learning and equivalent information, the promotion and engagement with the dietitian likely increased engagement by the AD shoppers. The experience provided during the AD may differ, thus influence
outcomes when compared with the video-based lesson; although equivalent in content, the lessons may not be equivalent in the experience.

The current project helps meet a need for community-based testing of nutrition education integrated within the natural environment during the grocery shopping experience. Education modes did not include unrealistic incentives, which typically result in incentive dependent behavior change. For this project, research staff served to provide training and coordination, but the grocery stores implemented both AD and TB interventions. This pilot project demonstrates real-life applicability for large grocery chains and implications for smaller grocers, as it was achieved with minimal resources required by the store. Nutrition educators and grocers should strive to engage shoppers by targeted messaging with interactive food experiences to provide convenient, nutrient-dense, cost-effective recipes that are proven tasteful by recipe sample.

Limitations

Exact engagement is difficult to determine without an intrusive intervention. The data presented assessed usage, collected by the RD documenting interactions and link usage with the TB mode. The RD educators in the AD stores were provided with equivalent training and lesson plans with scripts. Validity testing was not conducted to determine the extent to which the script was followed. Further, as each customer varies, the engagement may vary due to interest, questions, time and so on. The number of engaged AD customers was recorded; however, in this situation it was not realistic to detail the length of conversation or customer interest. Number of video plays (initiated) was documented within the TB mode, but this does not capture if the customer completed watching the 2-3 minute video.
Demographics for this intervention are representative of one rural, Midwest state, which limits ability to generalize to larger areas and other regions. While ERS codes are standardized, differences in race/ethnicity, age and socioeconomic status exist. Although the partner grocer randomly selected stores, demographics varied slightly by county. The TB stores had a lower income demographic, which could influence the likelihood of owning a smart phone, and thus ability to interact with the TB intervention. However, research has documented many low income individuals, particularly younger adults, have a smartphone. In fact, half of all adults under 50 years own a smartphone. Also, shoppers under 50 years of age are more likely to notice shelf signage (shelf strips and blades); a phenomenon also observed among our shoppers. In the current study, the TB stores had a younger demographic (by county and shopper survey) – whom would be more likely to engage technology.

The TB mode may have achieved further reach with different usage or platforms, as technology and social media are a constantly evolving landscape. Multiple networking-sites are used by 42% of online adults, and the top five sites emerged post-2003. At the time of project proposal, QR codes were gaining popularity. Low QR scans with this project may be due to dwindling usage of QR codes in general. The SEM suggests influence is dependent upon interaction within the ecology, which is greatly reliant on modality used. Other platforms which may have increased project participation were discussed, such as posting recipes on Pinterest or the Life in Motion technology. Additionally, marketing of intervention materials was difficult due to the level of marketing already utilized by the grocer, and the current project may not have been “sufficiently distinct from other signage” and advertisements.
Limited shopper participation/observation numbers constrained analysis of the intercept survey and may cloud interpretation. A larger and more diverse sample size would enhance analyses and interpretation. Participation numbers tended to be smaller with TB stores compared to AD stores, and affected ability to control for age on some items. National data suggests women account for 64% of grocery shoppers, which corresponds with our survey demographic. The shopper survey was self-report of behavior efforts, which may be influenced by attempts to provide desirable answers and thus biased.

The collaborative nature of the intervention limited activities to some extent; many activities were discussed, but did not come to fruition. More intense intervention assessment may have been utilized, such as tracking shoppers with rewards programs or use of a food frequency questionnaire. Implementation obstacles prevented analysis of sales data. Calls for analysis of sales data may not always be feasible when working with private industry due to its proprietary nature. Finally, as with all things involving humans, especially collaborative pilot projects, the importance of communication cannot be over stated.

**Implications for research and practice**

Future grocery-based education interventions should further assess comparisons of TB with AD modes of education. Sustained behavior change should be documented, where rewards programs to conduct pre/post-consumption analyses may be feasible. Reasons for non-engagement should be further explored, and addressed. Additional understanding may be achieved with combinations of AD and TB modes to solicit intervention engagement. And, if effects are dosage dependent.

This project found TB modes, such as Facebook, can reach grocery shoppers outside of the grocery setting. Staff investment of time online to provide customer interactions may
increase usage by shoppers. To create an online presence, TB shopper education should be strategic by use of brief and simple messaging, with visually appealing colorful images that are easily accessible.

This pilot project suggests the best way to reach customer during the grocery shopping experience remains with AD interactions. As with all efforts, this education should be strategic. The literature and this project conclude nutrition education benefits are additive in nature, with promotions and engagement relatively proportional. ADs should engage shoppers with sample tasting, and handouts should be brief and appealing. Nutrition educators should provide selective recipes to promote budgeted meal planning, which will meet customer interest, provide nutrition guidance long-term and thus impact sustainable behavior change.

FUNDING

The project was funded through a grant from the Iowa State University (ISU) Vice President for Extension and Outreach Strategic Initiative 2012.
<table>
<thead>
<tr>
<th>Table 1. Intervention Implementation by Mode of Education Relative to Social Ecological Model (SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advertising</strong></td>
</tr>
<tr>
<td>• Demonstration dates/times (i.e. Whole Grains April 10th 4-7pm)</td>
</tr>
<tr>
<td>• Large Color Poster&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>• Intercom messages</td>
</tr>
<tr>
<td><strong>Product</strong></td>
</tr>
<tr>
<td>• Product on display during lesson, extra available for purchase (price noted)</td>
</tr>
<tr>
<td>• Aisle Demonstration (AD)</td>
</tr>
<tr>
<td><strong>Lesson Format</strong></td>
</tr>
<tr>
<td>• Registered Dietitian (RD) conducted bi-monthly demonstration over 3-hour period</td>
</tr>
<tr>
<td>• Answer shopper questions</td>
</tr>
<tr>
<td><strong>Key messages</strong></td>
</tr>
<tr>
<td>• Taught by RD while providing sample</td>
</tr>
<tr>
<td>• Noted on recipe card</td>
</tr>
<tr>
<td><strong>Recipe</strong></td>
</tr>
<tr>
<td>• Sample of recipe provided</td>
</tr>
<tr>
<td>• Printed color photo 4 x 6 card</td>
</tr>
<tr>
<td>• Mobile friendly pdf/printable recipe</td>
</tr>
<tr>
<td>• Highlighted in posted video</td>
</tr>
<tr>
<td>• Facebook post with recipe photo and link</td>
</tr>
</tbody>
</table>

<sup>a</sup> Displayed at store entry with recipe photos, 22 x 28”

<sup>b</sup> QR code image with “Recipes & Tips” messaging, 4.25 x 5.5”
Table 2. Monitoring of technology-based materials

<table>
<thead>
<tr>
<th>Technology monitoring methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR Codes</td>
</tr>
<tr>
<td>the-qrcode-generator.com provided number of QR scans</td>
</tr>
<tr>
<td>• bitly.com provided number of times the QR was scanned then redirected to each store’s site separately</td>
</tr>
<tr>
<td>Grocery store website</td>
</tr>
<tr>
<td>Corporate provided counts</td>
</tr>
<tr>
<td>Facebook</td>
</tr>
<tr>
<td>Facebook Page Insights documents: Reach, Post Clicks &amp; Comments/Likes/Shares</td>
</tr>
<tr>
<td>Recipes &amp; Handouts</td>
</tr>
<tr>
<td>CyBox (file sharing website from box.com) hosted and provided counts for each store</td>
</tr>
<tr>
<td>Videos</td>
</tr>
<tr>
<td>Vimeo.com hosted videos, only available via special URL for each store</td>
</tr>
</tbody>
</table>

Table 3. Demographics of Intervention Counties and Survey Participants

<table>
<thead>
<tr>
<th>County Demographics a</th>
<th>Aisle Demonstration (AD)</th>
<th>Technology Based (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Population</td>
<td>8,010</td>
<td>16,818</td>
</tr>
<tr>
<td>County Age (median years)</td>
<td>42.3</td>
<td>48.4</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>45,997</td>
<td>56,136</td>
</tr>
<tr>
<td>% High School Graduates</td>
<td>86.7</td>
<td>93.3</td>
</tr>
</tbody>
</table>

Survey Participants

<table>
<thead>
<tr>
<th></th>
<th>Aisle Demonstration (AD)</th>
<th>Technology Based (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=19</td>
<td>n=30</td>
</tr>
<tr>
<td>Age b,c (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-34</td>
<td>5</td>
<td>6%</td>
</tr>
<tr>
<td>35-49</td>
<td>17</td>
<td>21%</td>
</tr>
<tr>
<td>50-64</td>
<td>25</td>
<td>31%</td>
</tr>
<tr>
<td>65+</td>
<td>32</td>
<td>41%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>21%</td>
</tr>
<tr>
<td>Female</td>
<td>63</td>
<td>79%</td>
</tr>
<tr>
<td>Total (n=133) b</td>
<td>80</td>
<td>60%</td>
</tr>
</tbody>
</table>

a American Community Survey 5-year Estimates
b Three responded with ‘prefer not to answer’ for age; one aisle, two tech (n=130)
c Significantly different age between AD and TB P<.05, Mann-Whitney U (mean rank=73.75, 52.72), U=1363, Z= -3.2, P=.001.
Table 4. Intervention Touch by Store, Treatment and Lesson

<table>
<thead>
<tr>
<th>Lesson Topics</th>
<th>MyPlate Intro</th>
<th>Lean Protein</th>
<th>Fruits &amp; Veggies</th>
<th>Whole Grains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comparison Shopping</td>
<td>Dairy</td>
<td>Beans</td>
<td>Seafood</td>
</tr>
<tr>
<td>Totals by Store</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aisle (AD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>288</td>
<td>30</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>B</td>
<td>201</td>
<td>35</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>C</td>
<td>386</td>
<td>70</td>
<td>49</td>
<td>37</td>
</tr>
<tr>
<td>Tech (TB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>24</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Y</td>
<td>389</td>
<td>48</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>Z</td>
<td>14</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Totals by Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aisle (AD)</td>
<td>875</td>
<td>135</td>
<td>108</td>
<td>99</td>
</tr>
<tr>
<td>Tech (TB)</td>
<td>427</td>
<td>58</td>
<td>39</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>1302</td>
<td>193</td>
<td>147</td>
<td>131</td>
</tr>
<tr>
<td>Totals by Lesson</td>
<td>(15%)</td>
<td>(11%)</td>
<td>(10%)</td>
<td>(15%)</td>
</tr>
</tbody>
</table>

*Recipe samples provided, except comparison shopping lesson represents verbally engaged shoppers (no sample)*

*QR code scans + Facebook “PostClicks.” Post Clicks – Engagement: The total number of clicks on your posts, not counting Likes, Comments, and Shares. This includes photo views, video plays, link clicks, and other clicks (Facebook. Page Insights: Glossary of Terms. 2013.)*

*Store X data unavailable for Facebook posts of recipes of Dairy, Beans & Seafood (4 posts for each lesson; the 3 other posts for each lesson are available and counted).*
<table>
<thead>
<tr>
<th>Intervention Awareness</th>
<th>Frequency</th>
<th>% Awareness</th>
<th>Frequency</th>
<th>% Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aisle (AD) (n=80)</td>
<td>51</td>
<td>64%</td>
<td>31</td>
<td>58%</td>
</tr>
<tr>
<td>Technology (AD) (n=53)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engagement with Intervention (aisle/technology)</th>
<th>Frequency</th>
<th>% Engagement (n=51)</th>
<th>Unique Frequency (QR, FB)</th>
<th>% Engagement (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample/Video *</td>
<td>46</td>
<td>90%</td>
<td>4 (0, 4)</td>
<td>13%</td>
</tr>
<tr>
<td>Recipe</td>
<td>20</td>
<td>39%</td>
<td>11 (2, 10)</td>
<td>36%</td>
</tr>
<tr>
<td>Purchase Product</td>
<td>11</td>
<td>22%</td>
<td>2 (2, n/a)</td>
<td>7%</td>
</tr>
<tr>
<td>Handout</td>
<td>13</td>
<td>26%</td>
<td>4 (0, 4)</td>
<td>13%</td>
</tr>
</tbody>
</table>

* Survey participants recognized intervention materials by photograph
* Response to follow-up questions, posed to those aware of intervention
* Among 31 unique subjects, 31 recognized QR code in store, 10 of 12 Facebook (FB) followers recognized intervention;
  * Significant at P<.05, X² comparing AD vs. TB.
## Table 6. Lesson Content Questions by Intervention Treatment and Aisle Demonstration Engagement

<table>
<thead>
<tr>
<th>Treatment</th>
<th>$X^2$ p-value</th>
<th>Question and Responses</th>
<th>Stores Receiving Aisle Treatment (AD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aisle (AD) (n=80)</td>
<td></td>
<td></td>
<td>Engaged (n=46)</td>
</tr>
<tr>
<td>Tech (TB) (n=53)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Familiarity: Percent</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59%</td>
<td>45%</td>
<td>.13</td>
<td>I have seen it and know a lot about it</td>
</tr>
<tr>
<td>41%</td>
<td>55%</td>
<td></td>
<td>I have seen it and know a fair amount about it</td>
</tr>
<tr>
<td><strong>Correct: Percent</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49%</td>
<td>43%</td>
<td>.55</td>
<td>Number of units of an item (weight/ounces or pieces)</td>
</tr>
<tr>
<td>51%</td>
<td>57%</td>
<td></td>
<td>Price of the item</td>
</tr>
<tr>
<td><strong>Recognize Slogan: Percent</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41%</td>
<td>30%</td>
<td>.19</td>
<td>Dairy – Get your calcium rich foods</td>
</tr>
<tr>
<td>20%</td>
<td>9%</td>
<td>.10</td>
<td>Beans – Magical growing power</td>
</tr>
<tr>
<td>19%</td>
<td>11%</td>
<td>.25</td>
<td>Seafood - Twice is nice</td>
</tr>
<tr>
<td>34%</td>
<td>26%</td>
<td>.37</td>
<td>Focus on fruits</td>
</tr>
<tr>
<td>26%</td>
<td>23%</td>
<td>.64</td>
<td>Vary your veggies</td>
</tr>
<tr>
<td>35%</td>
<td>19%</td>
<td>.04*</td>
<td>Whole grains: 101</td>
</tr>
</tbody>
</table>

$^a$ Survey respondents unaware of intervention and those reporting they saw aisle treatment materials, but did not engage by choice

$^b$ Responses collapsed for analyses

$^c$ Correct if selected only units and price

*Significant at P<.05
Table 7. Dietary Efforts of Survey Participants by Intervention Treatment and Aisle Demonstration Engagement

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stores Receiving Aisle Treatment (AD)</th>
<th>( \chi^2 ) p-value</th>
<th>Desired Action %</th>
<th>Desired Action %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stores Receiving Aisle Treatment (AD)</td>
<td>Engaged</td>
<td>Not Engaged</td>
<td>Stores Receiving Aisle Treatment (AD)</td>
<td>Engaged</td>
</tr>
<tr>
<td>(n=80)</td>
<td>(n=46)</td>
<td>(n=34)</td>
<td>(n=80)</td>
<td>(n=46)</td>
</tr>
<tr>
<td>Aisle (AD) (n=80)</td>
<td>Tech (TB) (n=53)</td>
<td>( \chi^2 ) p-value</td>
<td>Over the past year, which of the following, if any, have you made an effort to do (select all that apply)?</td>
<td>Aisle (AD) (n=80)</td>
</tr>
<tr>
<td>84</td>
<td>55</td>
<td>&lt;.001</td>
<td>Eat more Fruits and vegetables</td>
<td>87</td>
</tr>
<tr>
<td>60</td>
<td>21</td>
<td>&lt;.001</td>
<td>Foods with whole grains</td>
<td>65</td>
</tr>
<tr>
<td>53</td>
<td>23</td>
<td>.001</td>
<td>Lean protein</td>
<td>59</td>
</tr>
<tr>
<td>54</td>
<td>13</td>
<td>&lt;.001</td>
<td>Seafood</td>
<td>63</td>
</tr>
<tr>
<td>51</td>
<td>34</td>
<td>.04</td>
<td>Balance calories to manage my weight</td>
<td>59</td>
</tr>
<tr>
<td>74</td>
<td>45</td>
<td>.001</td>
<td>Consume smaller portions</td>
<td>85</td>
</tr>
<tr>
<td>73</td>
<td>43</td>
<td>.001</td>
<td>Cut calories by drinking water, low and no calorie beverages</td>
<td>70</td>
</tr>
<tr>
<td>58</td>
<td>32</td>
<td>.004</td>
<td>Compare sodium in foods like soup, bread and frozen meals</td>
<td>67</td>
</tr>
<tr>
<td>66</td>
<td>42</td>
<td>.005</td>
<td>Cut back on Foods higher in salt</td>
<td>67</td>
</tr>
<tr>
<td>51</td>
<td>28</td>
<td>.009</td>
<td>Foods higher in solid fats</td>
<td>59</td>
</tr>
<tr>
<td>70</td>
<td>40</td>
<td>.001</td>
<td>Foods higher in added sugar</td>
<td>74</td>
</tr>
<tr>
<td>58</td>
<td>23</td>
<td>&lt;.001</td>
<td>Full fat dairy and replace with a low- or no- fat alternative</td>
<td>57</td>
</tr>
</tbody>
</table>

*Survey respondents unaware of intervention and those reporting they saw aisle treatment materials, but did not engage by choice

b Test of intervention treatments and those performing the desired action

c Among all surveyed at aisle demonstration stores, test of those engaging/not and those performing the desired action

*Significant at P<.05.
Supplemental Table. Intervention Lessons, Recipes and Key Messages

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Recipe</th>
<th>Key Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison Shopping</td>
<td>Unit pricing</td>
<td>How to calculate unit prices</td>
</tr>
<tr>
<td></td>
<td>(activity for aisles &amp;</td>
<td>How to read a nutrition label</td>
</tr>
<tr>
<td></td>
<td>demonstrated in video)</td>
<td>Proper portion sizes</td>
</tr>
<tr>
<td>Dairy: Get your calcium-rich foods</td>
<td>Fruit and Yogurt Parfait</td>
<td>Eat 3 cups of dairy every day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Choose low fat (over age 2)</td>
</tr>
<tr>
<td>Beans: Magical growing power</td>
<td>Lentil Tacos</td>
<td>Eat 1.5 cups of beans every week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beans can be a vegetable or a protein</td>
</tr>
<tr>
<td>Seafood: Twice is nice</td>
<td>Salmon Patties</td>
<td>Eat seafood twice a week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canned fish counts (eating fish can be easy)</td>
</tr>
<tr>
<td>Focus on fruits</td>
<td>Raspberry Mango Spinach Smoothie</td>
<td>Eat 2 cups of fruit every day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus on whole fruits, which provide fiber (rather than juice)</td>
</tr>
<tr>
<td>Vary your veggies</td>
<td>Squash soup</td>
<td>Eat 3 cups of veggies every day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Season with herbs and spices (skip the salt)</td>
</tr>
<tr>
<td>Find the whole grain</td>
<td>Chicken avocado salad wrap</td>
<td>Look for “whole” as first ingredient</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whole Grains Council Stamp</td>
</tr>
<tr>
<td>Make half your grains whole</td>
<td>Quinoa and Arugula Salad</td>
<td>Recognize a 1 ounce equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ounce equivalent visual examples</td>
</tr>
</tbody>
</table>

References


cognitive intervention for nutrition behavior: Direct and mediated effects on fat, fiber,
fruits, and vegetables, self-efficacy, and outcome expectations among food shoppers.

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CHAPTER 6. SUMMARY AND OVERALL CONCLUSIONS

This thesis evaluates traditional and technology-based nutrition education modes, which were assessed within the framework of the SEM. Various nutrition education efforts are necessary to provide environmental influence. The various ecologies of the SEM coalesce to influence behavior change. Appropriate evaluation measures for nutrition education efforts are needed to document outcomes.

The implemented evaluation measure for the LYF program was easily self-administered and provided objective intake data for participants at pre- and post-LYF education. The BSFVF as a brief evaluation tool increased ability to document the LYF program as successful. Intake data showed a change from pre- to post-LYF with use of paraprofessional educators, and achieved this with less time commitment by the participant and educator. The LYF program is a low-cost mode of nutrition education, as evidenced by the reviewed participant data. With improved evaluation measures, LYF can provide better documentation of outcomes. This is important, as the LYF program is less expensive than other programs funded by SNAP-Ed and EFNEP.

Community-based testing of nutrition education integrated within the natural environment, during the grocery shopping experience, is needed within the current landscape. For this project, research staff served to provide training and coordination, but the grocery stores implemented both AD and TB interventions. This pilot project demonstrates real applicability for large grocery chains and implications for smaller grocers, as it was achieved with minimal resources required by the store. Nutrition educators and grocers should strive to engage shoppers with targeted messaging, which involves interactive
food experiences to provide convenient, nutrient-dense, cost-effective recipes that are proven
tasteful by recipe sample.

The Iowa State Fair Food Finder application was a successful technology-based
education mode. Consumers utilized the iPhone application/mobile website during the Fair,
this allowed the Food Finder to merge within the environment of the Fair by providing
information in an instant. The application/mobile website integrated within the various SEM
ecologies which were present during the Iowa State Fair.

Nutrition education efforts have been ongoing, and will continue, as the knowledge-
base of best practices needs additional research for concrete conclusions and strategies. This
thesis serves to provide additional insight into the various modes of nutrition education in the
current environment. Society and technologies available are ever-changing. Nutrition
education efforts must continually adapt with the ever-changing landscape. The SEM should
be utilized for planning of intervention efforts and evaluation measures.
APPENDIX A. IOWA STATE FAIR FOOD FINDER IPHONE APPLICATION

Article describing just-in-time consumer information provided by an iPhone application.

**GEM No. 542**

**Iowa State Fair Food Finder iPhone Application**

Ruth Litchfield, PhD, RD; Rose Martin, MS, RD; Jennifer Schultz, BA

**INTRODUCTION**

In 2011, Iowa adopted a privately led public initiative called the Healthiest State Initiative. The goal of this initiative is to move Iowa from being the 19th healthiest state to the first by 2016. The Gallup Healthways Well-Being Index is used to rank health status. Iowa consistently ranks low in healthy behavior, which include eating healthy, weekly consumption of vegetables, and weekly exercise frequency. Collaborations were sought to provide Iowans with information to improve these behaviors. One such collaboration was a partnership between Iowa State University (ISU) Extension and Outreach and The Des Moines Register to develop an app related to the well-attended Iowa State Fair.

The Iowa State Fair is frequently ranked as a top event in the country, with approximately 100,000 fairgoers daily and 1,000,000 annually. The fair offers nearly 200 food stands and 60 on-a-stick items. Availability and novelty draw significant attention to over-consumption of calorically dense fair foods. With an estimated 58% of Americans using smartphones, the development of an app with just-in-time information about Iowa State Fair foods seemed an appropriate method to provide nutrition and health education messaging. This GEM describes the partnership between ISU Extension and Outreach and The Des Moines Register in the development and use of the State Fair Food Finder app and mobile website to support the Healthiest State Initiative.

**PROJECT DESCRIPTION**

The State Fair Food Finder homepage was organized by Foods, Vendors, Healthy Fast, and Events. Foods provided a listing of almost 150 fair food items, which could be sorted as all foods, new foods, on-a-stick, and healthy foods. From this listing, a nutrition facts label could be selected for the food in the portion served at the fair. In addition to nutrition information, the nutrition facts label had a link to “How much physical activity to burn it off?” When selected, it redirected users to a calories calculator. Users entered their weight and selected from 40 activities to estimate minutes of physical activity required to expend the consumed calories. Vendors provided an interactive map of fair vendors. A menu of items sold by the vendor appeared when selected. Healthy Fast highlighted healthy foods, healthy events activities promoting physical, emotional, and spiritual health), calories calculator, and an iTunes store link to download a free pedometer app on their phone. Events included a daily listing of all fair events and highlighted healthy events.

Nutrition information on fair foods was gathered by an ISU Food Science and Human Nutrition faculty member and graduate student using a variety of methods. Vendors were contacted to provide recipes. Online searches captured pictures, videos of vendors making products, and blogs covering fair food. Various batters and fried foods were recreated in a cooking laboratory to estimate batter amounts used compared with pictures and videos. From these data estimation methods, portion amounts were projected.

The researchers obtained nutrient content from the US Department of Agriculture National Database and Food Processor (The Food Processor, version 10.12.0, ESHA Research, Salem, OR, 2012). Healthy Fast foods were identified by modifying the Institute of Medicine Nutrition Standards for Foods in Schools and National School Lunch regulations. Calories were adjusted to better reflect general population energy needs and sodium levels were increased to allow inclusion of more fair foods while still remaining well below the Dietary Guidelines for Americans. A total of 23 foods met all of the following criteria for 1 serving (portion provided by vendor):

- < 600 calories for entrées
- < 300 calories for side dishes
- < 35% of calories from total fat
- < 10% of calories from saturated fat
- < 35% of calories from sugar
- < 1,000 mg sodium

**IMPACT AND IMPLICATIONS**

The State Fair Food Finder was well-received and usage increased from the first to the second year. In the first year (2012), there were 516,790 combined app and Web site page views, whereas in the second year (2013), there were 1,241,208 combined app and Web site page views, a 292% increase. Over the 2 years, the app had over 24,000 downloads to iPhones and 1,577,000 app/Web site page views, of which 190,000 page views were of nutrition labels (Table). The Des Moines Register promoted the app and mobile Web site to their statewide readership, paper, and online...
subscribers. Standard press releases were also used to promote the mobile Web site and app, which was free of charge to all users. The statewide promotion and free access likely influenced use of the app and mobile Web site.

Measuring outcomes beyond the reach of an app (downloads and page views) to actual knowledge and/or behavior change requires further consideration. Some research suggests that apps alone are not useful in changing dietary behaviors, but the public interest in using such technology is evident, with over 100,000 mobile health care apps now available, a doubling of the number in just 2.5 years. Technology offers new opportunities for nutrition and health education messaging. Currently, almost half of all food expenditures are for food consumed away from home. Smartphone apps and mobile Web sites can provide just-in-time information with the potential to influence these food choices and, ultimately, health behaviors.

NOTES

The State Fair Food Finder app (Figure) is available for download with iPhones and a mobile Web site for all mobile devices. The Iowa State Fair Food Finder is available at: http://data.desmoineregister.com/foodfinder/. Review by the institutional review board was not required for this study because human subjects were not involved, as per US Department of Health and Human Services guidelines (http://www.hhs.gov/ohrp/policy/checklists/decisioncharts/htm#C1). The authors acknowledge the collaboration and contributions of The Des Moines Register in the development of the Iowa State Fair Food Finder.

REFERENCES


Table. Metrics of State Fair Food Finder App

<table>
<thead>
<tr>
<th></th>
<th>July/August, 2012</th>
<th>July/August, 2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downloads</td>
<td>14,164</td>
<td>9,974</td>
<td>24,138b</td>
</tr>
<tr>
<td>App page views</td>
<td>315,718</td>
<td>990,069</td>
<td>1,305,779</td>
</tr>
<tr>
<td>Mobile Web site views</td>
<td>1,027</td>
<td>251,142</td>
<td>262,169</td>
</tr>
<tr>
<td>App plus Web site views</td>
<td>316,740</td>
<td>1,241,208</td>
<td>1,557,948</td>
</tr>
<tr>
<td>Nutrition label views</td>
<td>86,621</td>
<td>81,664</td>
<td>168,285</td>
</tr>
</tbody>
</table>

*Total downloads since inception (July, 2012 through August, 2013). **241% increase from 2012 to 2013. ***292% increase from 2012 to 2013.


CONFLICT OF INTEREST
The authors have not stated any conflicts of interest.
APPENDIX B. THE SOCIAL-ECOLOGICAL MODEL

A visual depiction of the Social-Ecological Model (SEM). 105
APPENDIX C. INSTITUTIONAL REVIEW BOARD APPROVAL

Loving Your Family Exemption

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Date: 11/12/2012
To: Dr. Ruth Litchfield
1104 HNSB

From: Office for Responsible Research
Title: Loving Your Family Evaluation
IRB ID: 12-547

Study Review Date: 11/8/2012

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (1) Research conducted in established or commonly accepted education settings involving normal education practices, such as:
  - Research on regular and special education instructional strategies; or
  - Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.

- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designee may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

Please be aware that approval from other entities may also be needed. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.
Grocery Store Post-intervention Survey Exemption

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Date: 4/16/2014
To: Dr. Ruth Littlefield
1104 HNSB
CC: Jennifer Fath
1104 HNSB

From: Office for Responsible Research

Title: Strategic Initiative - Hy-Vee Intercept Survey

IRB ID: 14-206

Study Review Date: 4/16/2014

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:
- You do not need to submit an application for annual continuing review.
- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designees may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

Please be aware that approval from other entities may also be needed. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.
APPENDIX D. TRADITIONAL GROCERY EDUCATION MODE

Example protocol and materials for one lesson, tailored for the traditional education mode.

Advertising

Poster displayed at store-entrance

![Make MyPlate Your Plate!]

January 9 | 4-7 P.M.: Comparison Shopping
LEARN HOW TO UNIT PRICE!

January 25 | 9 A.M.-12 P.M.: Fruit & Yogurt Parfait
FEATURING: GREEK YOGURT

February 6 | 4-7 P.M.: Lentil Tacos
FEATURING: LENTILS

February 22 | 9 A.M.-12 P.M.: Salmon Patties
FEATURING: SALMON

March 6 | 4-7 P.M.: Smoothie
FEATURING: FROZEN RASPBERRY, MANGO & SPINACH

March 29 | 9 A.M.-12 P.M.: Squash Soup
FEATURING: CANNED PUMPKIN

April 10 | 4-7 P.M.: Chicken Avocado Salad Wrap
FEATURING: WHOLE WHEAT WRAP

April 26 | 9 A.M.-12 P.M.: Quinoa & Arugula Salad
FEATURING: QUINOA
Lesson Protocol

**Strategic Initiative – Demo 8: Make half your grains whole**

**2nd demonstration (of 2) in April 2014**

**Recipe:** Quinoa & arugula salad

**Product:**
- Full Circle Quinoa Bowl, UPC 2 36800 34270 5
- Full Circle Quinoa 16oz, UPC 0 36800 33691 9

(See attached pictures for reference)

**Class Overview/Objectives:**
Encourage customers to make half their grains whole. Encourage consumption by teaching customers to recognize a serving of grain and how many servings they need.

Less than 5% of American’s consume the recommended amount of whole grains each day (usually 3 oz-eq/day). The consumption of whole grains can reduce the risk of cardiovascular disease and is associated with lower incidence of Type 2 Diabetes and lower body weight.

**Items Needed for Class:**
- Booth/cart/table
- Sample
  - Prep in advance – Quinoa salad (refrigerate at least 2 hours)
    - Large covered dish for quinoa prep and serving
    - Measuring cups and spoons
    - Ingredients
      - Quinoa (cook or use the quinoa bowl)
      - Green onions, chopped
      - Arugula (chopped)
      - Lemon juice
      - Olive oil
      - Pepper and salt to taste
  - Other
    - Gloves (for prep and serving)
    - Napkins
    - 2 oz. serving cups
    - Spoons or forks
    - Trash – a paper bag lined w/ plastic works well
  - Demonstration – display items
    - CD case
    - Baseball
    - Computer mouse
- Bag of rubber bands
- Bowl/plate for putting rubber bands in
- Measuring cups to measure rubber bands

☐ Main ingredients (Quinoa) on display with price
☐ Recipe with $/serving displayed
☐ MyPlate poster with food items written on it
☐ Promotional items to giveaway (make notes as directed below)
  o Sample of quinoa salad
  o Recipe cards
  o Punch cards & hole punch
  o Additional information (flyers)
    ▪ Grains (Spend Smart, Eat Smart PM 2066E)

**Setup/Plan:**
Prepare quinoa salad in advance and refrigerate at least 2 hours. Keep the large covered dish cold (40°F or below) by placing on an ice bath. Share samples and encourage a discussion consuming more grains that are whole.

Display MyPlate poster - this will visually represent our recipe and show how our featured recipe meets MyPlate recommendations. Food groups not represented by our quinoa salad recipe should be highlighted as a food group to eat later as a snack or meal.

Write in the lines as follows on the MyPlate poster:
- Fruits – Pick one to add as a side &/or eat at a later meal
- Grains – Quinoa
- Dairy – Pick one to add as a side &/or eat at a later meal
- Vegetables – Arugula
- Protein – Pick one to add as a side &/or eat at a later meal

**Activities and Procedures/Talking Points:**
- Hold out the Ziploc bag of rubber bands and let customers choose a serving of rubber bands to represent how much pasta or grains they would normally eat. Then let the customer measure/compare to measuring cups for them to see what they actually chose.
- Eat 3 oz-eq of whole grains or half of your grains daily
- How to recognize a 1 oz-eq serving
  o 1 slice of bread = cd case
  o 1 ounce of cereal = ~1 cup = baseball
  o ½ cup cooked pasta or rice = computer mouse
- Quinoa is a great option for a whole grain
  o Substitute for rice or couscous
  o Hot breakfast cereal
- It cooks in 10-15 minutes!
- It is a complete protein with all the essential amino acids
- It has a bitter coating
- Rinse vigorously in a strainer to remove
  - Quinoa is a seed that is considered a whole grain
  - Making your plate look like MyPlate is a great goal for every snack and meal. Look at how the recipe meets MyPlate requirements and where you will want to fill in the blanks with other choices throughout your day.

**Intercom messages:**
Hungry? Do you have trouble staying full after eating? Try eating whole grains to help stay fuller longer. They give your digestive system something to do! Try quinoa, a whole grain between ___ & ___ on ___.

Ever heard of quinoa? It is an ancient seed that counts as whole grain and it’s delicious too! Give quinoa a try between ___ & ___ on ___.

**Recipe Adjusted for Demonstration Purposes:**
Based on serving 100 samples (adjust as necessary)
Sample Size (modify as you see fit): 2oz sample cup near full

**Ingredients needed:**
- 3 cup quinoa, cooked
- 2 bags or clamshells of arugula, (chopped - to fit in the sample cup)
- 1/2 cup lemon juice, bottled
- 1/4 cup and 2 tbsp. olive oil
- 2 bunches green onions, chopped
- 1/4 tsp. salt
- 1/2 tsp. pepper

1. Cook quinoa to package directions. Be sure your quinoa is rinsed prior to cooking (gets rid of bitter taste) by rinsing it for 2 minutes in a strainer.
   - How to cook: Usually it is a 2:1 ratio of water to quinoa. So, 3 cups water to 1.5 cups quinoa. Bring to a boil and then turn down to simmer about 20 minutes. Let cool.
2. Prepare the rest of the recipe while the quinoa cooks & cools
3. Chop arugula & green onions
4. Use a large bowl - add arugula, green onions, lemon juice & olive oil - stir
5. Add quinoa (after cooled) & stir well
6. Chill 2 hours, overnight works too
7. Add salt & pepper

**Product Pictures (for reference only):**
Aisle Demo Worksheet

Store: 

Demonstration: #8 – Whole Grains - Quinoa

Date: 

Time: 

Please complete this form and return to ISU within two weeks of the demo.

During the demonstration, please track the following items. You can track by making tally marks as you go or by counting your starting number & final number (ex: sample cups: start 100 - final 40 = 60 given out).

<table>
<thead>
<tr>
<th>Tally &amp; Total People You Spoke with:</th>
<th>Tally &amp; Total Samples Distributed:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tally &amp; Total ALL other handouts distributed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Punch Cards Signed</td>
</tr>
<tr>
<td>o Recipe cards</td>
</tr>
<tr>
<td>o Whole Grains (ISU Extension Pub FAM12)</td>
</tr>
</tbody>
</table>

Scan this page and email to jennfath@iastate.edu

OR

Mail to:
Jenn Fath
220 MacKay Hall
Iowa State University
Ames, IA  50011-1120

Questions? Contact Jenn by email or 515-294-3011.

Educational Handouts
Handouts for the traditional mode were full-color print.

Recipe card (front)

Recipe card (back)

Raffle-incentive for returning shoppers

Whole grains handout
Grains

Grain products are foods made from wheat, rice, oats, cornmeal, barley, or any other grains. According to MyPlate and the Dietary Guidelines for Americans, children need about 3 to 6 ounces of grains a day; teens and adults need 5 to 8 ounces.

In general, a 1-ounce equivalent is:

1 slice of bread
1 cup of ready-to-eat cereal
1 6-inch tortilla
½ cup of cooked rice, cooked pasta, or cooked cereal

The Dietary Guidelines for Americans recommend half of our servings be whole grains. Whole grains have been shown to reduce the risk of heart disease, cancer, and diabetes. Whole grain foods include all parts of the grain—germ, bran, and endosperm. Refined grains contain just the endosperm.

Spend Smart: strategies for bread

Look for whole grain

Whole grain products may cost a few cents more but the added nutritional value makes them a smart buy. Use these clues to make sure you get the whole grain you pay for.

• Choose products with whole grain listed as the first ingredient: whole wheat, whole rye, whole grain corn, whole oats, oatmeal, brown rice, wild rice.
• Do not be fooled by color. Caramel coloring may be added to give some bread products the appearance of being whole grain.
• Read the Nutrition Facts label. Whole grain products generally have at least 3 grams of fiber per serving.

Be patient and experiment

If your family prefers, or currently eats, refined bread and crackers, start with products that list both whole wheat and unenriched flour.

Consider shopping at a day-old bread store

Check the prices and stock up if you have freezer space. Prices can be at least one-third to one-half less than the grocery store.

Protect your investment — store and use bread wisely

• Store bread you will use soon in an airtight container at room temperature. Freeze the rest in airtight packaging and use within 6 months. Do not refrigerate; this draws moisture out of bread so it becomes stale more quickly.
• Use nearly-stale bread for French toast, stuffing, bread crumbs, or croutons.
Spending Strategically on Grains

**Less than $1.00 per ounce**
- Baking mix: $0.95
- Brown rice: $0.96
- White rice: $0.96
- Store brand popcorn, bag: $0.96
- Store brand oatmeal: $0.96
- Frozen bread dough: $0.97
- Pancake mix: $0.98
- Macaroni: $0.99
- Store brand whole wheat bread: $0.99

**$1.10 to $2.00 per ounce**
- Potori, colored: $1.10
- Saltine: $0.32
- Muffin mix: $1.32
- Instant brown rice: $1.50
- Oatmeal cookie mix: $1.90
- Marshmallow treats: $1.70
- Frozen Texas toast: $1.70
- Store brand wheat crackers: $1.99
- Store brand honey and oat cereal: $2.00

**$2.60 to $3.00 per ounce**
- Fruit and nut cereal: $2.70
- Store brand crackers: $2.70
- Store brand oatmeal, individual packets: $2.70
- Rice cake: $2.77
- Flax seed roll: $2.98
- Brown and serve rolls: $2.98

**More than $3.00 per ounce**
- Name brand wheat crackers: $4.41
- Bakery cookies: $4.42

**Answers:**
1. Whole wheat flour and 100% whole wheat
2. Store brand Honey O's ($1.05)
3. Store brand quick oatmeal ($0.15 per serving)
4. Store brand complete pancake mix
5. Frozen bagels are $0.50 each or $1.18 per ounce

**Visit these websites for more ideas**
- ISU Extension and Outreach
  - Spend Smart Eat Smart: [www.extension.iastate.edu/foodsavings](http://www.extension.iastate.edu/foodsavings)
- ISU AnswerLine: [www.extension.iastate.edu/families/answerline](http://www.extension.iastate.edu/families/answerline) (or, call 1-800-262-3804)
- ISU Extension and Outreach Nutrition and Health: [www.extension.iastate.edu/healthnutrition](http://www.extension.iastate.edu/healthnutrition)
- ISU Extension and Outreach Online Store: [store.extension.iastate.edu](http://store.extension.iastate.edu)
- Choose MyPlate: [http://www.choosemyplate.gov/](http://www.choosemyplate.gov/)

**Ideas**
- Try the store brand. Do a blind taste test to see if your family can really tell the difference. They may be requesting foods because of the advertising or packaging.
- You can cook many hot cereals in a microwave oven for the same amount of money. You can make them yourself and store them in an airtight container. Check package label for microwave cooking directions.
- Prepare rice and noodle side dishes with your own seasonings. Mixes do not save time because the cooking time is the same for homemade and mixes.
- Consider popcorn for a whole grain snack. Compared to other snack foods, it is low in calories, high in fiber, and is a bargain——if you use a hot-air popper or a pan on the stove. A half cup of kernels makes about 8 cups of popcorn.

**Prepared by:** Peggy Martin, MS, RD, state extension specialist. Reviewed by Ruth Loehrke (PhD), RD, LD, extension nutrition specialist.

**PhD 2666-1a, Reprinted July 2013**

[www.extension.iastate.edu/foodsavings](http://www.extension.iastate.edu/foodsavings)
APPENDIX E. TECHNOLOGY-BASED GROCERY EDUCATION MODE

Example protocol and materials for one lesson, tailored for the technology-based education mode. Screenshot images appear as customers would have seen them (on a cell-phone).

Advertising

Poster displayed at store-entrance

![Poster Image]
In-store QR code shelf tag

Facebook (screenshot)

Make half your grains whole and eat at least 3 ounce equivalents of whole grains daily.


Hy-Vee Leon shared a link.

Watch the video to learn how to make half your grains whole.


Grocery store website (screenshot)

Make half your grains whole - Leon

IOWA STATE UNIVERSITY
Extension and Outreach

Make half your grains whole - Leon
Video-based lesson (screenshot)

Strategic Initiative –
Demo 8:  Make half your grains whole

Promotional Period: April 16 - 30, 2014

Products:  
- Full Circle Quinoa Bowl, UPC 2 36800 34270 5
- Full Circle Quinoa 16oz, UPC 0 36800 33691 9
(See attached pictures for reference)

Recipe:  
Quinoa & arugula salad

Handouts:  
Grains (Spend Smart, Eat Smart PM 2066E)

Setup/Plan:  
Promote Full Circle Quinoa as follows:
  - Display QR codes near promotional item (Full Circle Quinoa) and key recipe ingredients as directed below
- Display Iron man sign at the front of the store (near entrance) for the months of January through April 2014
- Add intercom messages to store loop – each should play at least three times per day
- Encourage customers to use the QR code to access the store website & Facebook for the Quinoa Salad recipe and additional information

Questions? Contact Jennifer Fath: jennfath@iastate.edu or 515-294-3011.

Directions—

QR Code:
Post the QR code shelf tags by the featured product & recipe ingredients. Six QR shelf tags should be displayed at all times during the promotional period.
1. Full Circle Quinoa 16oz, UPC 0 36800 33691 9
2. Arugula
3. Lemon Juice
4. Olive oil
5. Bread
6. Canned vegetables

Iron Man Signage:
Keep the iron man signage posted near the entrance in view of customers. Assist (as much as possible) with customers needing assistance in using the technology by offering to help download a QR code reader or watching the videos and so on.

Intercom messages:
Please add messages to the store loop to play April 16 - 30, 2014.

Hungry? Do you have trouble staying full after eating? Try eating whole grains to help stay fuller longer. They give your digestive system something to do! Scan the QR code that is posted around the store and next to the Full Circle Quinoa for a Quinoa and arugula salad recipe.

Ever heard of quinoa? It is an ancient seed that counts as whole grain and it’s delicious too! Scan the QR code that is posted around the store and next to the Full Circle Quinoa for a Quinoa and arugula salad recipe.

Product Pictures (for reference only):
Strategic Initiative –
Demo 8: Make half your grains whole
Promotional Period: April 16 - 30, 2014

Products: Full Circle Quinoa Bowl, UPC 2 36800 34270 5  
Full Circle Quinoa 16oz, UPC 0 36800 33691 9  
(See attached pictures for reference)

Recipe: Quinoa & arugula salad

Handouts: Grains (Spend Smart, Eat Smart PM 2066E)

Setup/Plan:
Promote Full Circle Quinoa as follows:  
- Post items on Hy-Vee website: April 15th  
- Post to Facebook as directed below

Questions? Contact Jennifer Fath: jennfath@iastate.edu or 515-294-3011.

Directions—

Hy-Vee Website:
The following items should appear on the website in the order listed.  
- The video #8 – Make half your grains whole should be embedded in the Hy-Vee website. The video should automatically play when a customer is directed to the website.  
- The #8 – Whole grains handout should be linked below with the link visually displayed as “Learn more about whole grains”.  
- The Quinoa & arugula salad recipe card should be available as a pdf download for customers to print. A thumbnail image of the recipe picture should appear for the customer to see and click on. This should link to a full size pdf image of the recipe card for printing purposes.  
- Link to your store’s Facebook page. The link should be displayed as “share feedback on Facebook about our recipes & tips.”

Facebook:
April 16th  
Post the picture of the Quinoa & arugula salad with a link to the printable Quinoa & arugula salad recipe card pdf (hosted on the store website) on day one of the promotional period.
April 20th
Post the video #8 – Make half your grains whole and link to the Hy-Vee website for additional information.

April 24th
Key nutrition message: “Make half your grains whole and eat at least 3 ounce equivalents of whole grains daily.”
Post as a link back to the Hy-Vee website.

April 28th
Key nutrition message:
“Recognize a 1 ounce equivalent of grains:
- 1 slice of bread = a CD case
- 1 ounce of cereal (1 cup) = a baseball
- ½ cup cooked pasta or rice = a computer mouse”
Post as a link back to the Hy-Vee website.

Product Pictures (for reference only):
Educational Materials

Whole grains handout (screenshot)

Recipe card (screenshot)
APPENDIX F. GROCERY POST-INTERVENTION SURVEY

Survey for Traditional Aisle Demonstration Stores

Note: Each image represents a screen shot on the tablet.

Do you recall seeing food demonstrations with samples in the store over the past few months?

- Yes
- No
Did you (select all that apply):

- Try a sample
- Take a recipe
- Take a handout
- Purchase the highlighted product
- Take a punch card

(Aisle Demonstration Punch Card)

Please write your name and phone number on the back. Return the card to the store display by May 1, 2002.

Do you recognize any of these slogans (select all that apply)?

- Dairy - Get your calcium rich foods
- Beans - Magical growing power
- Seafood - Twice is nice
- Focus on fruits
- Vary your veggies
- Whole grains: 101
How familiar are you, if at all, with the above graphic?

- I have seen it and know a lot about it
- I have seen it and know a fair amount about it
- I have seen it, but know very little about it
- I have never seen it before
- Not sure

What information is needed to determine the unit price (select all that apply)?

- Number of units of an item (weight/ounces or pieces)
- Price of the item
- Number of servings on the nutrition facts panel
- Edible portion of the item
Most people should consume seafood twice a week.

- True
- False

It is always best to consume fruits and vegetables when they are fresh.

- True
- False

Which item in the pair is a whole grain?

**Twisted Elbows**

**Rotini**

- Twisted Elbows
- Rotini

**Twisted Elbows**

**Rotini**
Over the past year, which of the following, if any, have you made an effort to do (select all that apply)?

- Balance calories to manage my weight
- Compare sodium in foods like soup, bread and frozen meals, and choose the foods with lower numbers
- Consume smaller portions
- Cut back on foods higher in added sugar
- Cut back on foods higher in salt
- Cut back on foods higher in solid fats
- Cut back on full fat dairy and replace with a low- or no-fat alternative
- Cut calories by drinking water, low and no calorie beverages
- Eat more fruits and vegetables
- Eat more foods with whole grains
- Eat more lean protein
- Eat more seafood
To what extent do you try to consume or avoid the following? Drag each item in the left column to the appropriate box in the right column.

<table>
<thead>
<tr>
<th>Items</th>
<th>Consume</th>
<th>Avoid</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added sugars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fats/oils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omega-3 fats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturated fats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium/salt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole grains</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Age:
- 18 - 34
- 35 - 49
- 50 - 64
- 65 - 80
- 81+
- Prefer not to answer

Gender:
- Female
- Male
- Other
- Prefer not to answer
Survey for Technology-based Stores

Note: Each image represents a screen shot on the tablet.

Do you recall seeing any QR codes in the store over the last couple of months?

- Yes
- No

>>
Did you scan the QR code?
- Yes
- No

Did you (select all that apply):
- Watch the video
- Look at the recipe
- Purchase the highlighted product
- Look at the handouts

Why?
- Do not know what it is or how to use a QR code
- Do not have a QR code reader
- Too busy
- Not interested
- Other

[Buttons: <<, >>]
Do you follow Hy-Vee on Facebook?
- Yes
- No

Have you seen any of these on the Hy-Vee Facebook page (select all that apply)?
- Nutrition videos
- Nutrition handouts
- Healthy recipes

Do you recognize any of these slogans (select all that apply)?
- Dairy - Get your calcium rich foods
- Beans - Magical growing power
- Seafood - Twice is nice
- Focus on fruits
- Vary your veggies
- Whole grains: 101
How familiar are you, if at all, with the above graphic?

- I have seen it and know a lot about it
- I have seen it and know a fair amount about it
- I have seen it, but know very little about it
- I have never seen it before
- Not sure

What information is needed to determine the unit price (select all that apply)?

- Number of units of an item (weight/ounces or pieces)
- Price of the item
- Number of servings on the nutrition facts panel
- Edible portion of the item
Most people should consume seafood twice a week.

- True
- False

It is always best to consume fruits and vegetables when they are fresh.

- True
- False

Which item in the pair is a whole grain?

**TWISTED ELBOWS**

Made with:
- Spinach
- Broccoli
- Carrots
- Tomato
- Beet
- Shiitake Mushrooms

Net wt: 12 oz (340 g)

Ingredients: Durum wheat semolina (enriched with iron, folic acid) and B vitamins (niacin, thiamin, riboflavin, pantothenic acid), nutrients from whole food concentrates (spinach, broccoli, carrot, tomato, beet, shiitake mushroom), color (paprika oleoresin, fruit juice concentrate [watermelon, hibiscus, turmeric oleoresin], maltodextrin, gum arabic, ascorbic acid).

**ROTONI**

Whole wheat macaroni product

Net wt: 12.25 oz (350 g)

Ingredients: 100% durum whole wheat flour.

Contains: Wheat

**Without added salt in cooking water.**
Over the past year, which of the following, if any, have you made an effort to do (select all that apply)?

- Balance calories to manage my weight
- Compare sodium in foods like soup, bread and frozen meals, and choose the foods with lower numbers
- Consume smaller portions
- Cut back on foods higher in added sugar
- Cut back on foods higher in salt
- Cut back on foods higher in solid fats
- Cut back on full fat dairy and replace with a low- or no-fat alternative
- Cut calories by drinking water, low and no calorie beverages
- Eat more fruits and vegetables
- Eat more foods with whole grains
- Eat more lean protein
- Eat more seafood

To what extent do you try to consume or avoid the following? Drag each item in the left column to the appropriate box in the right column.

<table>
<thead>
<tr>
<th>Items</th>
<th>Consume</th>
<th>Avoid</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Added sugars</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fats/oils</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fiber</td>
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<tr>
<td>Omega-3 fats</td>
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<tr>
<td>Potassium</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Protein</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Saturated fats</td>
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<tr>
<td>Whole grains</td>
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</table>
Shopper Compensation for Survey
APPENDIX G. LOG-LINEAR MODEL FOR SHOPPER DIETARY BEHAVIORS

Estimates of log-linear models to compare the effect of treatment, food component, and customer behavior/intentions as reported in grocery post-intervention shopper survey.

Three-Factor Log-linear Model

<table>
<thead>
<tr>
<th>Effect</th>
<th>Partial Association $\chi^2$</th>
<th>P-value</th>
<th>Degrees of freedom</th>
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</thead>
<tbody>
<tr>
<td>Treatment * Food</td>
<td>6.478</td>
<td>0.840</td>
<td>11</td>
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<tr>
<td>Treatment * Shopper Intentions</td>
<td>140.126</td>
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<td>Food * Shopper Intentions</td>
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<td>66.234</td>
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</tr>
<tr>
<td>Food</td>
<td>0.000</td>
<td>1.000</td>
<td>11</td>
</tr>
<tr>
<td>Shopper Intentions</td>
<td>0.424</td>
<td>0.515</td>
<td>1</td>
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<td>Parameter</td>
<td>Estimate</td>
<td>Z (Estimate &amp; Standard Error)</td>
<td>Significance (P-Value)</td>
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<td>------------------------------------------</td>
<td>----------</td>
<td>--------------------------------</td>
<td>------------------------</td>
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<td>Constant</td>
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<td>-0.166</td>
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<tr>
<td>[Food = Sugar]</td>
<td>-0.393</td>
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<td>0.023</td>
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<tr>
<td>[Food = Portion]</td>
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<td>-2.831</td>
<td>0.005</td>
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<tr>
<td>[Food = Salt]</td>
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<tr>
<td>[Food = Solid Fat]</td>
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<tr>
<td>[Food = Sodium]</td>
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<td>-1.050</td>
<td>0.294</td>
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<tr>
<td>[Food = Balance kcal]</td>
<td>-0.115</td>
<td>-0.718</td>
<td>0.473</td>
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<tr>
<td>[Food = Eat F/V]</td>
<td>-0.808</td>
<td>-4.087</td>
<td>0.000</td>
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<td>[Food = Drink Water]</td>
<td>-0.468</td>
<td>-2.644</td>
<td>0.008</td>
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<tr>
<td>[Food = Whole Grain]</td>
<td>-0.115</td>
<td>-0.718</td>
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<tr>
<td>[Food = Full Fat Dairy]</td>
<td>-0.101</td>
<td>-0.636</td>
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<td>[Food = Lean Protein]</td>
<td>-0.049</td>
<td>-0.314</td>
<td>0.753</td>
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<tr>
<td>[Outcome = Desired]</td>
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<td>[Treatment = Aisle] * [Outcome = Desired]</td>
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<td>11.275</td>
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<td>[Food = Sugar] * [Outcome = Desired]</td>
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<td>3.291</td>
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<tr>
<td>[Food = Salt] * [Outcome = Desired]</td>
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<td>3.052</td>
<td>0.002</td>
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<tr>
<td>[Food = Solid Fat] * [Outcome = Desired]</td>
<td>0.188</td>
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<tr>
<td>[Food = Sodium] * [Outcome = Desired]</td>
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<td>1.610</td>
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<tr>
<td>[Food = Balance kcal] * [Outcome = Desired]</td>
<td>0.280</td>
<td>1.121</td>
<td>0.262</td>
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<td>1.460</td>
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<td>[Food = Drink Water] * [Outcome = Desired]</td>
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<td>[Food = Whole Grain] * [Outcome = Desired]</td>
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<td>1.121</td>
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<tr>
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<td>0.126</td>
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### Four-Factor Log-linear Model

**Table 3. Partial Associations for Intervention Treatment, Food and Customer Intention Variables**

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<tr>
<th>Effect</th>
<th>Partial Association $\chi^2$</th>
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REFERENCES


