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Behavioral Economics in the School Lunchroom: Can it Affect Food Supplier Decisions? A Systematic Review

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Abstract

A systematic review was conducted to provide a comprehensive overview on the emerging success of applying behavioral economics tools to promote healthy food choice decisions in school lunchrooms. This paper summarizes the current knowledge on the topic and facilitates meeting the recommendations of the White House Task Force on Obesity, and the Institute of Medicine (IOM). Further, the paper contributes to the White House Task Force's appeal on comprehensive research that target both consumers and producers. It extends the literature to assess evidence if food supplier decisions have been affected. This review suggests that there is an emerging best practice in applying choice architecture and nudging in school lunchroom that improves food choice. However, this information does not appear to have been utilized extensively in food supplier decisions. There is a need for research to include food supplier decisions in promoting healthy food choice.

Keywords: childhood obesity, food supply, National School Lunch Program, nudging, systematic review, lunchroom, choice architecture

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Introduction

There is a pressing and growing interest in addressing childhood obesity in the school lunchroom setting. The CDC reports more than one third of children and adolescents were overweight or obese (CDC 2010). Researchers have also observed that obese children are more likely to be obese adults (CDC 2010; Serdula et al. 1993, and Garn and LaVelle 1985). Clearly, children should be considered a priority population for obesity prevention strategies (Dehghan et al. 2005). As part of the response to this, the National School Lunch Program (NSLP) as directed by United States Department of Agriculture (USDA) in The Healthy, Hunger-Free Kids Act of 2010 seeks to ensure that meal patterns and nutrition standards be updated based on the latest Dietary Guidelines for Americans (FNS 2012); this legislation guarantees the increased availability of fruits, vegetables, and whole grains in the school menu. However, the USDA has reported very high "plate waste" and students "turning up their noses" at fruits and vegetables (Ralston et al. 2008). Healthy foods, such as fruits and vegetables, are often not chosen by children and frequently not eaten even when served.

The NSLP faces a trio of challenges: 1) increasing the healthfulness of food served in school lunchrooms, 2) staying financially solvent (Just and Wansink 2009, Ralston et al. 2008), and 3) competing with "competitive foods." The term "competitive foods" refers to all foods and beverages available or sold in schools with the exception of items served through the NSLP that compete with the NSLP meal for student purchases (Guthrie and Newman 2012). Several researchers like Bhatia et al. (2011), Fox et al. (2005), Snelling et al. (2007), and Story et al. (2009) have reported that the availability of "competitive foods" is associated with a high caloric intake among children. A question in the area of obesity prevention is if the competitive food producers can instead start supplying healthy foods to better address the Healthy, Hunger-Free Kids Act of 2010. Is there sufficient legislative push and demand pull to create a new demand channel for healthy food options? A push in this direction is contained in the "Smart Snack in School" nutrition standards announcement for competitive foods in a USDA[1] news release.

Within these challenges, increasing demand for healthy food by changing food behavior is possible and researchers have shown promising results (Aldridge et al. 2009 and Esposito et al. 2009). Success has been reported in applying behavioral economics to increase healthy food choice and consumption in school lunchrooms at low cost. Tools of behavioral economics like nudging and choice architecture can be low cost and provide distraction while preserving self-attribution. Self-attribution is when people feel that they have made their own decisions. Self-attribution has been recorded to provide greater satisfaction to the consumer (Just and Wansink 2009) and distraction as an external cue is reported to have a major effect on the food selected, the amount consumed and the eater's perception (Just et al. 2007). Choice architecture and nudging (where-in choices are affected without letting the decision makers know that their decisions have been influenced) has been shown to work with children (Hanks et al. 2012a; Just et al. 2007; Just and Wansink 2009; Roberto et al. 2010; Van Kleef et al. 2013 and Wansink et al. 2012 a,b). For example, Roberto et al. (2010) showed that children significantly preferred the taste of foods that had popular cartoon characters on the packaging compared with the same food without characters.

[1] USDA Release No. 0134.13

This suggests that the application of behavioral economics' tools such as choice architecture and nudging in school lunchroom have shown very positive results in promoting healthy food choice decision. However, the literature also suggests that it has not received the attention it should have; considering its potential to instill healthy food habits in children and its' overall potential to reduce childhood obesity. The increased consumption of fruits and vegetables in school lunchrooms may have a dual impact by first, preventing childhood obesity and second, by benefiting local fruits and vegetable producers and other lunchroom stakeholders like the local agribusiness entrepreneurs and lunchroom food suppliers. Despite promising results of ingenious yet subtle and low cost choice architecture modification, no reviews have been conducted on the effectiveness of specifically applying choice architecture in school lunchroom setting. No paper was found to consider nudging intervention in school lunchrooms in a comprehensive manner to include both consumers and producers. Related reviews in the area are: Skov et al. (2012),Thomson and Ravia (2011), Hernández-Garbanzo et al. (2013), Delgado-Noguera et al. (2011), and Khambalia et al. (2012).

This paper will report on the findings of applying choice architecture and nudging in school lunchrooms, and analyze the findings to see if food supplier decisions have been affected. An important contribution of this paper will be to consider whether businesses that supply foods to school lunchrooms have responded to nutrition improvement efforts by changing their products. A systematic review will be used to find research that have applied choice architecture and nudging to promote healthy food choice decision. As a second step, the results of the systematic review will be analyzed to identify if any alteration in food supplier decisions have been reported as a result of nudging and choice architecture intervention in school lunchroom. This research paper will provide a comprehensive overview of the emerging success of applying choice architecture and nudging in school lunchrooms with attention to school lunchroom food suppliers.

Methodology

Search Strategy

A systematic review was carried out in two steps: 1) a primary search to establish appropriate search terms, and 2) a systematic search in six relevant electronic databases: PubMed/Medline, Embase, PsychInfo and Cochrane Review, Web of Science, and Google Scholar. The search was conducted in three stages: the first two stages search were done in March 2013 and June 2013 for the search terms 'nudge(ing)' 'lunchroom' and 'choice architecture' 'lunchroom'. The search was revised in November 2013 to include 'food supplier decision(s)' and 'behavioral economics' in the third stage. This was done to ensure that the most recent studies were included and the search strategy fulfilled the objective of this paper.

Language and Data Restrictions

No language restriction and publication year restrictions were applied during the search. The searches include publications from earliest records available to the mid of November, 2013. However, most of the articles on the research topic were found to be published after the year 2005.

Selection Criteria

Inclusion criteria were developed to address the problem of heterogeneity in intervention type and outcome measures as suggested by Mulrow et al. (1997). The research question was specific. The inclusion criteria ensure that the research was conducted in a consistent manner and that the research participants were always the school students (ranging from age 4 to 18), and the outcome measure was the change in food intake. The applied selection criteria for the study were: 1) it must have a predetermined behavioral economics component-choice architecture or nudging, 2) it must be carried out in a school lunchroom setting, or report findings of research being carried out in school lunchroom setting, and 3) it must have a food consumption related outcome measures. All types of publication available in the databases were included. The exclusion criteria are: nudging in clinical trials, research conducted outside the school lunchroom setting, research that modifies food selection and/or prices. The researchers are specifically interested in the success of applying nudging and choice architecture modification in school lunchrooms without the potential interference from other factors, and its effect in food supplier decisions. A systematic review on economic incentives and nutritional behavior of children in the school setting has been done by Jensen et al. (2011).

Data Extraction and Synthesis

Following the systematic search, a screening of titles and abstracts was done to identify their potential inclusion in the review. The following data were extracted into Tables in the first screening: authors, publication year, research objectives, methodology and major results. The extracted data file was checked for completeness and accuracy and a final data file was made. A method of narrative synthesis adapted and developed by Popay et al. (2007) was followed for this review. This method has been followed by several researchers in the context of behavior change including: McMahon and Fleury (2012), Everson-Hock et al. (2013), Chisholm et al. (2012), Gordon et al. (2011) and Skov et al. (2013). The findings that made it through the final selection were grouped, and narrative synthesis was applied to each group. This systematic review process is shown in Figure 1.

Search Modification

The established search terms for this systematic review gave very few or no hits in PubMed, Embase, PsychInfo and Cochrane Review. The search term ‘choice architecture’ ‘lunchroom’ and ‘choice architecture’ ‘lunchroom’ ‘behavioral economics’ ‘food supplier decision(s)’ had zero hits in PubMed, Embase, PsychInfo and Cochrane Review. The search term ‘food supplier decision(s)’ had zero hits in all the databases. To address this problem in the systematic review process, the search terms ‘nudge(ing)’ and ‘choice architecture’ were used without combining them with rest of the search terms. A separate search for search terms: ‘lunchroom’ and ‘behavioral economics’ were done in PubMed, Embase, PsychInfo and Cochrane Review databases. However, the search terms ‘nudge(ing)’ and ‘choice architecture’ without combining with ‘lunchroom’ in Google Scholar and Web of Science resulted in many (1573 to >2 million) hits and thus were not included in the systematic search. A systematic search for ‘lunchroom’ was done only in Web of Science (58 hits) and not in Google Scholar (25200 hits). Similarly a systematic search for ‘behavioral economics’ and ‘lunchroom’ was done in Google Scholar (65 hits) but in Web of Science, PubMed, Cochrane Review, Embase, PsychInfo it resulted zero hits.

Results

From the 1889 searches (1615 hits in Google Scholar excluding patents and citations, 61 hits in Web of Science(WoS), 149 hits in PubMed, 21 hits in Embase, 16 hits in PsychInfo and 27 hits in Cochrane) only 31 (unduplicated) searches met the inclusion criteria (Figure 1). Of the 31(listed in Table 1, see Appendix), 24 were published and from the rest of the 31, three were dissertation theses, and four were works in progress. Dissertation theses and works in progress are not included in the narrative synthesis to preserve the credibility of the review; these unpublished research work also report positive results from applying behavioral economics' tool in school lunchroom. Among the 24 published reports, 18 were full text articles and six were published abstracts (marked * in Table 1). The narrative analysis was conducted for the eighteen publications by grouping them into, 1) Experimental research reports, and 2) Non-Experimental reports. The published abstracts also report positive results from nudging and choice architecture.

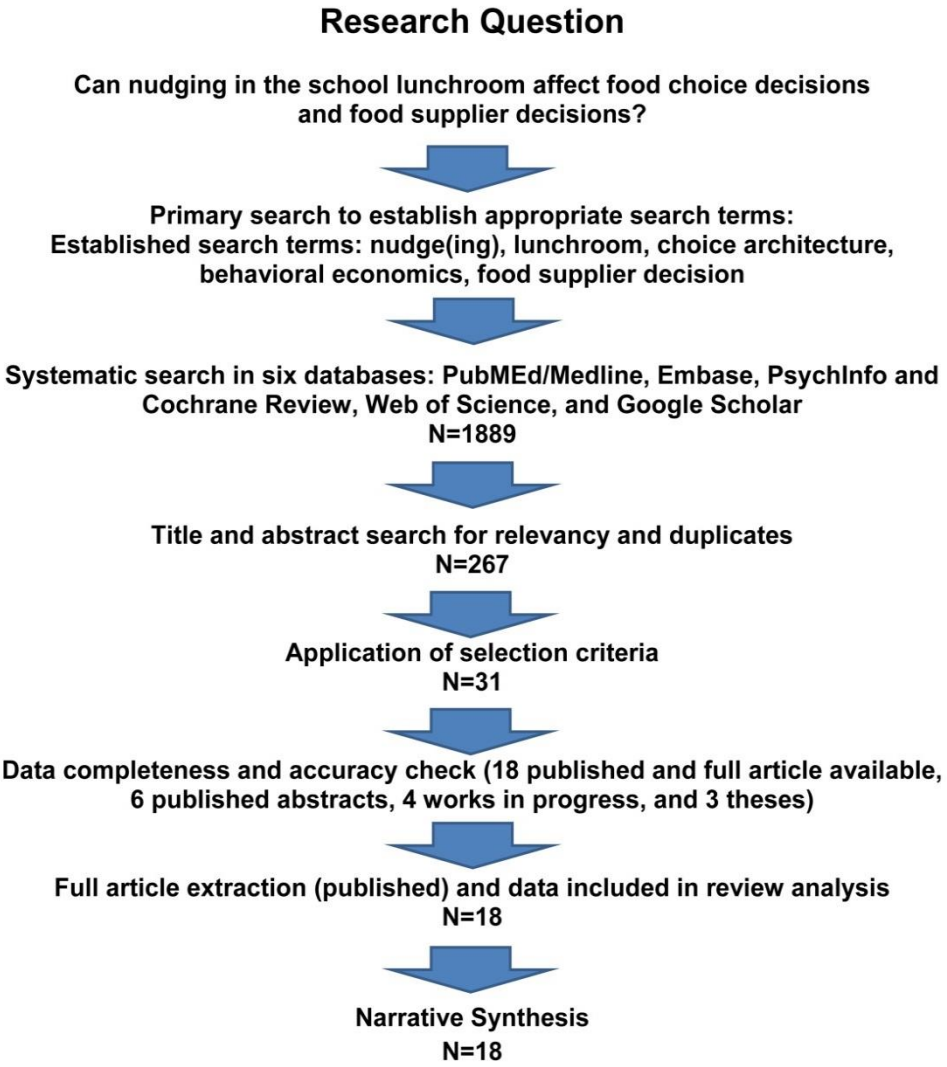

Figure 1. The Systematic Review Process Used

Narrative Synthesis

This narrative synthesis will report on the findings of applying behavioral economics' tools such as choice architecture and nudging in school lunchroom from the included research articles in two groups. The review about food supplier decisions being affected is presented in a different subsection at the end of this section.

Experimental Research Reports

Within the experimental research group, researchers have nudged healthy eating by different techniques like trigger foods, serving styles, pre-sliced food, attractive names, healthy convenience and active choice. However, regardless of the type of nudging or choice architecture modification technique being used, all of these strategies have had some successes. Within this group of literature nudges are the uses of subtle choice architecture modification to prompt healthy food choice decisions. The nine papers in this group were based on outcomes of eight experiments. The experiments were set up consistently with data collection before and during the intervention, but were based in numerous locations: Copenhagen Denmark, rural northern California, four in several locations in western New York and in a Midwestern city school. In the experiment conducted in Denmark (Olsen et al. 2012) it is not clear if the experiment was conducted in the local school lunchroom, however the recruited participants were from local schools. Therefore, this study has been dealt with very briefly in the narrative synthesis and is not listed in Table 2 (see Appendix). One experiment did not have a control population (Hakim and Meissen 2013).

Table 2 provides a concise extraction of the research action, nudges being used, research outcome, outcome measure, results and conclusion of the searches in the experimental research reports group for the narrative synthesis. As shown in this Table, different types of nudging were used to accomplish similar outcomes: increased sales of healthier food options or increased consumption of healthier food options. The target outcome was achieved in each of the reported studies. Also, increased fruit consumption following enhanced fruit accessibility has been supported by Cullen et al. (2003). Altering the shape and size of fruits and vegetables and providing visual cues usually have worked but not in all cases (Table 2). Interestingly, the shape of the fruits and vegetables served matters (Liem and Zandstra 2009 and Olsen et al. 2012).
The five studies: 1) Hanks et al. (2012a), 2) Wansink et al. (2013), 3) Wansink et al. (2012b), 4) Hanks et al. (2012b) and Hanks et al. (2013a), and 5) Hanks et al. (2013b) conducted under the Behavioral Economics in Child Nutrition Program, Cornell University point to the prospect of the interventions having a low cost. The experiment by Hakim and Meissen (2013) reported on the effectiveness of nudging in both an offer and serve NSLP model. Goto et al. (2013) suggests an implication for school policies.

Overall, this review shows that there is only a limited amount of published research that has been conducted to date in applying tools of behavioral economics in school lunchroom setting. Further, the majority of available research is done by a small number of researchers working in the area. The trend of literature suggests that more work is being done (23 of the 31 searches were published in 2012 and 2013), and there are pipeline works that could be published within the next year. However, the authors suggest that there is value of more researchers working in

this area because nudging and choice architecture modification has potential to promote healthy food habit at low cost.

Non-Experimental Reports

Nine research papers that report on the success in promoting healthy food choice decision by applying behavioral economics' tools including nudging and choice architecture in school lunchroom are included in this group (marked ** in Table 1). Wallace (2011) reiterates the effectiveness of using schools to reach children with information and intervention strategies to improve health and quality of life behaviors. Removing the less healthy option is not the best solution because sooner or later, the children will face food selection decisions in an environment that is not necessarily healthy. This paper also reports on how a catchy, fun and cool name like "Spiderman Spinach Salad" gets the children's attention. The second paper is a theme overview for Choices magazine by Jensen (2009). This paper highlights the recommendations made to the meal programs by the IOM to include a new focus on increasing fruits and vegetables and whole-grain-rich foods and reducing the amount of saturated fat and sodium. The third paper (Just and Wansink 2009) is a collection of case studies that have shown success. The paper concludes "through careful thought and simple innovations great changes can be made even in the school lunchroom". The fourth paper is a CDC publication (Huang et al. 2013). It provides a practical set of spatially organized and theory based strategies for making school environments more conducive to learning about and practicing healthy eating by optimizing the physical resources and learning spaces. The target population is practitioners in architecture and public health. The fifth paper (Gittelsohn and Lee 2013) has provided case studies of three multilevel, integrated interventions implemented by Johns Hopkins University between 2004-2011 in an effort to develop and integrate interventions that change the food environment, nutrition education, and employment of behavioral economics strategies into the same conceptual framework to potentially contribute to healthier diets and reduce the risk of chronic disease. The sixth paper (Liu et al. 2013) has highlighted several phenomena from the behavioral economics literature to explain how awareness of these phenomena can help regulate public school cafeterias beyond information to nudge people towards healthier food choices. This paper has suggested that leveraging the behavioral economics insight at the policy making level can fulfill the needed supplementary approaches to promote healthy eating, also suggested by (Gittelsohn and Lee 2013). The seventh paper (Wansink 2013) has summarized the tested nudges into convenient, attractive and normative approach (CAN). This paper reports the CAN approach as an evolutionary approach in changing how children eat. The eighth paper (Guthrie and Newman 2013) has reported that nudging can increase food acceptance in children and that nudging can further pay dividends in the context of raising food costs to the USDA in compliance with the changed USDA food standards for school lunchroom. The final paper (Godfrey 2013) in this sub-group is very important because it reports the perspective of using behavioral economics' tools from the food service director of the school where one of the experiments in the experimental research reports group was conducted. Other reports such as these and other articles reviewed in this paper have potential to reach lunchroom food suppliers.

Have food supplier decisions been affected?

The included publications in both the experimental research report and non-experimental report group were analyzed to see if any alteration in food supplier decisions was reported as a result of school lunchroom nudges and choice architecture intervention. In the experimental research report group, Goto et al. (2012) have linked the research implication to school policies, while the rest of the eight papers have discussed the cost component of intervention. However, none of the studies in both experimental and non-experimental group have looked at the changes in food supplier decisions or choices as a result of an overall push in making school lunchroom healthier. There is no evidence in the nudging literature of efforts by food companies to offer improved products. However, what can be adopted by food suppliers from this body of literature are reported in Godfrey (2013), Just and Wansink (2009), Guthri and Newman (2013), and Wansink (2013). Just and Wansink (2009) have reported examples from lunchroom innovators that provide big bang for the buck; some examples are as simple as replacing the grain based snacks being offered while student waited to pay by fruits. These are easily replicable ways of increasing sales of healthy food options. In addition, the successes of behavioral economics' tools in school lunchroom do provide opportunities for food suppliers to adopt nudging strategies to increase student acceptance of healthy foods (Guthrie and Newman 2013). There is also some evidence of independent actions done by private food companies that can be adopted by lunchroom food suppliers. For example, efforts done by foundations like Produce for Better Health Foundation on creating demand for fruits and vegetables reported in its State of the Plate report (PBH 2010). A recent evidence of nudging efforts from private companies is the partnership of the Sesame Workshop and the Produce Marketing Association with Partnership for a Healthier America (PHA) in a two year agreement to help promote fresh fruit and vegetable consumption to kids (Cohen 2013).

The new regulations on school lunches as encapsulated in the "Smart Snack in School" nutrition standards announcement for competitive foods (USDA news release, June 27, 2013) will undoubtedly provide a necessity that food suppliers will need to meet. It might be useful for the food suppliers and government policymakers to actively collaborate in developing improved market offerings which include appropriate and tested tools of behavioral economics like nudging and choice architecture. Similar recommendations have been made by Byker et al. (2013).The findings of this paper are in line to the strong interest in healthier foods in the lunchroom as emphasized by the White House Taskforce on Obesity (2010). This Taskforce appealed for a more comprehensive research and evaluation of policies that target both consumers and producers. Similar suggestions have been made by National Research Council (2010). The need for an environmental component, in addition to successes in applying behavioral economics to change food behavior, where in interventions are designed with policymakers and other stakeholders to promote environmental support for action has been identified by Contento (2008). Following the recommendations from Brownson et al. (2006), and National Research Council (2010), Borys et al. (2012) has listed identifying obesity prevention stakeholders as a strategy to prevent childhood obesity. Additionally, critical participation from the business community to effectively address the problem of obesity is highlighted by Bleich (2013).

This paper leads to a needed research in addressing the effect of nudging and choice architecture on food supplier decisions towards a collaborative effort to promote healthy food choice decision. It should be clear that when more fruits and vegetables are consumed there is an increased demand for fruits and vegetables to be met by suppliers; hence future studies should look at the effect of lunchroom success of applying behavioral economics' tools on lunchroom food suppliers. The success of behavioral economics suggests a win-win strategy of improving school children's health without compromising food suppliers' revenue. Food suppliers thus need to be encouraged to innovate and be rewarded for applying tested behavioral economics' tools like nudging and choice architecture to make fruits and vegetables more appealing. The "Smart Snack in School" mandate may not accomplish this desirable outcome by itself. However, a complementary effort of applying behavioral economics' tools to promote sale and consumption of healthy food options while complying with the competitive food regulations shows promise. More research is needed which incorporates food supplier decisions as a major component of the research.

Conclusion

A systematic review was conducted to provide a comprehensive overview of the emerging success of applying choice architecture and nudging in school lunchroom and analyze the findings to see if lunchroom food supplier decisions have been affected. This review suggests that when strict inclusion criteria are used to do an electronic search, all the studies show that nudging in the lunchroom leads to healthier food choice decision. None of the studies found that nudging is not effective. Addressing the childhood obesity epidemic by applying behavioral economics is relatively new and most of the research in this area conducted so far has often focused on increasing healthy food consumption, including fruits and vegetables. An interesting outcome is that the effect on major lunchroom stakeholder-the food supplier decisions was not documented. There is some evidence of efforts by private companies to increase the demand for fruits and vegetables but overall there appears to be a reliance on regulations, such as, most recently the "Smart Snack in School" mandate, and efforts to improve the system often view food suppliers as the problem (For e.g. Hirsch 2006) or they are more commonly not mentioned (APHA, n.d.). Moreover, it is important to note that none of the studies included in this study refers to the impact that changes in lunchroom choice architecture might have on food supplier decisions. This paper identifies the need and suggests that, for the next wave of studies, emphasis should be placed on studying ways of using choice architecture and nudging by food suppliers. In this line, first parents, school administrators and school district officials need to be convinced of the reliability of the results summarized in this paper. Second, they need to enlist the help of politicians and local business organizations in working with food suppliers to improve their marketing and production practices. Without such a change, a vision of children trashing tasteless but nutritious food comes to mind.

This paper helps by providing a synthesis of current emerging knowledge about using nudges and shows their common effectiveness. The larger challenge of incorporating these changes and changing school lunch policies to use nudges has received relatively little attention. There are more than 31 million children participating in the NSLP and using nudges to make the lunchroom a healthier food environment while ensuring increased healthy foods, fruits and vegetables consumption shows promise in offsetting childhood obesity trends while working

hand-in-hand with lunchroom food suppliers. Thus, amidst a comprehensive research effort and alarming childhood obesity statistics, it is apparent that a holistic low cost intervention that increases healthy food consumption and increases demand for healthy food at local and national level is much needed. Such an approach would be most effective if it engages rather than ignores the potential role of food suppliers.

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Appendix

Table 1. Summary of searches that have choice architecture component in a school lunchroom setting with food choice decision outcome variable

SN	Search terms	Database	Reference	Title
Published work				
1	Nudge(ing) and lunchroom and lunchroom	WoS, PubMed	Hanks et al. (2012a)	Healthy Convenience: Nudging Students Toward Healthier Choices in the Lunchroom
	Nudge and lunchroom	Google Scholar		
2	Nudge(ing) and lunchroom and lunchroom	WoS	Smith et al. (2011a)*	Healthy Convenience: Nudging Students to Make Healthier Choices in the Lunchroom
3	Nudge(ing) and lunchroom and lunchroom	WoS	Wansink et al. (2010) *	Smarter Lunchrooms: Payment Systems that Nudge Healthier School Lunch Choices
4	Lunchroom	WoS	Wansink et al. (2013)	Pre-sliced Fruit in School Cafeterias Children's Selection and Intake
5	Lunchroom	WoS PubMed	Hanks et al. (2013a)	Smarter Lunchrooms Can Address New School Lunchroom Guidelines and Childhood Obesity
6	Lunchroom	WoS	Wansink et al. (2012b)	Attractive Names Sustain Increased Vegetable Intake in Schools
7	Lunchroom	WoS	Wansink et al. 2011*	Lunch Line Redesign: Making School Lunchrooms Smarter
8	Lunchroom	WoS	Smith et al. (2011b) *	Convenience Drives Choice in School Lunch Rooms: A Salad Bar Success Story
9	Choice architecture	PubMed	Hakim and Meissen (2013)	Increasing Consumption of Fruits and Vegetables in the School Cafeteria: the Influence of Active Choice.
	Choice architecture and lunchroom	Google Scholar		
10	Nudging and lunchroom	Google Scholar	Huang et al. (2013) **	Healthy Eating Design Guidelines for School Architecture
11	Nudge and lunchroom	Google Scholar	Hanks et al. (2012c) *	A Source of Contention or Nutrition: An Assessment of Removing Flavored Milk from School Lunchrooms
12	Nudge and lunchroom	Google Scholar	Just and Wansink (2009) **	Smarter Lunchrooms: Using Behavioral Economics To Improve Meal Selection

Table 1. *Continued*

SN	Search term	Database	Reference	Title
13	Nudge and lunchroom	Google Scholar	Hanks et al. (2012b)	Trigger Foods: The Influence of 'Irrelevant' Alternatives in School Lunchrooms
14	Nudge and lunchroom	Google Scholar	Goto et al. (2012)	Do Environmental Interventions Impact Elementary School Students' Lunchtime Milk Selection?
15	Nudging and lunchroom	Google Scholar	Wallace (2011) **	BEN and the Smarter Lunchroom: Nudging Children to Healthy Choices
16	Nudging and lunchroom	Google Scholar	Olsen et al. (2012)	Serving Styles of Raw Snack Vegetables. What do Children Want?
17	Nudge and lunchroom	Google Scholar	Jensen (2009) **	Theme Overview: Weighing Healthy Choices For The School Meals Program
18	Behavioral Economics and lunchroom	Google Scholar	Gittelsohn and Lee (2013)**	Integrating Educational, Environmental, and Behavioral Economic Strategies May Improve the Effectiveness of Obesity Interventions
19	Behavioral Economics and lunchroom	Google Scholar	Hubbard et al. (2013) *	Impact of A Smarter Lunchroom Intervention on Food Selection and Consumption Among Adolescents and Young Adults With Intellectual and Developmental Disabilities in a Residential School Setting
20	Behavioral Economics and lunchroom	Google Scholar	Liu et al. (2013)**	Using Behavioral Economics to Design More Effective Food Policies to Address Obesity
21	Behavioral Economics and lunchroom	Google Scholar	Wansink (2013)**	Convenient, Attractive, and Normative: The CAN Approach to Making Children Slim by Design
22	Behavioral Economics and lunchroom	Google Scholar	Hanks et al. (2013b)	Preordering School Lunch Encourages Better Food Choices by Children
23	Behavioral Economics and lunchroom	Google Scholar	Guthrie and Newman (2013)**	Eating Better at School: Can New Policies Improve Children's Food Choices?
24	Behavioral Economics and lunchroom	Google Scholar	Godfrey (2012)**	Making Lunchroom Smarter in Ithaca City School District
Work in Progress				
25	Nudge and lunchroom	Google Scholar	Just et al. (2008)	Constrained Volition and Healthier School Lunches
26	Nudge and lunchroom	Google Scholar	Ferro et al. (2013)	The Effect of Pre Selection and Visual Cues on Food Item Selection by Middle School Children
27	Nudge and lunchroom	Google Scholar	Castellari et al. (2013)	Hunger Driven Food Choices: An Experiment to Test The Effect of Providing Pre-Lunch Snacks on School Lunch Choices

Table 1. *Continued*

SN	Search term	Database	Reference	Title
28	Nudge and lunchroom	Google Scholar	Newman et al. (2013)	School Meals Experiment: Can a Taste Test Increase Vegetable Acceptance?
Theses				
29	Nudge and lunchroom	Google Scholar	Young (2012)	School Health Policy: School Lunch Consumption Patterns of Middle School Students
30	Behavioral Economics and lunchroom	Google Scholar	McDowell (2013)	Determining the Effectiveness of a Behavioral Economics Cafeteria Intervention in Big Walnut High School Designed to Improve Healthfulness of Student Purchases
31	Behavioral Economics and lunchroom	Google Scholar	Miller (2013)	Increasing Portion Sizes of Fruits and Vegetables in an Elementary School Lunchroom Can Increase Fruits and Vegetable Consumption

*full article not available ** Non-Experimental

Table 2. Research Summary for Narrative Synthesis

Healthy convenience - high school lunchroom, Hanks et al. (2012a).	
Action	Introduced convenience lunch line that contained only healthier food options as well as flavored milk
Nudge	**Convenience**
Outcome	Sales of healthier foods
Measure	Purchase data
Results	Sales of healthier foods increased by 18% (significant)
Conclusion	Convenience most likely nudged the students to take the food but food preference may have led them to limit their consumption.
Comprehensiveness	Action can be replicated at low cost to other lunchrooms and cafeterias outside school lunchroom
Recommends	Post intervention data collection
Pre-sliced fruits - middle school lunchroom, Wansink et al. (2013).	
Action	Offer pre-sliced fruits
Nudge	**Convenience, size and shape**
Outcome	Selection and Intake
Measure	daily apple sales, percentage of an apple serving consumed per student, percentage of an apple serving wasted per student
Results	Increased by 71% compared to control Percentage who ate more than half increased by 73% Percentage that wasted half or more decreased by 48%
Conclusion	An example of low cost environment change that promotes healthy eating and decrease waste
Assumption	No seasonal effect Novelty effect
Comprehensiveness	Has a cost component
Attractive names - elementary school lunchroom, Wansink et al. (2012b).	
Action	Study 1:Paired carrots with an attractive name in five elementary schools Study 2:Systematically attractively named or not named vegetables
Nudge	**Attractive names**
Outcome	Study 1: Selection and consumption of carrots Study 2: Vegetable selection
Measure	Study 1: Selection and consumption of carrots Study 2: Food sales of vegetable
Results	Study 1: Elementary students ate twice the percentage of their carrots – named "X-ray Vision Carrots" than when named "Food of the Day" Study 2: Elementary school students were 16% more likely to persistently choose more hot vegetables when given fun and attractive names
Conclusion	Attractive names effectively and persistently increased healthy food consumption. Impact of attractive names lasts.
Comprehensiveness	Little or no cost, one volunteer student could do it!

Table 2. *Continued*

Active choice - Kindergarten through 8th grade lunchroom, Hakim and Meissen (2013).	
Action	Introduced an active forced choice into the school lunchroom
Nudge	**Active choice**
Outcome	Consumption of fruits and vegetables
Measure	daily apple sales, percentage of an apple serving consumed per student, percentage of an apple serving wasted per student
Results	An average daily 15% significant consumption increase of fruits and vegetables during the intervention period. Students were almost three times more likely to consume more that 50% of the vegetable serving than they were when they are not given a choice.
Conclusion	The model works in both "offer" and "serve" NSLP model
Environmental interventions - elementary school lunchroom, Goto et al. (2012).	
Action	School 1: White milk made easily accessible vs. ask for chocolate milk School 2: Three fold greater quantity of white compared to chocolate milk
Nudge	**School 1: Accessibility and School 2: Visual cue**
Outcome	Selection decision
Measure	Selection of white milk
Results	School 1: Significantly increased selection of white milk School 2: No significant alteration in selection pattern
Conclusion	School based practices that apply behavioral economics may offer useful strategies for improving food selection
Comprehensiveness	Suggest the research implication for school policies.
Trigger foods - high school lunchroom, Hanks et al. (2012b) and Hanks et al. (2013a).	
Action	Offer foods that either increase or decrease the selection of fruits, vegetables, or unhealthy sides simply through their presence on the lunch
Nudge	**Libertarian paternalism**
Outcome	Selection and consumption of healthier food options
Measure	Waste data
Results	Demonstrates the impacts of offering a single vegetable or fruit may have significant implications for the whole meal (Hanks et al., 2012). The students were 13.4% more likely to take a fruit and 23% more likely to take a vegetable following the lunch room makeover and the makeover increased actual fruit consumption by 18% and vegetable consumption by 25% (Hanks et al., 2013).
Conclusion	Small change in cafeterias and lunchroom can have a significant influence in guiding students towards healthier behaviors.
Comprehensiveness	Points that the makeover took only 3 hours to implement and cost less than $50 (Hanks et al., 2013).
Pre-ordering, elementary school lunchroom, Hanks et al. (2013b).	
Action	Students use an electronic system to pre-order their lunch entrée.
Nudge	**Libertarian paternalism**
Outcome	Selection and consumption of healthier food options
Measure	Sales record

Table 2. *Continued*
Pre-ordering, elementary school lunchroom, Hanks et al. (2013b).

Results	When students preordered their entrée, 29.4 % selected the healthier entrée compared with 15.3% when preordering was not available. The paper has not reported consumption data but has reported that the consumption data collected by visual estimation techniques supports the robust result.
Conclusion	Pre-ordering can effectively lead students to pick healthier entrée.
Comprehensiveness	The reported research used a computerized preordering system but reports that an alternate paper- based system is easy, inexpensive and an immediately implementable alternate.

