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RESEARCH CONTRIBUTIONS:


School Nutrition Professionals Perceptions of Key Performance Indicators

School Cooks' Motivations to Engage in Protective Action against Food Tampering

Evaluating the Impact of Food Safety Messaging Posters on Observed Employee Food Safety Behavior: A Mixed Methods Approach

A Mixed Methods Approach to Examining Food Allergy Accommodation Efforts in Colleges and Universities

Use of Modified Problem Based Learning in an Undergraduate Quantity Food Production Course



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ABSTRACTS

Research Manuscripts

Nutrition Professionals Perceptions of Key Performance Indicators

This study examined food allergy accommodation practices and policies in colleges and universities (CU) using a two-phase explanatory sequential mixed methods design. Seventy-six (22.2% response) foodservice professionals responded to a national survey; 11 of whom participated in follow-up interviews. Most (74%) questionnaire participants reported departmental level food allergy policies existed at their institutions while 34% of participants reported presence of institutional level policies. Differences in the likelihood of published policies existed according to institutional demographic characteristics (e.g. institution type, foodservice management type), however findings suggest variability in CU foodservice professionals' approaches to accommodations, regardless of policy presence.

School Cooks' Motivations to Engage in Protective Action against Food Tampering

Food defense depends on restricting access of unauthorized persons to food production and storage areas. In school foodservice operations, cooks are available to challenge visitors, but little is known about their motivations to do so. Food production and meal service were observed at twelve schools and implementation of select food defense practices was noted. Two cooks from each school were interviewed about their perceptions of the threat of food tampering at their worksite. Although cooks expressed confidence in their ability to control access to work areas, they were less sure which stakeholder groups should be prohibited from entry.

Evaluating the Impact of Food Safety Messaging Posters on Observed Employee Food Safety Behavior: A Mixed Methods Approach

This study examined changes in retail foodservice employees' food safety behaviors after food safety messaging poster implementation in eight foodservice sites serving older adults. Microbial, observational, and interview data were collected at each site on three occasions: pre-, short term post-, and long term- post poster intervention. Based on observational data, no significant changes in compliance rates were found upon short term post-intervention. Increased compliance was observed in two facilities and decreased compliance in two other facilities at long term post-intervention. Factors that appeared to impact intervention included: involvement of employees in poster implementation, food safety training, and poster rotation.

A Mixed Methods Approach to Examining Food Allergy Accommodation Efforts in Colleges and Universities

This study examined food allergy accommodation practices and policies in colleges and universities (CU) using a two-phase explanatory sequential mixed methods design. Seventy-six (22.2% response) foodservice professionals responded to a national survey; 11 of whom participated in follow-up interviews. Most (74%) questionnaire participants reported departmental level food allergy policies existed at their institutions while 34% of participants reported presence of institutional level policies. Differences in the likelihood of published policies existed according to institutional demographic characteristics (e.g. institution type, foodservice management type), however findings suggest variability in CU foodservice professionals' approaches to accommodations, regardless of policy presence.

Use of Modified Problem Based Learning in an Undergraduate Quantity Food Production Course

Problem-Based Learning (PBL) is a case-driven, student-centered, small group instructional strategy that encourages learning through the use of "real-world" examples. PBL was implemented in an undergraduate quantity food production course (n=75) to enhance student understanding of basic foodservice management principles while developing students' soft skills such as problem solving and critical thinking. Overall, PBL was perceived as an engaging and collaborative learning environment. When implemented properly, students agreed that PBL can reinforce course learning outcomes. Group time management and group communication were identified as challenges with completing the PBL assignment.

SCHOOL NUTRITION PROFESSIONALS PERCEPTIONS OF KEY PERFORMANCE INDICATORS

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ABSTRACT

The purpose of this study was to explore school nutrition (SN) professionals' perceptions of key performance indicators (KPIs). An expert panel of SN professionals helped develop a national survey. The survey was sent to a random sample of 700 SN professionals stratified by USDA region. The response rate for the survey was 29.3% (N=205). The results indicated that most SN professionals perceive they have an adequate understanding of standard SN KPIs. Most SN professionals feel KPIs are easy but time consuming to use. Results of this study suggest the need for the development of KPI training and resources to support SN professionals.

Keywords: key performance indicator (KPI), productivity, and data driven decision making

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INTRODUCTION

School nutrition (SN) management is a challenging profession, fraught with continually changing regulations, limited budgets, and a demanding customer base. Thriving in this environment requires savvy decision making. Effective SN professionals must be able to reasonably determine the best use of their time and resources. They need to know where costs can be reduced, where revenues can be increased, and how to evaluate the impact of their efforts. Data driven decision making, utilizing key performance indicators (KPIs), meets this need.

Data driven decision making is the process of using operational data, commonly collected by SN programs, to make informed decisions about planning and implementing change (Boettger, 2009). The operational data that is used to track the most important aspects of a SN operation are called KPIs (Boettger, 2009). Fahey (2011) described KPIs as measures of performance that allow school officials to identify problem areas, measure progress in correcting these problems, and demonstrate program efficiency and effectiveness. Buzalaka (2010) described KPIs as metrics that allow SN professionals to utilize a rigorous numbers oriented approach to target specific areas of emphasis and gauge results in an objective and measurable way. KPIs can be used to help identify where resources should be invested to have the most positive impact (such as equipment or labor), and they can be used to track the progress of major initiatives (such as breakfast in the classroom, salad bars, and farm to school) on participation, cost, and revenue (Buzalaka, 2010).

Several KPIs that are useful for decision making in SN programs have been identified in literature. That list includes costs per revenue (e.g., food, labor, supply, equipment, other, and total), fund balance as a percent of revenue, breakfast and lunch participation rates (by grade and school), meals per labor hour, costs per meal (food, labor, supply, equipment, other, and total), inventory on hand, and revenue per student. (Boettger, 2009; Council for Great City Schools, 2012; and Cater et al., 2005).

School nutrition industry professionals suggest that effective utilization of KPIs requires specific attributes of the individuals using the KPIs, as well as specific characteristics of the SN program where there KPIs are being utilized. The individual attributes include an understanding of financial management and good business acumen. The program characteristics include the existence of operational systems for data gathering and analysis, and a compatible database of comparable statistics against which KPIs can be measured and benchmarked (Buzalaka, 2010).

In 2009, Boettger suggested that most SN professionals spend a considerable amount of time and resources collecting data, but far less time analyzing this data to make wise decisions. Currently, there is a lack of research concerning SN professionals' perceptions of KPIs as a tool to support SN program management. Therefore, the purpose of this study was to explore SN professionals' perceptions of KPIs.

METHODOLOGY

Research Plan

This project, which received approval from the Institutional Review Board at The University of Southern Mississippi prior to implementation, was conducted in three phases. In Phase I, the primary investigator visited a SN program where the director had demonstrated success in utilizing KPIs for operational decision making. In Phase II, an expert panel of SN professionals experienced in applying KPIs was convened to discuss issues associated with utilizing KPIs in SN programs. The intent of Phase I and II of the study

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was to gather information to support the development of a national survey to meet the objectives of the study. In Phase III, a national survey was developed and validated with the assistance of a review panel of SN professionals. The survey was then mailed to a random sample of 700 SN directors representing the seven United States Department of Agriculture (USDA) regions.

Phase I: Site Visit - A location for the site visit was identified by contacting two state agency child nutrition directors and asking for recommendations of SN directors who demonstrate excellence in utilizing KPIs for operational decision making. Two SN directors were recommended by state agency directors to participate in site visits, of those, one agreed to participate in this study. The site visit consisted of structured interviews with the SN director and SN managerial staff, and a tour of the SN program to view routine operations. During the structured interviews, the following information was gathered: the specific KPIs used by various levels of SN staff members; the frequency KPIs are calculated; how KPIs are utilized; the strengths/advantages of using each KPI; and the barriers/disadvantages of using each KPI. The tour of the SN operation included visits to several schools in the district to observe how and what data were captured for calculating KPIs.

Phase II: Expert Panel - Potential participants for the expert panel in Phase II were also identified by contacting state agency child nutrition directors for recommendations. From this list, 14 SN program directors and one state agency child nutrition director were selected based on three criteria: representation from each USDA Region, and a good distribution based school district student enrollment levels and the percentage of students approved for free and reduced priced meals. One state agency child nutrition director and nine SN directors agreed to participate.

Prior to conducting the expert panel, discussion topics for the meeting were expanded from the question used in the site visit interviews based on information gained from the site visit, the research objectives, and previous research.

The expert panel session was conducted at the Institute of Child Nutrition, Applied Research Division (ICN, ARD) located on the campus of The University of Southern Mississippi in Hattiesburg, Mississippi. The agenda established for the expert panel was designed to address the issues outlined in the research objectives so that discussion supported the development of a survey to be utilized in Phase III of the study. Throughout the session, participants were asked semi-structured, open-ended questions related to the research objectives. A structured approach was employed to keep the discussion on target. The expert panel was moderated by one researcher, while an additional researcher captured participant comments on a computer. Toward the end of the session, after all questions were discussed, the moderator summarized responses, and participants were asked to verify the accuracy of the depiction of the discussion summation. Afterwards, the responses recorded during the expert panel were incorporated into statements that were utilized to develop the quantitative survey instrument.

Phase III: Survey development - In Phase III of the study, themes identified from the qualitative data collected from the expert panel discussions were used to develop a survey instrument. The survey, *Key Performance Indicators for Measuring Productivity in School Nutrition Programs*, consisted of 105 multiple choice questions divided into the following two sections: "Your Opinion" and "Personal/Program Characteristics".

The "Your Opinion" section of the survey contained nine sets of questions, which are described below. In several of these question sets, respondents were asked information concerning 11 standard SN KPIs including: Meals per Labor Hour, Cost as a Percent of Revenue, Cost per Meal, Revenue per Meal, Inventory Turnover Rate, Days of Inventory On-Hand, Average Daily Participation, Percent Over Production, Breakeven Point, Staff Turnover Rate, and Absentee Rate. In one question set respondents were asked to rate their level of understanding of each SN KPI based on a three-point scale ranging from 1 (*no understanding*) to 3 (*adequate*). The second question set, respondents were asked to indicate if they have access to the necessary data to calculate each SN KPI. In a third question set asked respondents to rate their level of agreement with 12 statements pertaining to the value and ease of use of SN KPIs. The four-point rating scale for the ninth question ranged from 4 (*strongly agree*) to 1 (*strongly disagree*).

The "Personal and Program Characteristics" section of the survey contained 21 questions. Examples of data gathered regarding personal characteristics included respondent's position title, level of education, certification status, years of experience in their current position, and prior work experience. Examples of data gathered pertaining to SN program characteristics included: school district enrollment size, level of food processing (scratch vs. premade), level of disposable dishes vs. machine washables, location of the school district, percentage of students approved for free and reduced-price meals, and percentage of average daily participation.

Survey validation: review panel - A group of 57 SN professionals were asked via e-mail to participate in a review panel to evaluate the draft survey. This group consisted of expert panel members and SN professionals who were referred by state agency child nutrition directors to participate in the expert panel. The e-mail invitation contained instructions explaining the review process, and included the following attached documents: an informed consent form, a draft survey cover letter, a draft survey instrument, and an evaluation form. The instructions asked recipients to read each of the attached documents, complete the evaluation, and return the evaluation form via e-mail or fax within two weeks. The evaluation form contained 15 questions/statements to assess the readability, clarity, and flow of the survey cover letter and survey instrument. Additional space was provided on the evaluation form for reviewers to provide comments and suggestions to revise the cover letter, survey statements, and response categories. A reminder e-mail was sent to all recipients one week prior to the deadline. Return of the evaluation form served as consent to participate in the review process. Twenty-one (37%) evaluation forms were returned.

Revisions were made based upon comments and suggestions offered by the reviewers. The survey instrument used in this study was produced in a scannable form, using Magenta 5.0 Forms Designer software. This program creates scannable forms which allow participants to record their responses using a number two pencil. Surveys may then be scanned using Remark Classic OMR 2.5 software and directly transferred to a statistical program for analysis. Survey Sample and Distribution

Survey Sample

The study sample was selected from the database of school districts maintained by Market Data Retrieval, a company that specializes in the school market. A random sample of 700 SN directors representing the seven USDA regions was selected for the national survey administration. Sample members were mailed pre-notice letters one week prior to mailing the survey packet. The survey packet consisted

of a survey cover letter, survey instrument, and a stamped, self-addressed, return envelope. Two weeks after the survey packets were mailed, a reminder post card was sent.

Data Analysis

Survey data were analyzed using the statistical package SPSS Version 21.0 for Windows. Descriptive statistics included means, standard deviations, and frequencies of total responses. One-way ANOVA with Tukey's post hoc tests were conducted to determine the relationship between research variables.

RESULTS AND DISCUSSION

Program Characteristics

The response rate for the survey was 29.3% (N=205). The largest percentages of respondents were from the Southeast (23.3%) and Southwest regions (18.0%), while the smallest percentages were from the Northeast (5.8%) and West (9.5%). Most respondents were from districts with student enrollments between 2,000 and 29,000 (65.0%).

The majority of respondents were SN directors (77.6%), while the remainder were district level nutrition supervisors (17.3%) or school level nutrition managers (5.1%). Therefore, from this point forward, respondents will be referred to as SN professionals. Approximately 40% had an associate's degree or less as their highest level of education, while 27.4% had a bachelor's degree. The most common areas of study for those with a bachelor's degree or higher was nutrition and dietetics (21.5%). The majority of respondents indicated they were not certified (36.1%). The most common certification was School Nutrition Association Certified (27.3%), and the least common certification was American Culinary Federation Certified (1.0%). More than one third of respondents indicated that they had worked in SN programs for greater than 20 years (37.6%); however, 34% indicated they had only been in their current position for 1 to 5 years. When asked where they worked prior to taking their current position, less than half indicated they worked in a managerial role for an SN program (43.4%).

Perceptions of Key Performance Indicators

Respondents were asked to indicate their perceptions of KPIs based on the following areas: their understanding of KPIs, their access to data for calculating KPIs, the value of KPIs, the ease of use of KPIs and the adequacy of training that SN professionals receive with regards to KPIs. Those results are provided below.

Understanding of KPIs

When respondents were asked to rate the level of understanding of SN KPIs on a three point scale (3=adequate, 2=partial, and 1=no understanding), the KPIs that received the highest mean ratings were Average Daily Participation (2.95 ± 0.27), Meals Per Labor Hour (2.87 ± 0.38) and Cost Per Meal (2.84 ± 0.41). The KPIs that received the lowest mean ratings were Percent Over-Production (2.25 ± 0.76), Inventory Turnover Rate (2.54 ± 0.63), and Days of Inventory On-Hand (2.58 ± 0.62) (Table 1.) When the frequencies and percentages for respondents' level of understanding of SN KPIs were tallied, three issues became apparent (Table 2). First, the majority of respondents indicated they had an adequate understanding of 11 of the 12 SN KPIs. Second, Percent Over-Production was the only KPI where less than half of respondents (44.6%) indicated they had an adequate understanding. Third, 19.3% of respondents indicated they had no level of understanding of the KPI Percent Over-Production. (Table 2.)

Access to data for calculating KPIs

When respondents were asked if they have the necessary data to

Table 1: Mean Rating for Level of Understanding of KPIs

	Mean ^a	SD ^b
Average Daily Participation	2.95	0.27
Meals Per Labor Hour	2.87	0.38
Cost Per Meal	2.84	0.41
Revenue Per Meal	2.75	0.47
Absentee Rate	2.69	0.54
Staff Turnover Rate	2.67	0.58
Cost as a Percent of Revenue	2.66	0.58
Break Even Point	2.65	0.58
Day of Inventory On-Hand	2.58	0.62
Inventory Turnover Rate	2.54	0.63
Percent Over-Production	2.25	0.76

^aThree-point rating scale: adequate=3, partial=2, and no understanding=1

^bStandard deviations for each mean

calculate each SN KPI, the majority said "Yes" (Table 3). Average Daily Participation, Cost per Meal, and Meals per Labor Hour were the KPIs that received the most responses of "Yes" (98.0%, 94.0%, and 93.6%, respectively). Percent Over-Production, Inventory Turnover Rate, Breakeven Point, and Days Inventory On-Hand were the KPIs that received the most responses of "No" (14.9%, 13.9%, 12.9%, and 12.9%, respectively) and "I do not know" (18.3%, 9.5%, 8.4%, and 7.9%, respectively).

Value/ease of use/adequacy of KPI training

Respondents were asked to rate their level of agreement with several statements associated with the value, ease of use, and training of SN KPIs. The four point rating scale ranged from 4 (*strongly agree*) to 1 (*strongly disagree*). These are provided in Tables 4-6 in descending order based on the combined frequencies/percentages of strongly agree and agree ratings given.

Value of KPIs

As demonstrated by the results in Table 4, the overwhelming majority of respondents agreed or strongly agreed that KPIs are a valuable SN managerial tool: "Key Performance Indicators, when calculated correctly, can provide essential information about the SN program" (95.5%); "Key Performance Indicators are useful for

Table 2: Level of Understanding of KPIs?

	Adequate (n / %)	Partial (n / %)	No Understanding (n / %)
Average Daily Participation	195 / 95.6	7 / 3.4	2 / 1.0
Meals per Labor Hour	178 / 88.1	21 / 10.4	3 / 1.5
Cost Per Meal	173 / 85.2	27 / 13.3	3 / 1.5
Revenue Per Meal	156 / 76.5	45 / 22.1	3 / 1.5
Staff Turnover Rate	149 / 73.0	43 / 21.1	12 / 5.9
Absentee Rate	147 / 72.8	47 / 23.3	8 / 4.0
Cost as a Percent of Revenue	145 / 71.1	48 / 23.5	11 / 5.4
Breakeven Point	142 / 70.3	49 / 24.3	11 / 5.4
Days of Inventory On-Hand	132 / 65.3	56 / 27.7	14 / 6.9
Inventory Turnover Rate	123 / 61.2	63 / 31.3	15 / 7.5
Percent Over-Production	90 / 44.6	73 / 36.1	39 / 19.3

n = Frequency of responses

% = Percentage of responses

Table 3: "Do you have access to the necessary data to calculate KPIs?"

	Yes (n / %)	No (n / %)	I do not know (n / %)
Average Daily Participation	198 / 98.0	3 / 1.5	1 / 0.5
Cost Per Meal	189 / 94.0	9 / 4.5	3 / 1.5
Meals Per Labor Hour	190 / 93.6	7 / 3.4	6 / 3.0
Revenue Per Meal	184 / 89.8	13 / 6.3	8 / 3.9
Staff Turnover Rate	170 / 83.7	21 / 10.3	12 / 5.9
Cost as a Percent of Revenue	168 / 82.4	26 / 12.7	10 / 4.9
Absentee Rate	162 / 81.8	25 / 12.6	11 / 5.6
Days of Inventory On-Hand	160 / 79.2	26 / 12.9	16 / 7.9
Breakeven Point	159 / 78.7	26 / 12.9	17 / 8.4
Inventory Turnover Rate	154 / 76.6	28 / 13.9	19 / 9.5
Percent Over-Production	135 / 66.8	30 / 14.9	37 / 18.3

n = Frequency of responses
% = Percentage of responses

decision making" (94.5%); and "Key performance indicators are valuable tools for evaluating an SN program" (92.0%). However, most agreed or strongly agreed that many SN professionals do not understand the value of KPIs (72.9%).

Ease of use of KPIs

With regard to ease of use, SN professionals' perceptions of KPIs were mostly positive (Table 5). The majority of respondents agreed or strongly agreed that decisions based on incorrectly interpreted KPIs can have negative consequences (88.5%), KPIs are time consuming to calculate (71.7%) KPIs are easy to calculate (67.0%), and data for calculating KPIs is easy to obtain (58.6%). Further, only 32.6% agreed or strongly agreed there is no uniform process for calculating KPIs and only 33.8% agreed or strongly agreed KPIs are difficult to interpret. (Table 5)

Adequacy of KPI training

The SN professionals' perceptions suggest the need for more KPI training (Table 6). When respondents were asked to rate their level of agreement with the statement "School nutrition professionals receive adequate training on KPIs," 81.6% disagreed or strongly disagreed. Additionally, the majority of respondents reported that cooks, school level managers, and district level supervisors, either do not receive training on KPIs, or they did **not** know if individuals in these positions receive KPI training (91.0%, 60.0%, and 53.0%, respectively (Table 7).

Enrollment and Perceptions of KPIs

In the section below, the findings that are presented include the relationship between district enrollment size and respondents' perceptions of KPIs associated with understanding, value and ease of use. No significant findings were observed between any other program/personal characteristics and access to or usage of KPIs; therefore, no further details regarding the relationship between these variables are presented.

Enrollment and understanding of KPIs

One-way ANOVA and Tukey's post hoc comparisons demonstrated a significant relationship between district enrollment and respondents' perceived understanding of four KPIs (Table 8). As school district enrollment size increased from $\leq 1,999$ to 2,000-29,999, respondents' perceived level of understanding of meals per labor hour and breakeven point significantly increased ($p < 0.05$ and $p < 0.05$, respectively). However, for the same KPIs (meals per labor hour and breakeven point) no significant differences were observed between districts with enrollment of $\leq 1,999$ and districts with enrollment of $\geq 30,000$ or between districts with enrollments of 2,000-29,999 and $\geq 30,000$. Additionally, it was observed that respondents' perceived level of understanding of cost as a percentage of revenue and revenue per meal significantly increased as school district size increased from $\leq 1,999$ to 2,000-29,999 ($p < 0.05$ and $p < 0.05$; respectively) and from $\leq 1,999$ to $\geq 30,999$ ($p < 0.05$ and $p < 0.05$; respectively). (Table 8)

Enrollment and ease of use of KPIs

Two trends pertaining to enrollment and perceived ease of use of KPIs were exposed using one-way ANOVA testing (Table 9). First, as district enrollment increased from $\leq 1,999$ to 2,000-29,999 and from $\leq 1,999$ to $\geq 30,000$, respondents' agreement ratings with the following statements significantly increased: KPIs are easy to calculate; data for calculating KPIs is easy to obtain; and decisions based on incorrectly interpreted KPIs can have negative consequences ($p < 0.05$; $p < 0.05$, and $p < 0.05$; for each respectively). Second, as enrollment size increased from $\leq 1,999$ to 2,000-29,999, respondents' level of agreement with the following two statements significantly increased: KPIs are difficult to interpret and KPIs are time consuming to calculate ($p < 0.05$ for each). However, no significant differences were observed between respondents with enrollments of $\leq 1,999$ to $\geq 30,000$ regarding these two statements. (Table 9)

Table 4: Agreement with Statements Pertaining to the Value of KPIs

	Strongly Agree (n/%)	Agree (n/%)	Disagree (n/%)	Strongly Disagree (n/%)	N/A (n/%)
KPIs when calculated correctly can provide essential information about the school nutrition program	88 / 44.2	102 / 51.3	0 / 0.0	0 / 0.0	9 / 4.5
KPIs are useful for decision making	72 / 36.2	116 / 58.3	4 / 2.0	0 / 0.0	7 / 3.5
KPIs are valuable tools for evaluating a school nutrition program	67 / 33.5	117 / 58.5	5 / 2.5	2 / 1.0	9 / 4.5
Many school nutrition professionals do not understand the value of KPIs	44 / 22.1	101 / 50.8	35 / 17.6	4 / 2.0	15 / 7.5

n = Frequency of responses
% = Percentage of responses

Table 5: Agreement with Statements Pertaining to the Ease of Use of KPIs

	Strongly Agree (n/%)	Agree (n/%)	Disagree (n/%)	Strongly Disagree (n/%)	N/A (n/%)
Decisions based on incorrectly interpreted KPIs can have negative consequences	35 / 17.6	141 / 70.9	10 / 5.0	2 / 1.0	11 / 5.5
KPIs are time consuming to calculate	34 / 17.2	108 / 54.5	39 / 19.7	8 / 4.0	9 / 4.5
KPIs are easy to calculate	34 / 17.0	100 / 50.0	50 / 25.0	6 / 3.0	10 / 0.5
Data for calculating KPIs is easy to obtain	14 / 7.1	102 / 51.5	63 / 31.8	10 / 5.1	9 / 4.5
KPIs are difficult to interpret	7 / 3.5	61 / 30.3	101 / 50.2	22 / 10.9	10 / 0.5
There is no uniform process for calculating KPIs	9 / 4.5	56 / 28.1	104 / 52.3	16 / 0.8	14 / 7.0

n = Frequency of responses

% = Percentage of responses

Enrollment and value of KPIs

One-way ANOVA testing suggested a significant relationship ($p < .05$) between enrollment and perceived value of KPIs (Table 10). As district enrollment increased from $\leq 1,999$ to 2,000-29,999 and from $\leq 1,999$ to $\geq 30,000$, respondents' level of agreement with the following statements significantly increased: when calculated correctly, KPIs can provide essential information about a SN program; many SN professionals do not understand the value of KPIs; KPIs are valuable tool for evaluating a SN program; and KPIs are useful for decision making. However, no significant differences were observed between respondents with enrollments from 2,000-29,999 to $\geq 30,000$ regarding these statements. (Table 10)

CONCLUSIONS AND APPLICATIONS

The findings of this study suggest that SN professional' overall access to data for calculating KPIs is good. Most SN professionals believe they have access to the necessary data to calculate SN KPIs, especially average daily participation, cost per meal, and meals per labor hour. Further, most professionals do not have to go outside their own departments to gather KPI data, because this data is usually captured in the district SN office.

This study reveals some consensus among SN professionals' regarding their perceptions of KPIs. With the exception of percent over-production, most SN professionals perceive they have an adequate understanding of each of the SN KPIs. The vast majority of SN professionals perceive that SN KPIs provide essential information about SN programs and that they are valuable managerial tools for activities such as program evaluation and decision making. However, most of the respondents believe KPIs are undervalued by SN professionals, and most are concerned that decisions based on incorrectly interpreted KPIs can have negative consequences for an SN program. The majority SN professionals feel KPIs easy, but time consuming to use; and the vast majority do not believe SN professionals receive adequate, if any, training on KPIs.

The results of this study suggest that there is a significant relationship between district enrollment and SN professionals' perceptions of KPIs related to understanding, value, and ease of use. To simplify this explanation, district enrollment ranges are categorized as follows: small = $\leq 1,999$, medium = 2,000-29,999, and large = $\geq 30,000$. School nutrition professionals from medium districts are more likely than

those from small districts to report an adequate understanding of two KPIs (meal per labor hour and breakeven point); while SN professionals from medium and large districts are more likely than those from small districts to report an adequate understanding of two other KPIs (cost as a percentage of revenue and revenue per meal). It is unclear why district enrollment size only affects SN professionals' understanding of these select KPIs.

SN professionals from medium and large districts are more likely to perceive the process of capturing KPIs data and calculating KPIs as easy compared to those from small districts. Further, SN professionals from medium and large districts are more likely to realize and appreciate the consequences of negatively interpreted KPIs and more likely to place a higher value on KPIs compared to those from small districts. This may indicate that SN professionals from medium and large size school districts have more experience and training related to the utilization of KPIs. However, SN professionals from medium size school districts are more likely to perceive that KPIs are time consuming to calculate and difficult to interpret, compared to those from small districts. The possible reasons for this are not as clear. SN professionals from medium size school districts may utilize and rely on KPIs more than those from small districts, and therefore have a greater understanding of what is involved in accurately calculating and interpreting KPIs. However, no significant findings were revealed when comparisons were made between school district enrollment size and usage of KPIs.

SN professionals from medium and large districts are more likely to perceive that KPIs are a valuable for managing SN operations. As stated earlier, this may indicate that SN professionals from medium and large size school districts have more experience and training related to the utilization of KPIs, and therefore, a greater appreciation for the value of KPIs.

Some of the findings from this study match up with what was found in the review of literature. For example, Buzalaka (2010) suggested that effective utilization of KPIs requires understanding of financial management and good business acumen by SN professionals, and the existence of operational systems for data gathering and analyzing, and benchmarking KPIs at SN programs. While SN professionals understanding of financial management and good business acumen was not measured in the study, results suggest that most SN programs have access to the necessary data for calculating KPIs and

Table 6: Agreement that SN Professionals Receive Adequate KPI Training

	Strongly Agree (n/%)	Agree (n/%)	Disagree (n/%)	Strongly Disagree (n/%)	N/A (n/%)
School nutrition professions receive adequate training on KPIs	6 / 3.0	21 / 10.4	94 / 46.8	70 / 34.8	10 / 5.0

n = Frequency of responses

% = Percentage of responses

Table 7: The level of SN Professional that Have Received Training on KPIs at School Districts

	Yes (n / %)	No (n / %)	I do not know (n / %)
District Level Supervisors	93 / 47.0	77 / 38.9	28 / 14.1
School Level Managers	80 / 40.0	100 / 50.0	20 / 10.0
Cooks	18 / 9.0	168 / 84.0	14 / 7.0

n = Frequency of responses
% = Percentage of responses

Table 8: Enrollment Compared to Respondents' Understanding of KPIs

KPIs	Enrollment	n	Mean ^g	SD
Meals per Labor Hour	≤ 1,999 ^a	54	2.69	0.58
	2,000 – 29,999 ^a	131	2.93	0.25
	≥ 30,000	15	2.93	0.26
Cost as a % of Revenue	≤ 1,999 ^{bc}	55	2.42	0.69
	2,000 – 29,999 ^b	132	2.74	0.50
	≥ 30,000 ^c	15	2.87	0.35
Revenue per Meal	≤ 1,999 ^{de}	55	2.60	0.60
	2,000 – 29,999 ^d	132	2.80	0.41
	≥ 30,000 ^e	15	2.93	0.26
Break Even Point	≤ 1,999 ^f	54	2.43	0.72
	2,000 – 29,999 ^f	131	2.73	0.49
	≥ 30,000	15	2.80	0.41

^a F(2, 197) = 8.74, p = .001 Comparison of enrollment to Respondents' Understanding of KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{bc} F(2, 199) = 7.83, p = .001 Comparison of enrollment to Respondents' Understanding of KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{de} F(2, 199) = 4.81, p = .009 Comparison of enrollment to Respondents' Understanding of KPIs using one-way ANOVA and Tukey's post hoc comparisons
^f F(2, 197) = 6.34, p = .002 Comparison of enrollment to Respondents' Understanding of KPIs using one-way ANOVA and Tukey's post hoc comparisons
^g The rating scale for level of understanding was a 3-point (3=adequate understanding, 2=partial understanding, 1=no understanding).

Table 9: Enrollment Compared to Agreement with Statements regarding Ease of Use of KPIs

Statements	Enrollment	n	Mean ⁱ	SD
KPIs are easy to calculate	≤ 1,999 ^{ab}	54	2.37	1.22
	2,000 – 29,999 ^a	131	2.80	0.82
	≥ 30,000 ^{ab}	15	3.13	0.64
Data for calculating KPIs is easy to obtain	≤ 1,999 ^{cd}	54	2.20	1.09
	2,000 – 29,999 ^c	129	2.60	0.77
	≥ 30,000 ^d	15	2.93	0.59
Decisions based on KPIs can have negative consequences	≤ 1,999 ^{ef}	53	2.51	1.31
	2,000 – 29,999 ^e	131	3.09	0.60
	≥ 30,000 ^f	15	3.13	0.35
KPIs are difficult to interpret	≤ 1,999 ^g	54	1.91	1.09
	2,000 – 29,999 ^g	132	2.27	0.70
	≥ 30,000	15	2.13	0.10
KPIs are time consuming to calculate	≤ 1,999 ^h	53	2.47	1.20
	2,000 – 29,999 ^h	130	2.89	0.75
	≥ 30,000	15	2.60	0.83

^{ab} F(2, 197) = 5.76, p = .004 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{cd} F(2, 195) = 5.96, p = .003 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{ef} F(2, 195) = 9.52, p = .001 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^g F(2, 198) = 3.61, p = .029 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^h F(2, 195) = 4.12, p = .018 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
ⁱ The agreement scale contained four points 4=strongly agree, 2=agree, 3=disagree, and 4=strongly disagree).

Table 10: Enrollment Compared to Agreement with Statements regarding Value of KPIs

Statements	Enrollment	n	Mean ⁱ	SD
KPIs when calculated correctly, can provide essential information about a SN program	≤ 1,999 ^{ab}	53	2.79	1.26
	2,000 – 29,999 ^a	131	3.47	0.58
	≥ 30,000 ^b	5	3.67	0.49
Many SN Professionals do not understand the value of KPIs	≤ 1,999 ^{cd}	53	2.40	1.31
	2,000 – 29,999 ^c	132	2.90	0.92
	≥ 30,000 ^d	14	3.07	0.83
KPIs are valuable tools for evaluating a SN program	≤ 1,999 ^{ef}	54	2.67	1.26
	2,000 – 29,999 ^e	131	3.31	0.62
	≥ 30,000 ^f	15	3.60	0.51
KPIs are useful for decision making	≤ 1,999 ^{gh}	53	2.81	1.13
	2,000 – 29,999 ^g	131	3.35	0.58
	≥ 30,000 ^h	15	3.73	0.46

^{ab} F(2, 196) = 14.69, p = .001 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{cd} F(2, 196) = 5.12, p = .007 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{ef} F(2, 197) = 13.49, p = .001 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
^{gh} F(2, 196) = 13.03, p = .001 Comparison of enrollment to respondents' Agreement regarding statements about KPIs using one-way ANOVA and Tukey's post hoc comparisons
ⁱ The agreement scale contained four points 1=strongly agree, 2=agree, 3=disagree, and 4=strongly disagree).

data for calculating KPIs is easy to obtain, which meets at least one of the criteria for effective utilization of KPIs. Further, Boettger (2009), Buzalaka (2010), and Fahey (2011) all suggest that KPIs are important tools that can be used by SN professional for making operational decision and evaluating programs. These sentiments were corroborated by the majority of SN professional who indicated “KPIs when calculated correctly can provide essential information about the SN program,” “KPIs are useful for decision making,” and “KPIs are valuable tools for evaluating a SN program.”

Results of this study suggest the need for the development of training and resources to support SN directors, managers, and supervisors regardless of district size in effectively utilizing KPIs.

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SCHOOL COOKS' MOTIVATIONS TO ENGAGE IN PROTECTIVE ACTION AGAINST FOOD TAMPERING

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ABSTRACT

Food defense depends on restricting access of unauthorized persons to food production and storage areas. In school foodservice operations, cooks are available to challenge visitors, but little is known about their motivations to do so. Food production and meal service were observed at twelve schools and implementation of select food defense practices was noted. Two cooks from each school were interviewed about their perceptions of the threat of food tampering at their worksite. Although cooks expressed confidence in their ability to control access to work areas, they were less sure which stakeholder groups should be prohibited from entry.

Keywords: food defense, food tampering, school nutrition programs, bioterrorism

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INTRODUCTION

Food tampering is contamination of food with chemical, biological, or physical agents with the intention to cause harm to those who consume it (New York State Department of Health, 2005). Contamination may occur at any time as food flows from producer to consumer. Dalziel (2009) reported 11 confirmed incidents of food tampering in school and university settings worldwide between 1979 and 2005; four of these occurred in the United States. Food tampering is a significant concern because approximately 31 million school lunches are served daily in the United States (United States Department of Agriculture, Food and Nutrition Service [USDA-FNS], 2013). The large quantities of food produced for school meals make it possible for one act of contamination to affect many children. The time between preparation of the food and its consumption is short, posing a risk that many children may be exposed to the contaminant before it is detected.

Protective practices designed to reduce the threat of intentional food contamination are collectively called *food defense*. Restriction of access to food production and storage areas is a key practice in maintaining food defense. It has been noted that few schools in the upper Midwest have food defense plans in place (Klitzke, 2013). If a

food defense plan is in place, it was most likely developed by a district-level administrator who is not directly involved in production and storage activities. In practice, implementation of many aspects of a food defense plan will depend on the actions of the employees working in the kitchen. Production employees (cooks) are employees most likely to observe entry of unauthorized persons to vulnerable areas, yet little is known about their perceived ability or motivation to challenge intruders or implement other aspects of food defense.

On at least one occasion school foodservice employees prevented an attempted contamination of school food with *Salmonella*. In the 1984 Rajneeshee bioterror attack, a large community outbreak of *Salmonella* Typhimurium infections in September 1984 in The Dalles, Oregon prompted the local county public health department to request an investigation by the U.S. Centers for Disease Control (Torok, et al., 1997). The event occurred in September and October 1984, when members of a local religious sect contaminated salad bars on multiple occasions in ten restaurants. Their motivations were to influence a local election, the outcome of which they perceived would allow expansion of their physical facilities. The Centers for Disease Control identified salad bars as the source of the infections, but ruled out restaurant employees and food handling practices as causes. A year passed before criminal investigations by the U.S. Federal Bureau of Investigation linked the foodborne illnesses to the religious group. Grand jury testimony, reported in Carus (1998), quoted one woman who was directed to distribute *Salmonella* in two schools, but was unsuccessful. She related,

What happened is ... I didn't put [*the bacteria*] in [*the food*] because it –thank god for the fact that those ladies were really watching you see. So I could at least get in the car and dump the stuff out on the street (p.56).

Guidelines for food defense in school foodservice operations have been developed by USDA-FNS (2012) and the National Food Service Management Institute (2005), but have not given advice on motivating their implementation (Yoon, 2007). Limited research has been published about implementation of food defense practices in schools (Yoon, 2007; Klitzke, Strohbehn, & Arendt, 2014; Klitzke & Strohbehn, 2015). However, little is known about the motivations of the kitchen workers who have the most influence on access to food storage, preparation and service areas during the workday. Therefore, the research questions guiding this study included:

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- What are school cooks' perceptions of the threat of food tampering in their schools?
- Do school cooks feel they can be effective at preventing unauthorized persons from tampering with food during storage, preparation, and service?
- What procedures are in place to prevent unauthorized persons from entering food production and storage areas in school settings?

METHODS

Research Design

The study used a holistic case study design as described by Yin (2009). Twelve school sites were studied, with observation and interview data collected at all sites. This study was funded as part of a summer undergraduate research fellowship. Data collection took place during the spring/summer of 2014 and 2015. The goal for the first summer was to recruit two cooks at each of twelve schools; however only six schools and 12 cooks were recruited; the decision was made to extend data collection to a second summer. The first research group consisted of four upper division students and one faculty advisor. One student and the faculty member continued into the second year; in addition four new students and a second faculty advisor were added to the team. The returning student researcher assumed the role of student team leader, training and coaching the new student researchers so that data was collected consistently in both summers. This study was approved by the Institutional Review Board at Viterbo University.

Sample: A convenience sample of 24 public schools from Wisconsin, Minnesota, and Michigan were invited to participate; from these 12 schools and 24 cooks were recruited. Reasons for non-participation included lack of interest, busy time of year (near the end of the school year), kitchen was short-staffed, kitchen staff did not want to be observed, or health and safety policy would not permit researchers to have access to the kitchen. District enrollments ranged from 600 to 22,000 students and schools were located in municipalities with populations ranging from 1,600 to 99,000 (Table 1). Two school cooks, those with the longest and shortest employment at each school, were invited to participate in interviews.

Data Collection

Interview: Merriam (2009) asserted that a structured interview guide or schedule helps new researchers gain confidence in interviewing. The interview guide was developed by the first group of student researchers. It included 16 defined answer items selected to measure perceptions of the severity and likelihood of food tampering at their school and their ability to prevent or respond to such an

incident. The items were derived, with permission, from items used by Yoon (2007) to assess threat appraisal and protection motivation of a national sample of school and healthcare foodservice directors. The diction was simplified to be appropriate for a spoken format intended for a general audience. For example, Yoon's item *if someone intentionally contaminates food in my operation, my employees or customers will suffer from the attack* was adapted to *if someone tampers with the food in my school, my coworkers or students will suffer*. *Food tampering* was used rather than *intentional food contamination* because the phrase is more commonly used. As part of their training on the research protocol, the first summer research team engaged in role-playing an interview using the guide; from this they identified follow-up questions to evoke responses beyond the Likert scale options. The interview guide is shown in Appendix A. Interviews were audio-recorded, with prior permission of the interviewee.

One student researcher participated in both rounds of data collection and was assigned a leadership role in the second year. As group leader, she was instrumental in training the second cohort of researchers to follow the study protocol. She accompanied each member of the second group on their first school visits to provided support and assure consistent data collection procedures. Her efforts minimized variation in data collection procedures between the two years.

The six senior-level student researchers had completed a college course on motivational interviewing prior to this study. Their interviewing skills were assessed as part of their education program. Training for data collection included role-playing using the interview guide.

Observation: Researchers observed breakfast production and stayed until lunch service was completed. An instrument was developed to guide the observation period and to serve as a form for recording field notes (Appendix B). Fourteen food defense practices were selected from an assessment tool prepared for use in school food defense planning (USDA-FNS, 2012). Practices were identified from three sections: Inside Security, Foodservice Operation Security, and Personnel Security and Training. Items were selected if they were practices that focused on restricting access to production and storage sites and if they could be easily observed by the researchers. Team members of the first research group were trained to observe in the kitchen at a local school where they had previous work experience. To assure inter-rater reliability, team members made individual field notes at the training site and then compared observations until all were in agreement. To ensure consistent observation and interview

Table 1: School District Characteristics of Participating Schools

	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L
Student enrollment ^a	3,400	3,200	2,000	600	1,600	21,700	5,500	5,500	1,200	3,500	5,100	3,600
Primary production System ^b	CO	OS	OS	OS	OS	CE	OS	OS	OS	OS	OS	OS
Population of city ^c	21,000	28,000	6,000	1,620	3,000	99,000	18,000	18,000	5,000	9,000	11,000	9,000
Proportion of city population below U.S. federal poverty level 2009-2013 ^d	26%	21%	8%	NA ^e	NA ^d	19%	16%	16%	10%	5%	8%	7%

^aRounded to protect identity

^bCO = combination, OS = On-site, CE = Central

^cPopulation: Obtained from 2010 Census; rounded to protect identity; <http://www.census.gov/en.html>

^dData from 2010 United States Census

^eNA = data not available; central production systems have no facilities to serve meals to students; on-site production systems prepare and serve meals at the same

practices during the second summer, the student team leader accompanied each new researcher to her first school visit. Handwritten field notes were scanned and uploaded to QSR International's Nvivo 10 qualitative research software immediately upon return from the school visits.

Photographs: Permission was obtained to take photographs at all sites. Photographs of physical barriers and signs were taken to document implemented or absent best practices related to access to food storage, production, and service areas. Examples of photographs are shown throughout.

Data Analysis

Interview data: Recordings of interviews were transcribed by a transcriptionist trained in protection of human subjects in research. All team members read all of the transcripts obtained during their round of data collection. One student and both faculty mentors read all transcripts from both rounds of data collection. Team members individually identified themes from the transcripts, which were then discussed, defined, and refined during group discussion. The entire group agreed upon the phrases that were coded to each theme. Transcripts were uploaded into QSR International's Nvivo 10 qualitative research software and one member of the research team used the software to code quotes from the transcripts to themes according to the group decisions. After all transcripts were coded, a report showing the quotes assigned to each theme was printed. The second group of researchers reviewed all quotes coded to each theme and compared them to the definition assigned to each theme, revising the list as needed until all were in agreement.

RESULTS AND DISCUSSION

During May and June of 2014 and 2015, 12 schools were visited (Table 1). Observation was made of all meals served on the day of the visit and two cooks were interviewed at each site ($n = 24$). Photos were taken at five schools.

Analysis of the transcripts from the first round of data collection resulted in preliminary identification of six themes and 12 subthemes.

Seven themes were finalized after the second round of data collection and the number of subthemes was reduced (Table 2).

Cognitive Aspects

The theme of Cognitive Aspects reflected the thinking processes that emerged from the interviews. Sub-themes were Awareness and Insight, Misunderstanding, and Experience.

Awareness and Insight: Awareness emerged as a superficial understanding of the possibility of food tampering, which most interviewees dismissed as unlikely to happen at their site. If tampering were to occur, it would be more likely to occur prior to the arrival of the food at the school, during processing, packaging, or transportation. A disgruntled employee or angry student were identified as possible offenders. Insight reflected a deeper thinking process and recognition of the potential threat, up to and including the possibility of a terrorist act. Sample comments included:

I feel like it's urban myths, but there could be like glass in things that could hurt people in their food.

You might get a student who's mad and you try not to make enemies with these kids because you don't want them to just maliciously do something to their friend because they're mad at the foodservice.

Misunderstanding: This theme reflected the poor distinction made between intentional food tampering and contamination indicative of food safety issues. Most responses were focused on contamination as the result of unsafe food handling practices.

I'm not really afraid [of tampering] but one concern you would have is when the kids come through and they're not using the tongs or the utensils that are provided. If they have a cut on their hand or an open wound or other things and don't have clean hands, they're passing it on to others...

Experience: Only two food tampering incidents were reported: cooks from two different sites each mentioned a food tampering

Table 2: Comparison of Themes Identified From Interviews of School Cooks Over Two Rounds of Data Collection

Themes and Subthemes	
Spring 2014	Spring 2015
Knowledge	Cognitive
Experience	Awareness/insight
Confusion	Experience
Training	Misunderstanding
Consequences	Consequences
Sickness and death	Discipline
Loss of reputation	Sickness and death
	Reputation
Authorization	Authorization
Those authorized to be in the kitchen	(no subthemes)
Authorization is situational	
Physical Security	Physical Security
	(no subthemes)
Job Priorities	Job Priorities
False sense of security	(no subthemes)
Food defense is not my responsibility	
Worker Confidence	Worker Confidence
Confidence in ability to ask unauthorized visitors to leave the kitchen	(no subthemes)
Trust in coworkers and students to follow the rules	
	Physical Aspects
	(no subthemes)

situation that involved a student putting their used chewing gum into a container of fruit on a self-service line. This is fewer than the six food tampering incidents reported by school employees in a study of five school districts made by Klitzke (2014).

Consequences

Cooks identified possible physical, emotional and financial consequences of a food tampering incident at their school. Three subthemes emerged: Sickness or Death, Loss of Reputation, and Discipline (Table 2).

Sickness or Death: Sickness was most frequently stated as a consequence, mentioned by 13 of the 24 cooks. Cooks identified that tampering could lead to death: “someone could get sick or possibly die” and “we might get sick, get very, very ill, end up in the hospital.” Two cooks elaborated on symptoms that could be expected, “It would affect their body in one way or another with sickness, vomiting, diarrhea, that type of thing. And if it went further, it could be death. Nasty.” Another explained that “somebody could get very sick, choke, poisoned.”

Loss of Reputation: Cooks also identified personal consequences that could result from food tampering. They expressed beliefs that a food tampering incident would lead to a loss of reputation, which then would cause them to lose work time.

Yes, not only are there consequences to yourself but consequences to the entire school because then the news gets hold of it and letters go out to parents and now you're in front of everybody so now you have earn back that trust of the community and parents because they're going to want to send food to school with their kids versus eating at school because they're going to be afraid.

Somebody gets sick or die and then the reputation [of the program is harmed]. Totally lose the program and then out of a job.

Discipline: A theme emerged that an incident of food tampering would have disciplinary consequences and possibly bring in outside investigators.

I would think they [student perpetrators] would be expelled from school ... I'm sure the cops would be called in and there'd be an investigation, all that fun stuff they don't want to go through.

Authorization

All cooks were asked who was allowed, or authorized, to enter the kitchen area. Only two cooks flatly stated that no one was allowed in the kitchen except for the cooks. Fourteen (58%) of the cooks identified at least one stakeholder group given access to the kitchen, including principals, students, teachers, parents, custodians, and delivery personnel. Principals were perceived as having access to any part of the school building: “I would have to say principals can come in because they're allowed to come into any classroom. They have the authority.”

In certain situations cooks deemed it acceptable for non-foodservice employees to be in the kitchen. Several cooks noted necessity in authorizing delivery personnel to be in the kitchen.

‘Cause you'll have your deliveries coming in or your towel guy, it like ‘go in this area. Don't park it right here.’ We

kinda work with them and they know where to stay outta our way and vice versa.

Cooks identified the need for building maintenance staff to access the kitchen for repairs or to collect the garbage. The presence of teachers was tolerated, and even welcomed, if teachers needed to get food for students with special needs.

We have a couple of teachers come in and get coffee and generally, well you saw (name) walk into the kitchen. She came in and got a cup of coffee.

Teachers and other staff members are definitely allowed in here because ... we have a lot of diabetics who are struggling with keeping their blood sugar compliant so I want them to be able to come and get [snacks].

Parents were viewed as unauthorized visitors, with the caveat that parents selling concessions for school events may need access.

I guess the only people I have not seen in here, because I'm new, is parents. Parents don't get to come in here but everyone else pretty much does.

Observation field notes documented a variety of circumstances when unauthorized persons were allowed entry to the kitchen. Students filming for a class project entered the kitchen and were asked to leave. At another site students were observed to enter the service area and peek under lids to see what was for lunch, but they were not asked to leave. Coffee service attracted many teachers, a retired kitchen employee, and a bus driver. At two different sites the children of foodservice employees waited in the kitchen until it was time to be taken to a different school.

Physical Security Measures

Signs were used to control access to facilities (Photo 1). One cook doubted that signs were effective in preventing entry of unauthorized persons saying, “I know there's people back there even after posting the note.”

Many schools had storage areas located in areas distant from the kitchen, making access control difficult. Only one school had a security procedure in place to alert if the door to the distant freezer was opened. Chemical storage areas were observed to be unlocked and accessible to students in four schools (Photo 2). Dry storage



Photo 1. Example of sign restricting access to production area.



Photo 2. The open door on the left leads to a chemical storage area. The freezer is at the end of this hallway, in a remote location.

areas were observed to be unlocked during the school day at most sites (Photo 3).

Even when keyed areas were locked, poor control of keys reduced physical security. Periodically changing the locks had limited success in maintaining access control.

Well, we already tried re-keying certain areas that only certain people have [access to] but pretty soon copies start being made and handed out to this person or that person... or they said we've got authorization to the custodial [staff] and they don't know any better and they don't want to get caught up in the hassles. They usually let them in.

A cook reported that food service employees at the school do not have control over what goes on in the kitchen and storage areas outside of the normal work hours, "with the building open until 10:00-11:00 [at night], you've got people in here roaming around, the custodians are in here cleaning and go to do something else and somebody wanders in. Out of our control."

Physical Aspects

Observation data and interviews with the cooks presented elements of kitchen and storage layouts that were both obstacles and protective mechanisms. As an example, windows in the main kitchen office allowed managers to view production and service of meals (Photo 4). A layout feature with a negative effect was a dry storage area located next to an unlocked custodial closet (Photo 5).



Photo 3. Access to dry storage areas was unrestricted in five of the schools visited.

Although cooks expressed confidence that they could detect entry of visitors to the kitchen, observation showed that this was true while they were working in the kitchen, but not while they were working at serving breakfast and lunch. At four sites observers reported that activity in the kitchen was not visible from the cashier or the serving positions, and that there were not enough employees to monitor both kitchen and service areas. During observation at one school a cook reported that students sometimes stole food from the serving line because neither she nor the employee in the kitchen was able to



Photo 4. Office of foodservice director has large windows and clear view of service area.



Photo 5. The custodial closet and dry storage room are adjacent and both unlocked.

see and monitor the entire service line.

Physical features of the kitchen layout contributed to cooks' confidence that they could protect food from intentional contamination. Locks, counters acting as barriers, and an unobstructed line of site contributed to the perception that it was not difficult for cooks to keep unauthorized visitors out of their workspaces (Photo 6).

I don't feel that it's difficult to keep them from getting in. We're all in too many different areas and we have the



Photo 6. A physical barrier limits access but allows monitoring of service area after hours.

visibility to see if there is something going on so I don't think it is that difficult to keep them out because we're all in different areas, we can see if there's someone who popped up, it throws us a red flag right away.

Job Priorities

Foodservice production employees ranked day-to-day tasks as more important than keeping unauthorized people out of the kitchen and storage areas. Food defense was viewed as a manager's responsibility. One stated, "I feel it's the responsibility of the person in charge of the kitchen to make sure things are stored properly, they are cooked properly, and handled properly."

Cooks identified the need to handle food properly and maintain safe temperatures as taking precedence over food defense practices. Cleanliness, handwashing, preventing cross contamination, producing food on time, being organized, and maintaining safe conditions were prioritized above food defense.

It would be ... your handling of the food, your cleanliness, everything that's connected with keeping the food safe. That would be the most important thing. And then that would be naturally after that but you want to make sure everything, your work area is clean, your hands are covered, your hair is covered and what you're working with, everything is safe.

[*More important*] than keeping someone out of there? Doing my specific jobs that I do and then helping out the others when they need it just to make sure meals are prepared properly and get everything ready for the students for the day.

Worker Confidence

Cooks indicated varying levels of confidence in their ability to take action to keep unauthorized persons out of the production and storage areas if necessary. Some expressed strong confidence: "I can if I want to" and "No [I haven't been trained]; I have a big mouth, though," or "they gotta get past me first." Some were less sure they could keep out unauthorized visitors: "I'm not sure if I've run into that too much, but I would say no, I can't" and "if they want to fight me, I can't." For some, keeping students out of the kitchen was not an issue because the students know they are not allowed in those areas and adhere to the rules, stating "Our kids are pretty good here. They stay out."

Cooks reported occasional experience confronting unauthorized persons: "Well in the morning, once in a while the kids get kind of wild out there and then it's like they'll come in and pester but I say no, you kids have to back up," and "I've told people to get out of the area. Go on the other side of the serving line or whatever." Visitors may challenge cooks' authority: "Like [you tell them] no, you can't just come through the kitchen and then you get that look like who do you think you are. Ya, I've had that happen before."

CONCLUSIONS AND APPLICATIONS

The cooks interviewed in this study expressed a desire to prepare safe food for the children they serve. Their job priorities show a commitment to food safety that can be expanded on to include greater awareness of the threat of food tampering and implementation of food defense practices to mitigate it. Training programs for cooks planned to increase their awareness of this threat may increase their confidence in controlling access to school kitchens and storerooms. Knowledge of food defense threats and prevention falls under an essential function listed under Competency 4.2 of the

competencies for district-level school nutrition professionals put forth by the National Food Service Management Institute (2009).

The confidence to keep unauthorized persons out of the kitchen is a major component in maintaining food defense. Cooks tended to trust those with whom they worked, and held confidence that staff and students would follow the rules. The frequency with which cooks mentioned parents and students as unauthorized persons suggests cooks are certain that these groups should not be in the kitchen, however cooks may be less certain about the need to restrict teachers from the kitchen. Teachers were allowed in the kitchen if they had to obtain food needed for students with special needs; these visits could be eliminated if food items needed for medical or behavioral purposes were managed by the school nutrition program, but kept in another location, such as the health aide's office.

It may be necessary for custodial staff to have free entry to kitchen and storage areas, yet they may not be aware of the policies in place in order to prevent food tampering, suggesting they, too, should be involved in training for food defense. Cooks facing time pressures depend on delivery personnel to store food; however food defense can be improved if delivery personnel show credentials, make deliveries at pre-determined times, and arrange to have delivery entrances unlocked just prior to delivery.

Public school buildings in established communities may have been built more than 50 years ago, at the height of the baby boom. These facilities were built at a time when food was prepared from raw ingredients on site; the amount of refrigerator and freezer space needed then was much less than today. To cope, school foodservice operations may have had to locate storage facilities according to where they fit, not according to where they would be secure. The resulting hodgepodge of storage facilities should be assessed for security and priority given to restricting access to these areas, particularly areas where chemical supplies are stored. Observation data showed signs, locks, doors, and cameras were used as protective measures, but not always enforced. Locks tended to be left unlocked, and doors allowed to stand open for the sake of convenience. Key security was an issue because keys were given out to an array of people for deliveries and custodial needs. In those school districts where planning is underway for new construction, consultation with foodservice personnel trained in food defense practice would be beneficial in designing an environment suited for safety.

School foodservice operations in recent years have experienced reductions in staff to control costs at the same time they are adjusting to new, more stringent, regulations. One can understand why locks are available, but not used. There is a need for new and affordable technology that streamlines the process of locking and unlocking cupboards or doors.

The responsibilities of building custodial and maintenance staff are entwined with the foodservice operation because of the need to have access after-hours for cleaning and trash removal. Custodial staff should receive food defense training and processes be developed to promote collaboration between the physical plant and foodservice operations. Working together, cooks, custodians, and their managers could create practical, workable, low-cost strategies to restrict access to sensitive areas.

This study provides evidence that school cooks perceive food tampering as a dangerous threat, but one that is unlikely to happen. They express motivation to keep students safe; training about the threat of food tampering may be effective in giving them confidence

to keep unauthorized persons from kitchen and storage areas. Cooks assert that they can restrict students and parents from the kitchen, but observation revealed that unauthorized persons are allowed to enter production areas. Physical layouts that foster visibility are effective at promoting food defense, whereas locks and signs tend to be disregarded.

Limitations

Data was collected in two summers by eight researchers who were participants in a summer undergraduate research program. The number of researchers in this study was both a limitation and a strength. The large number of researchers was of value in recruiting the sample for this study. Many students had success recruiting their former high schools to participate in the study.

The large number of researchers provided strength in the coding and analysis of the interview data because all were actively involved, and served to establish trustworthiness of the data through the iterative discussions. Each student researcher was assigned one to two school visits; the small number of visits reduced the fatigue that might be associated with multiple day-long observation periods.

The small convenience sample of 12 schools and 24 cooks is a limitation of this study. Eleven of the twelve schools had an enrollment of 5,500 students or less and only one large school district was sampled. Ten out of the twelve sites were on-site production facilities; only one was a central kitchen production facility. These demographics limit the generalizability of these findings to larger school districts, or those with central or commissary production systems. Even so, small size does not make a community immune to bioterrorism: Torok, et al. (1997) reported that the population of The Dalles, Oregon, at the time of the intentional contamination of salad bars described earlier, was 10,500, with a countywide population of 21,000.

The observation and interview data was collected in May, very near the end of the school year. During this time of the year, some aspects of the foodservice operation may have been atypical. During all site visits meals were being produced as usual, but fewer food deliveries were likely being made because managers would want to end the year with as little food in storage as possible. This would limit the opportunities to observe cooks' reactions to visitors. In contrast, more students may have been visiting the kitchen during this time because they needed to clear up outstanding balances to their lunch accounts.

Although demographics relating to the school districts were collected, no effort was made to collect demographics of the cooks who were interviewed. The research protocol was to choose the most long-term and most recently hired cooks to interview. Cooks perceive that they hold relatively low status within the school; we did not want to ask for personal information that might strain the interview situation. Our sample was not large enough to allow difference tests based on demographics. In the geographic area represented by this study there is little ethnic or racial diversity among the population.

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**APPENDIX A
Interview Guide**

Site Code:	Participant Code:
Date of Interview:	Interview start time:

Obtain Informed Consent. Keep signed copy and hand interviewee an unsigned copy for them to keep.

Establish Rapport: Talk about weather, your memories of school, the season or other general topics.

I would like to know your opinions about food tampering. The definition of food tampering is: the contamination of food with chemical, biological or physical agents with the intention to cause harm to those who consume it. Contamination may occur during storage, preparation or service of food.

I want to keep my school safe.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

The top priority in my school is keeping students safe.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

It is unnecessary to worry about food tampering.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

I want to have more information about preventing food tampering.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

If someone tampers with the food in my school, my coworkers or students will suffer.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:
(If response is agree or strongly agree): What would be the consequences of a food tampering incident?

If someone intentionally contaminates food in my school, it will damage the reputation of our program.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

It is likely that a student will contaminate food in my school.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:

- Have you ever had an incident where food was contaminated by students?
- Can you describe what happened?
- Have you personally experienced food tampering?
- Is it possible that someone other than a student would tamper with food in your school?

Food tampering is frightening.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:

- What are you afraid might happen?
- How frightening is food tampering compared to other food safety issues?

Next I have a few questions about who **is** and **is not** allowed in the kitchen.
Who in your school **is not** allowed in the kitchen? Are students allowed? Principals? Custodians? Parents? Teachers?
We will call those not allowed in the kitchen **unauthorized** people

The following statements come in pairs, so they sound a lot alike. The first statement refers to the kitchen. The second statement in the pair refers to the storage rooms, refrigerators, and freezers.

Keeping unauthorized people out of the kitchen disturbs my work routine.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: (If response is agree or strongly agree) Can you give an example?				
Keeping unauthorized people out of the storage areas disturbs my work routine.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: (If response is agree or strongly agree) Can you give an example?				
I am able to keep unauthorized people out of the kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: Have you ever had to do this? What are you trained to do?				
I am able to keep unauthorized people out of the storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: Have you ever had to do this? What are your trained to do?				
It is important to keep unauthorized people out of the kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: Among your job duties, what is more important than keeping unauthorized people out of the kitchen?				
It is important to keep unauthorized people out of storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: Among your job duties, what is more important than keeping unauthorized people out of the storage areas?				
It is difficult to keep unauthorized people from entering our kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: What would make is less difficult?				
It is difficult to keep unauthorized people from entering our storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: What would make is less difficult?				

Thank you for participating in our study. Your participation is very important. The results of our study will be used to plan training programs about food tampering for school cooks like you. Do you have any questions you would like to ask me?

End of interview. State the time.

**APPENDIX B
Observation Form**

Site Code:	Date:
Observation Period: _____ to _____	
IRB Approval No.:	
Food Defense Practices:	Data Collection:
Limiting Access to Production and Storage Areas	
Visitors are restricted to specific areas or accompanied by school personnel	Describe restrictions or controls you experienced as a visitor to the school.
Access to foodservice production areas is restricted to foodservice or other authorized employees.	Record observations of any person, who is not a foodservice employee, who enters production or storage areas.
Access to food storage areas, including cold and dry storage areas, is limited (e.g., by locked door/gate or other) to essential employees.	Record observations of employees or others who enter dry storage rooms, walk-in freezers or walk-in coolers. Photograph signs, locks, or other methods of restricting access to these areas.
Unsupervised access, either during work hours or off hours, by giving keys, codes, etc. to suppliers/vendors, is not allowed.	Ask kitchen manager when deliveries are received. If deliveries are made outside of normal production areas, ask how the delivery personnel gain access to production and food storage areas.
Our school foodservice operation controls access by employees and vendors entering foodservice operation areas during <u>working</u> hours (e.g. coded doors, receptionist on duty, swipe card, etc.)	Photograph measures used to control access to production and storage areas.
Employees, visitors, and vendors are identified in some manner at all times while on the school premises.	Record observations of identification worn by foodservice employees, other school employees, and visitors.
Procedures exist for dealing with an unauthorized person(s) in restricted areas, including restricted foodservice areas.	Ask available foodservice workers what they have been told to do if unauthorized persons enter production or storage areas. Record reactions of foodservice personnel to unauthorized persons entering production and storage areas.
Monitoring of Production and Storage Areas	
At least one authorized employee is required to be present in the foodservice area at all times when the area is not locked, for example during meal service set-up.	Observe whether at least one foodservice employee is present in the production area at all times while area is unlocked.
Foodservice equipment (such as steam-jacketed kettles, steamers, choppers, hot/cold storage systems, or mixers) is monitored when in use to prevent someone from intentionally contaminating food during preparation.	Observe whether at least one foodservice employee is within sight of foodservice equipment while it is being used to prepare food.
There are procedures to monitor all foodservice areas for signs of suspicious activity or unauthorized entry. This includes self-service areas such as buffets and salad bars, receiving, outside storage, and sold waste disposal.	Observe employee monitoring of self-service bars during meal service. Observe receiving processes for food orders.
Management	
An updated employee roster is kept by management, i.e., who is absent, who the replacements are, and when new employees are being integrated into the workforce.	Ask kitchen manager about employee roster, attendance records, and monitoring of new employees.
All foodservice employees receive training on food defense procedures as part of their orientation training.	Ask available foodservice employees if they have been trained to prevent food tampering, and when this training occurred.
All foodservice employees receive training on food defense procedures as part of regular in-service update training.	Ask available foodservice employees if they have received training during which the term "food defense" was used.
Employees are encouraged to report signs of unknown or suspicious persons in the facility.	Ask available foodservice employees what they are trained to do if they observed a suspicious person in food production, storage, or service areas.

EVALUATING THE IMPACT OF FOOD SAFETY MESSAGING POSTERS ON OBSERVED EMPLOYEE FOOD SAFETY BEHAVIOR: A MIXED METHODS APPROACH

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ABSTRACT

This study examined changes in retail foodservice employees' food safety behaviors after food safety messaging poster implementation in eight foodservice sites serving older adults. Microbial, observational, and interview data were collected at each site on three occasions: pre-, short term post-, and long term- post poster intervention. Based on observational data, no significant changes in compliance rates were found upon short term post-intervention. Increased compliance was observed in two facilities and decreased compliance in two other facilities at long term post-intervention. Factors that appeared to impact intervention included: involvement of employees in poster implementation, food safety training, and poster rotation.

Keywords: food safety training, safe food handling, observational study, mixed methods

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INTRODUCTION

Foodborne pathogens are estimated to cause 47.8 million illnesses, 127,839 hospitalizations and 3,037 deaths annually in the United States (Scallan, Griffin, Angulo, Tauxe, & Hoekstra, 2011; Scallan et al., 2011). Given Americans' increased consumption of food away from home (United States Department of Agriculture & Economic Research Service, 2014), the risks of illness associated with unsafe food handling practices among retail foodservice employees is present. In fact, 75% reported foodborne illness outbreaks between 1998 and 2008 were attributed to foods purchased from a retail foodservice establishment (Gould, Walsh, Vieira, Herman, Williams, Hall, & Cole, 2013). Foodservice employees' health and hygiene, and unsafe food handling practices have been identified as two (of nine) contributing factors of restaurant-associated foodborne illness (Gould, Rosenblum, Nicholas, Phan, & Jones, 2013). This highlights the important role foodservice employees have on maintaining food safety.

Some individuals are more vulnerable to foodborne illness than others, including people with compromised immune systems, pregnant women, children, and older adults (McCabe-Sellers, &

Beattie, 2004). Research has shown older adults are susceptible to various foodborne illnesses (McCabe-Sellers, & Beattie, 2004; Nielsen et al., 2010; Weinberger et al., 2004), and more likely to die after having infections such as *Escherichia coli* O157:H7 (Gould, Demma, Jones, Hurd, Vugia, Smith, Shiferaw, Segler, Palmer, Zansky, & Griffin, 2009). Contributing factors to the high risk of foodborne illness among older adults include compromised immune systems, decreased gastric motility, prevalence of malnutrition, and living environments (e.g., long term care facilities) (Smith, 1998). Vulnerable populations (e.g., older adults) should avoid high risk foods such as unwashed fresh vegetables, including unwashed leafy greens (Lund & O'Brien, 2011).

Foodborne illnesses have been associated with a variety of commodities including fresh produce (e.g., leafy greens). Globally, leafy greens have been ranked a high priority commodity of concern due to risk of microbiological hazards related to high volume production, high number of foodborne illness outbreaks associated with leafy greens, and complex growing and processing conditions (Food and Agriculture Organization of the United Nations & World Health Organization, 2008). Based on Foodborne Disease Outbreak Surveillance System data from 1998-2008, about half of domestically acquired foodborne illnesses in the United States were associated with plant commodities (Painter, Hoekstra, Ayers, Tauxe, Braden, Angulo, & Griffin, 2013). More specifically, an estimated 22.3% (n=2,152,652) of foodborne illnesses were attributed to leafy greens (Painter et al., 2013). Increased consumption of fresh produce – and leafy greens in particular, the tendency for leafy greens to be consumed raw (e.g., ready-to-eat salads), and unsafe food handling practices may be potential contributors to illnesses linked to leafy greens.

Foodservice employees' shortcomings related to safe food handling practices are well-documented (Food and Drug Administration, 2000; Food and Drug Administration, 2009; Strohhahn, Sneed, Paez, & Meyer, 2008). Targeted interventions and training to improve foodservice employees' food handling practices have been created, implemented, and evaluated in a variety of foodservice environments. Research suggests the one-size-fits-all approach to training is not effective for a diverse foodservice workforce; therefore, multiple methods should be used to deliver food safety messages (Roberts, Arendt, Strohhahn, Ellis, & Paez, 2012). Use of minimal text posters may be one strategy to educate, remind, and cue employees to follow safe food handling practices when producing and serving potentially risky food items, such as leafy greens.

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Statement of Purpose

The purpose of this research project was to examine leafy green handling practices of retail foodservice employees serving older adults; and to use that information to develop, implement, and evaluate a food safety messaging intervention to improve safe food handling practices. The study was multifaceted, involving microbiological analysis of leafy greens and contact surfaces (data not presented); development and evaluation of food safety messaging and implementation materials; analysis of observed employee food safety behaviors; and analysis of interviews with employees about their food safety behaviors. The focus of this manuscript is to answer the research questions: 1) Did observed employee food safety behaviors improve post-intervention (after food safety messaging posters were implemented)? 2) What factors contributed to changes in observed food safety behaviors post-intervention? Both observational and interview data were integrated to address these research questions. Other findings from the research project, such as the microbial data, are reported elsewhere.

MATERIALS AND METHODS

Research design

A three-phase design was implemented to address the overall goal of developing effective food safety messaging for use in retail foodservice environments. In the first phase, a convenience sample of foodservice operations serving the elderly located in two states were visited (n=8). At that first visit, observations (of both employees and operations) were made and interviews were conducted. Observations were done when the employee was preparing and serving raw leafy green menu items, Validated assessment forms (Sneed, Strohbahn, & Gilmore, 2004; Strohbahn et al., 2008) which included 134 items, were used to record data about operational aspects (i.e. food safety messaging, standard operating procedures regarding leafy greens, facility design and equipment), however emphasized employee behavior when preparing leafy greens (i.e. hand hygiene, glove use, utensil use). Employees (n=16) were interviewed about their observed food handling behaviors. Researchers used an interview guide, however additional questions were asked during the interviews based on observed behaviors. For example, if an employee washed heads of lettuce before cutting them, the researcher asked why the lettuce was washed before cutting. Likewise, if a behavior was observed that was not in compliance, the researcher asked employees why an action was not taken. Researchers hand recorded responses.

Additionally, microbial data of both leafy greens and contact surfaces were collected but results are reported elsewhere. In brief, all samples were negative for *Listeria monocytogenes*, *Escherichia coli* O157 and *Staphylococcus aureus* tests; aerobic plate counts and coliform counts were not significantly different before and after intervention ($P < 0.05$). After intervention, fecal coliforms counts in samples of leafy greens from hospitals and restaurants were significantly lower than before intervention ($P < 0.0004$) (Roy, Shaw, Rajagopal, Strohbahn, Arendt, & Sauer, 2016).

Informed by the first phase results, the second phase involved development, evaluation and dissemination of visual-based, minimal-text, food safety messaging posters to each of the eight sites. The posters conveyed both leafy green handling and general food safety messages; the full set of posters can be viewed and downloaded from www.iowafoodsafety.org. The effectiveness of the intervention (i.e. food safety messaging poster implementation) was assessed in the third phase by collecting microbial, observational and interview data again at each of two post-intervention visits. The short term post-intervention visit occurred one month after poster implementation and the long term post-intervention visit occurred after three months

of poster implementation. Comparisons were made between pre-intervention (phase one) data and post-intervention (phase three) data to assess effectiveness of the food safety messaging intervention.

Site and participant selection

A purposeful sample of eight foodservice operations (two hospitals, two long term care facilities, two assisted living facilities, two restaurants) were included in the study. Matched facilities in two Midwestern states (i.e. one hospital in each state) were selected. Visits coincided with menus where at least one raw leafy green product was served to ensure researchers could observe and interview employees who prepared and served leafy greens. Employees who participated in the study were responsible for handling leafy greens (n=16). Foodservice managers (n=11) were also interviewed on two occasions post-intervention (at one month and after three months). Institutional Review Board approval and human subject consent was obtained for this study.

Data analysis

Compliance rates were examined to determine whether observed food safety behaviors improved post-intervention. Rates were computed as the number of observational items (i.e. behaviors) in compliance divided by the total number of items observed at each visit. In effect, when converted to a percentage, rates indicate percentage of food safety behaviors observed in compliance. The rates were computed for each site visit (pre-intervention, short-term post-intervention, long term post-intervention) at each of the eight sites (A-H). Chi-square was used to examine differences in compliance rates pre-intervention versus compliance rates short term post-intervention; and compliance rates pre-intervention versus compliance rates long-term post intervention. Statistical Analysis Software (SAS 9.4) was used to run the analyses.

Data from interviews were compiled and then hand coded independently by three researchers. Three researchers agreed upon codes and themes before final analyses were completed. Interview and other observational data are integrated in the following report of results.

RESULTS

Participant and site characteristics

Efforts were made to interview the same employees at each of the three visits, but because research design requiring coordination of site visits with the menu offerings, time frame constraints for visits, and employee turnover, this was not always possible. Table 1 depicts participants, identified by code names, and their demographic characteristics. Sixteen foodservice employees participated in the study, six of whom were interviewed and observed at more than one site visit. Most employees (n=13; 81.25%) worked full time. Employees represented a wide range of experience in foodservice operations, ranging from less than one year to 37 years of experience (average 15.4 years). Time worked in the current operation varied greatly as well, with employment at the current site ranging from two months to 32 years, with an average of 9.1 years tenure.

Statistical analyses

Figure 1 illustrates trends in compliance rates between pre-intervention, short term post-intervention, and long term post-intervention visits at each of the eight facilities involved in the study. No significant differences were noted in compliance rates short term post-intervention as compared to pre-intervention (Table 2). Statistically significant differences in compliance rates between pre-intervention and long term post-intervention visits were noted for four facilities (Table 3). Positive change (or increased compliance)

Table 1: Study Participant Demographic Data

Site	Pre-intervention				Short term post-intervention				Long term post-intervention			
	Name ¹	Status	Foodservice experience (years)	Tenure (years)	Name ¹	Status	Foodservice experience (years)	Tenure (years)	Name ¹	Status	Foodservice experience (years)	Tenure (years)
A	Abbie	FT	37	32	Mary	FT	21	11	Abbie	*	*	*
B	Buelah	FT	17	14	Buelah	*	*	*	Yvonne	FT	19	19
C	Candy	FT	27	22	Kate	PT	8	2	Kate	*	*	*
D	Daisy	FT	10	3	John	FT	5	.67	John	*	*	*
E	Elena	FT	7	0.8	Elena	*	*	*	Elena	*	*	*
F	Fiona	FT	10	6	David	FT	25	20	Donna	FT ²	10	5
G	Gayle	FT	25	3	Gayle	*	*	*	Gayle	*	*	*
H	Hailey	FT	22	7	Kyle	PT	2	.5	Denise	PT	< 1	.17

¹Pseudonyms have been used to maintain the privacy of the respondents
²FT = full time, PT = part time; *employee interviewed at previous site visit.

was observed in two facilities and negative change (decreased compliance) was observed in two facilities. In the next section, each of these cases are discussed in depth.

Integration of observational and interview data

Significant changes post-intervention (compared to pre-intervention) were noted for four sites: A, B, C, and F. The following discussion integrates the statistical results with qualitative results (e.g., interview and observation) to address the research questions.

Site A: For Site A (a hospital), the long term post-intervention compliance rate (91%) was significantly higher than the pre-intervention compliance rate (77%, $p=0.019$). Two different employees were interviewed and observed at Site A. Specifically, “Abbie” participated during the pre-intervention and long term post-intervention site visit; while “Mary” participated in the second site

visit. Both had substantial experience working in foodservice (37 years and 21 years, respectively) and had worked at Site A for more than ten years (32 years and 11 years, respectively). Abbie had received more formal food safety training through the ServSafe® Certification program and experience as a certified dietary manager whereas Mary was not ServSafe® Certified, but had participated in the organization’s food safety training. Though there was a small change between pre-intervention (when Abbie was observed) and short term post-intervention compliance rates (when Mary was observed), it was not significant (0.77, 0.82, respectively; $p=0.4640$). Note the same person was observed at pre-intervention and long term post-intervention visits which yielded a significant positive change in compliance rates. Also, a change in management occurred after the short term post-intervention site visit. This occurred after poster implementation.

The foodservice manager implemented the food safety messaging posters by first discussing the posters with employees at an in-service meeting, and then receiving employee input as to which posters should be displayed in the facility. When interviewed about the posters, this manager indicated “Posters are nice and look nice... employees helped pick the posters to display. They [employees] felt involved.” The act of involving stakeholders in making decisions that potentially impact them is termed participatory decision making. Participatory decision making has been widely studied across disciplines (Ananda, 2007; Irvin, & Stansbury, 2004; Parchman, Zeber, & Palmer, 2010; Severt, Xie, & Dipietro, 2007). Organizations are complex systems in a constant state of change because they must adapt and evolve in response to both internal and external forces. Participatory decision making can be a vehicle to enhance existing connections between people and tasks, as well as establish new connections (Ashmos, Duchon, McDaniel, & Huonker, 2002). The byproducts of establishing these connections between people and tasks include the exchange of specialized information as well as

Table 2: Analysis of Pre-Intervention and Short Term Post-Intervention Compliance Rates

Site	Pre-intervention	Short term post-intervention	Chi Square	p-value
	compliance rate	compliance rate		
A	0.77	0.82	0.5362	0.4640
B	0.89	0.86	0.4451	0.5047
C	0.79	0.84	0.8669	0.3518
D	0.63	0.50	3.7148	0.0539
E	0.74	0.67	1.4928	0.2218
F	0.81	0.74	1.5677	0.2105
G	0.60	0.63	0.3710	0.5424
H	0.64	0.54	2.5356	0.1113

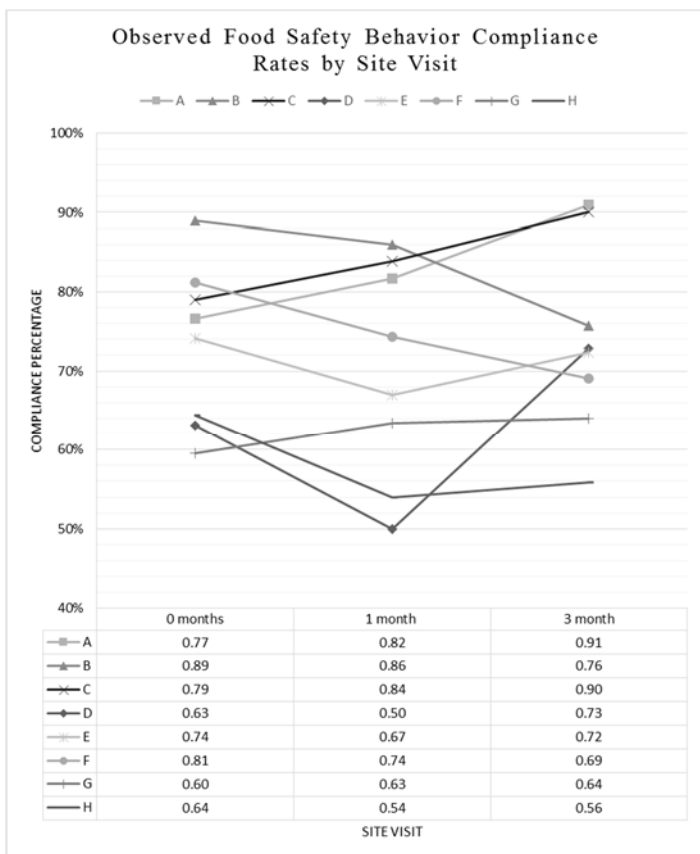


Figure 1: Observed food safety behavior compliance rates by site visit

Table 3: Analysis of Pre-Intervention and Long Term Post-Intervention Compliance Rates

Site	Pre-intervention compliance rate	Long term post-intervention compliance rate	Chi square	p-value
A	0.77	0.91	5.5229	0.0188*
B	0.89	0.76	6.0188	0.0142*
C	0.79	0.90	5.2941	0.0214*
D	0.63	0.73	2.3478	0.1255
E	0.74	0.72	0.1007	0.7510
F	0.81	0.69	4.5672	0.0326*
G	0.60	0.64	0.5099	0.4752
H	0.64	0.56	1.6997	0.1923

*Statistically significant at $p < .05$ level

commentary and discussion of the meaning of that information – both of which contribute to an amplified effect of the information (Ashmos et al., 2002).

When the Site A foodservice manager involved employees in the implementation of food safety messaging posters, employees were provided the opportunity to make connections with each other, and with the information (food safety messages). Involving employees in selection of the posters likely yielded discussion of the food safety messages, thereby amplifying the impact of the information as compared to if posters had been hung without discussion. Additionally, Abbie’s food safety training may have provided a foundation for knowledge, and the posters served as a reminder for safe food handling practices. These factors may have contributed to the significant positive change in behavior compliance noted at the long term post-intervention visit.

Site B: Conversely, for Site B (a long term care facility), the long term post-intervention compliance rate (76%) was significantly lower than the pre-intervention compliance rate (89%, $p=0.014$). The negative change in compliance rates may be attributed to changes in personnel during the study – including the employee interviewed/observed and the manager. Posters were displayed on the communications and safety bulletin board and remained there throughout the study period. Managers at participating sites were asked by the research team to rotate food safety messaging posters as a strategy to call attention to posters and increase exposure to different food safety messages. This strategy was not implemented at Site B.

At the initial visit, there appeared to be a positive food safety culture established as evidenced by daily “safety huddles” with all kitchen employees. The term “organizational culture” refers to the shared beliefs and values which govern the way things are done in an organization (Ungku Zainal Abidin, Arendt, & Strohbehn, 2014); in foodservice operations, food safety culture refers to “the way we do things [food safety] around here” (Yiannis, 2009, p. 12) and is a component of the cultural constructs of the organization. Yiannis, vice president of food safety at Walmart, noted “There is no question that an organization’s culture influences how it does safety. The organization’s culture will influence how individuals within the group think about safety, their attitudes toward safety, their willingness to openly discuss safety concerns and share differing opinions, and, in general, the emphasis they place on safety” (Yiannis, 2009, p. 13).

Leadership plays a crucial role in establishing and maintaining a positive food safety culture as it is best implemented when initiated

at the top and flows down (Yiannis, 2009). Before the short term post-intervention visit, Site B had a change in foodservice managers. The food safety messages were implemented at this site, the then-manager called attention to the posters during the safety huddle. Four posters were implemented and remained on display through the duration of the study. Though the compliance rate did not improve short term post intervention, the positive food safety culture was maintained despite the change in management personnel as evidenced by no significant change between pre-intervention and short term post-intervention visits (89% at pre-intervention, 86% at short term post-intervention, $p=0.5047$). It is possible the newer manager at this site did not effectively maintain the previously established food safety culture, or the manager’s focus was elsewhere. Either of which may have impacted the long term significant decrease in observed food safety behavior compliance rate.

Perhaps a more plausible explanation is that the negative change in compliance rates may be attributed to observation of different employees. “Buelah,” was interviewed/observed during pre-intervention and short term post-intervention visits, while “Yvonne” was interviewed/observed during the long term post-intervention visit. No significant change was noted between the two visits at which Buelah was observed/interviewed. Buelah was a full time employee: 17 years of experience in foodservice; 14 years of experience in current operation; 17 years of experience handling leafy greens; and ServSafe® certified. It was apparent Buelah had internalized knowledge gained from formal food safety training and that the knowledge she had served as a form of motivation for safe food handling behaviors. When asked why gloves were used when handling leafy greens, she said, “For [this state], prepared food/ready-to-eat food, you must use gloves,” and that “It is a ready-to-eat food so we need to use gloves.” Buelah exhibited awareness for cross contamination as she was observed cleaning the sink before washing leafy greens in a colander. When asked about this procedure, she indicated lots of different foods were handled in that work area, so she washed sink as a precaution. Research has shown formal food safety training courses can have positive impact on attitudes, awareness (knowledge), and appreciation for food safety behaviors, though these benefits may or may not translate to actual behaviors (Brannon, York, Roberts, Shanklin, & Howells, 2009). Based on Buelah’s rationale for following certain safe food handling behaviors, the formal training she received appeared to have a positive impact on her behaviors.

The behavior compliance rate was significantly lower at the long term post intervention visit, when Yvonne was observed/interviewed. Yvonne was a full time employee with 19 years of experience in long term care, and 10 years of experience at the current operation. Yvonne had no formal food safety training; her coworker taught her how to handle leafy greens when she first started. Yvonne had several years of experience working in non-commercial foodservice operations, however this experience may not have had an impact on food safety behaviors in the absence of formal food safety training. Experience alone may not yield sufficient knowledge or appreciation for handling food safely (Brannon et al. 2009). On two separate occasions, when Yvonne was asked why safe food handling behaviors were followed it was indicated she simply followed the instructions of management. Specifically, when asked why gloves were worn Yvonne reported, “They told me to – I don’t know why.” And when asked about cleaning and sanitizing procedures, Yvonne said, “Supervisor told me about this.”

Site C: Implementation of the food safety messaging posters appeared effective at Site C. Compliance rates post-intervention were

significantly better than compliance rates pre-intervention at Site C, an assisted living facility. The long term post-intervention compliance rate (90%) was significantly higher than the pre-intervention compliance rate (79%, $p=0.021$). Contrary to Site A, which utilized participatory decision making during the implementation process, this positive outcome was achieved without managers taking any additional measures during poster implementation. That is, posters were simply selected by the manager and displayed in the facility, without announcement or employee input.

“Candy” was interviewed and observed at the pre-intervention visit whereas “Kate” was interviewed at both short and long term post-intervention visits. Candy was a full time employee who had worked at the operation for 22 years, with a total of 27 years foodservice experience. Her responsibilities since hire included preparing leafy greens. Candy was ServSafe® certified, and had also received basic food safety training as part of her Certified Dietary Manager requirements. Kate was a part time employee who had been working in various foodservice operations (e.g., restaurants, university dining, retirement community) for eight years. She had received ServSafe® certification as part of a college class.

Studies have shown foodservice managers and employees with food safety certifications, such as ServSafe®, had greater knowledge than those without food safety certifications (Brown et al., 2014; Lynch, Elledge, Griffith, & Boatright, 2003). Though knowledge does not always result in desired behaviors, knowledge can serve as a motivator for behaviors. Furthermore, combining ServSafe® training with food safety interventions has been shown to yield better employee food safety behaviors, as illustrated in a recent study. York et al. (2014) investigated the relative effectiveness of ServSafe® training, a targeted on-site intervention (including providing thermometers, incentive program, and persuasive signs), and a combination of both ServSafe® training and the intervention. When examining overall food safety behavior compliance rates, the group of employees who received the ServSafe® training only performed similarly to the group who received the intervention only. However, the group that received both Servsafe® training and the intervention had a higher compliance rate score than the intervention only group (York et al, 2014). These results illustrated the effectiveness of combining an on-site intervention with formal food safety training methods.

Similar to the York, et al. (2014) study, the combination of Site C participants’ ServSafe® certification training and the food safety messaging intervention may have contributed to the positive changes in food safety compliance rates observed.

Site F: Despite implementation of the food safety messaging posters, food safety behavior compliance rates decreased post-intervention at Site F, a long term care facility. Specifically, the long term post-intervention compliance rate (69%) was significantly lower than the pre-intervention compliance rate (81%, $p=0.033$). This decline in compliance rates may be due to participant changes during the study.

Three different employees from Site F participated in the study: “Fiona” during pre-intervention visit, “David” at short term post-intervention visit; “Donna” at long term post-intervention visit. Fiona was a full time employee with 10 years foodservice experience. She had worked in the current operation for six years and had been responsible for preparing leafy greens throughout the duration. Fiona received some general training when she started and stated the following, “...about how to handle things. Mostly, how to keep

lettuce looking fresh and stuff for the customer. We talk about food safety about once a year. It’s really important.” David was a full time employee with 25 years foodservice experience. He had worked at the current operation for about 20 years and had been responsible for preparing leafy greens during that entire time. David had not received training specifically for produce handling; he said, “We pretty much just know what to do, you know keep stuff clean and don’t make people sick.” There was a decline in compliance rate between the pre-intervention visit with Fiona (0.81) and the short term post-intervention visit with David (0.74), however this change was not significant ($p=0.215$).

At the long term post-intervention visit, the foodservice manager commented, “several new staff were hired since your last visit.” Donna, who participated in the long term post-intervention visit, was one of those newer employees. She was a full time employee with 10 years of experience in foodservice and had worked at the operation about two months when she participated in the study. She had been responsible for preparation of leafy greens since her hire. When asked about food safety training, Donna indicated she had “a little training in her Certified Dietary Manager courses.”

The lower compliance rates post-intervention may be attributed to employee turnover without opportunity for food safety specific on the job training upon hire. Also, because Donna had not worked in the operation throughout the duration of the study, her exposure to the food safety messaging posters may not have been as great. The effect associated with the novelty of “new” posters being hung may not be as great because posters were already implemented upon hire.

Other sites: Compliance rates for Sites D and H (both restaurants) were consistently among the lowest in comparison to other sites. This may be attributed to lack of knowledge about safe handling of leafy greens, and lack of motivation to change food safety behaviors. Employees ($n=5$) from these two sites indicated a lack of training on how to handle leafy greens. “Hailey,” who worked at Site H, reported, “on the first day we get some general sanitation training. We don’t really do anything specific to produce, it is broad.” “John” and “Daisy,” from Site D, were taught how to handle leafy greens by a previous chef. A manager at Site D commented the poster content showed “some discrepancy with current thinking” particularly related to the practice of re-washing bagged lettuce. At the initial site visit, an employee was observed rewashing bagged leafy greens. Despite implementation of task-specific food safety messaging poster (i.e. Bagged Leafy Greens Do’s and Don’ts) in the facility, an employee was observed improperly re-washing bagged leafy greens at the long term post-intervention visit as well. Though the intervention directly addressed a misconception presumably passed from one employee to another via informal on-the-job training, behavior change was not realized. Managers play an essential role in training, monitoring, and enforcing employees’ safe food handling behaviors (Food and Drug Administration, 2009). These management roles are increasingly important when employee turnover is evident as well.

In addition to Sites D and H, food safety messaging posters did not appear to change observed food safety compliance rates long term at Site E (a hospital) or G (an assisted living facility). Though the difference was not significant, compliance rates decreased post-intervention for each of these sites despite the fact the same employees were observed throughout the duration of the study. Researchers noted employees who participated in consecutive site visits appeared more familiar with the protocol, comfortable with researchers, and relaxed at the latter site visits. Characteristic of the

Hawthorne effect, employees' participation in the study itself may have altered their behaviors – especially at the initial site visit. Knowing they were being observed, employees may have behaved differently at the initial site visit thereby not accurately reflecting day-to-day behaviors. However, as the study progressed and employees became more relaxed with the research protocol, their observed food safety behaviors may have been more reflective of the norm.

DISCUSSION

The purpose of this inquiry was to examine changes in employee food safety behavior after food safety messages were implemented in foodservice operations serving older adults. Significant changes were detected for four of the foodservice operations; two of which were positive and two negative. Coupling statistical (chi square) data with qualitative observational and interview data for each of the four cases showing significant changes yielded several implications for industry professionals.

In the case of Site A, positive changes in employee food safety behaviors were observed post-intervention. The then-manager involved employees in the selection and implementation of posters. This participatory decision making process may have amplified the impact of the food safety messages. The effect of letting employees connect with the messages, and each other in the participatory decision making process may have negated the potential effect of having change in management during the study (assuming the change in management may have negatively impacted compliance rate). Therefore, we suggest industry professionals involve employees in this process as it appeared to heighten interaction with the subject matter, and with each other, which can support positive behavioral outcomes. The effect of peer interactions on food safety behaviors in the workplace has not been reported in the literature, and poses an opportunity for future research.

Study findings illustrate the fact that no single intervention will remedy all deficits in employee food safety behaviors. Visual-based, minimal-text, food safety messages can serve as tools for education and/or re-iteration. As illustrated in the case of Site C, even if employees have received food safety training previously, onsite food safety messaging interventions can still be helpful to influence food safety behaviors. Posted food safety messages serve as reminders of previous knowledge in the case of foodservice employees who have formal food safety training. Future studies may investigate whether the impact of the food safety messages differ among employees with previous formal food safety training and those without previous training. Food safety messages provide visual cues when strategically placed in food preparation areas. Further, the visual-based nature of the posters allowed for those with limited literacy to understand the message. Researchers suggested periodic rotation of the posters to ensure food safety messages did not become ordinary (and ineffective) to employees. Periodic poster rotation can help keep employees' attention, capitalizing on the effect of the visual cue.

The same participant was observed/interviewed at all three site visits for only two sites (E and G). This added complexity to the comparison of pre-intervention and post-intervention food safety compliance rates given that variability in the data may be attributed to employee-related factors as opposed to the intervention itself. Because site visit schedules were driven by facility menus and inability to coordinate employee schedules or control turnover, researchers could not ensure consistency in employee participation at any given site. However, researchers have considered differences among study participants in the report of results in an effort to minimize this limitation.

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A MIXED METHODS APPROACH TO EXAMINING FOOD ALLERGY ACCOMMODATION EFFORTS IN COLLEGES AND UNIVERSITIES

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ABSTRACT

This study examined food allergy accommodation practices and policies in colleges and universities (CU) using a two-phase explanatory sequential mixed methods design. Seventy-six (22.2% response) foodservice professionals responded to a national survey; 11 of whom participated in follow-up interviews. Most (74%) questionnaire participants reported departmental level food allergy policies existed at their institutions while 34% of participants reported presence of institutional level policies. Differences in the likelihood of published policies existed according to institutional demographic characteristics (e.g. institution type, foodservice management type), however findings suggest variability in CU foodservice professionals' approaches to accommodations, regardless of policy presence.

Keywords: food allergies, foodservice, college dining, mixed methods

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INTRODUCTION

Food allergies are a serious condition which can cause potentially life-threatening immunological reactions to ingesting specific foods (Branum & Lukacs, 2008). Food allergies impact about 15 million Americans (Food Allergy Research and Education [FARE], 2014). Ingestion of food allergens by affected individuals can cause symptoms involving various systems including respiratory tract, skin and mucous membranes, digestive tract, and nervous system (FARE, 2014); death by anaphylaxis is possible (Bock, Munoz-Furlong, & Sampson, 2001; Sampson, Mendelson, & Rosen, 1992). Having a food allergy can have psychosocial impacts on individuals (Bocket al., 2001; Sampson et al., 1992; Cummings, Knibb, King, & Lucas, 2010). Minimizing the risk of food allergic reactions requires avoidance of foods containing known allergens (FARE, 2014), which may be difficult – especially when food allergic individuals dine away from home. Difficulty in food avoidance when dining away from home may be compounded when a substantial proportion of an individual's dietary intake comes from foodservice operations, such as school or college and university (CU) dining. Foodservice operations' failure to safely accommodate food allergic patrons is documented (Knoblauch, 2009; Kwon & Lee, 2012).

Section 504 of the Americans with Disabilities Act of 1990 (ADA) indicates an individual with a disability cannot be denied benefits of any program or service receiving federal funding based on their disability. Reasonable accommodations must be made to meet the needs of students with disabilities to the extent that other students' (without disabilities) needs are met (U.S. Department of Education, 2009). This legislation has implications for K-12 schools and higher education institutions as both may receive federal funding and potentially serve students with food allergies, which can be

considered a disability under the ADA. Given the increased prevalence of food allergies among children and adolescents (Branum & Lukacs, 2008, 2009), the legal requirement to accommodate, and a general concern for students' overall well-being, K-12 school officials must make efforts to ensure safe environments for food allergic students. Food allergy accommodations in K-12 schools have received considerable attention (Molaison & Nettles, 2010; Sheetz et al., 2004). The recent School Health Policies and Practices Study (SHPPS) conducted by the Centers for Disease Control and Prevention (CDC) revealed 84% of states distributed model policies, policy guidance, or other materials addressing severe food or other allergies (U.S. Department of Health and Human Services, CDC, 2013).

College and university (CU) foodservice operations face unique challenges when accommodating students with food allergies. Adolescents and young adults are the most susceptible to food allergy induced anaphylaxis due to risk taking behaviors, failure to recognize symptoms of anaphylaxis, and failure to carry and/or administer self-injectable epinephrine in a timely manner (Bock et al., 2001; Sampson et al., 1992; Sampson, Munoz-Furlong, & Sicherer, 2006). A review of 32 cases of fatality due to food allergy induced anaphylaxis revealed 21 (66%) were adolescents or young adults between the ages of 13 and 21 (Bock et al., 2001). Sampson, Munoz-Furlong, and Sicherer (2006) found that in comparison to other activities, adolescents with food allergies were more concerned about school, making friends, and staying fit than about their food allergies.

Legal implications for CUs can occur when college students are not adequately accommodated. In 2009, the U.S. Department of Justice received a complaint that Lesley University had violated the ADA because reasonable accommodations were not made for students with celiac disease. (U.S. Department of Justice, 2013). This case set a legal precedent as it was the first time a higher education institution and the Department of Justice settled an alleged violation of the ADA pertaining to dietary accommodation (HSE Legal Currents, 2013). The details of the settlement have practical implications for professionals at other CUs, outlining measures that can be taken to accommodate students with celiac disease and other diet-restricting conditions such as food allergies (Celiac Community Foundation of Northern California, 2013; Gragreen, 2013; HSE Legal Currents, 2013).

Though limited research regarding food allergy accommodations practices in CUs exist, known studies have examined food allergy management from various perspectives including foodservice workers (Choi & Rajagopal, 2013), students with food allergies (Greenhawt, Singer, & Baptist, 2009), and foodservice directors (Rajagopal & Strohbehn, 2011). Rajagopal and Strohbehn (2011) examined CU foodservice directors' perceptions and attitudes toward food allergy accommodation practices and policies. Foodservice directors reported lack of published food allergy policies both at the institutional level (72 of 95 had no institutional policies) and foodservice department level (52 of 95 had no department policies)

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(Rajagopal & Strohbehn, 2011). Because the environment for CU food allergy accommodations may have changed in the five years that have passed (e.g. Lesley settlement, *Voluntary Guidelines* in the K-12 sector) since Rajagopal and Strohbehn (2011) published this work, this study examined food allergy accommodation policies and practices that are currently being used in CUs. The specific objectives are to:

1. Analyze formal (published) policies and procedures for food allergy accommodations in CU foodservice operations.
2. Evaluate food allergy accommodation practices in CU foodservice operations.
3. Determine whether variation in food allergy accommodation practices exist between different types of CU foodservice operations.

METHODS

A two-phase explanatory sequential mixed design was employed to address the research objectives. The sequential design involved use of the quantitative phase (i.e. questionnaire) results to inform the qualitative phase (i.e. interviews) (Nastasi, Hitchcock, & Brown, 2010). Approval from the university's Institutional Review Board (IRB) was received prior to contacting potential participants.

Phase One: Questionnaires

Population: Participants were recruited from the 2014 National Association of College and University Food Services (NACUFS) membership directory. One foodservice professional from each 4-year, U.S. institution listed was selected (n=359). The first person listed in the directory for each qualifying school, typically the director, was selected. However, if the director was not listed, then either a manager or dietitian/nutritionist was selected.

Due to firewalls or invalid e-mail addresses, the invitation e-mail reached 342 foodservice professionals. The invitation e-mail contained a link to the Qualtrics[®] questionnaire. Participants had the

opportunity to enter a drawing to win a gift card valued at \$25. Distribution and follow up followed guidelines set forth by Dillman, Smyth, and Christian (2009).

Questionnaire: A questionnaire was developed, pilot tested, and administered online to assess CU foodservice professionals' perceptions of food allergy management policies and practices. The pilot study occurred in two phases. First, three content experts reviewed the questionnaire and then the questionnaire was administered to a subsample (n=6) of the target study population. Each group of participants provided feedback regarding content, readability, format, and time required for completion. Revisions were made to the questionnaire after review from each group.

The final questionnaire contained items related to demographics, food allergy accommodation practices and policies, and other questions not reported in this manuscript. The first section collected information about participants, foodservice departments, and institutions represented. The second section contained items that assessed presence of various elements of food allergy accommodation policies at the institutional and departmental levels (see sample questionnaire items in Figure 1); items were adapted from previous research (Rajagopal & Strohbehn, 2011) or developed anew. Additional questions regarding training and operational practices were asked.

Data analysis: Questionnaire data were analyzed using SPSS 22.0. Frequencies were computed for each questionnaire item. Two sample population proportion tests were used to determine whether the presence of food allergy accommodation policies differed according to demographic characteristics (e.g. institution type, foodservice management type). Specifically, this statistical test was used to examine whether a difference existed between the proportions of public CUs with policies in comparison to the proportion of private CUs with policies. Food allergy accommodation practice scores were computed for each

Which of the following are included in either the institution or foodservice department food allergen policy (written and published in governance documents)?

	Institution	Department
Outline of qualifications and eligibility criteria	<input type="checkbox"/>	<input type="checkbox"/>
Required medical documentation of food allergy	<input type="checkbox"/>	<input type="checkbox"/>
Required documentation of disability due to life threatening food allergy	<input type="checkbox"/>	<input type="checkbox"/>
Required students to sign a release of liability waiver	<input type="checkbox"/>	<input type="checkbox"/>
Contact person for food allergy accommodation inquiries	<input type="checkbox"/>	<input type="checkbox"/>
Person responsible for ordering allergen-free products	<input type="checkbox"/>	<input type="checkbox"/>
Required development of emergency action plans	<input type="checkbox"/>	<input type="checkbox"/>
Required multiple departments' coordination of accommodation efforts	<input type="checkbox"/>	<input type="checkbox"/>
Outlined evaluation of quality of food allergy accommodation efforts	<input type="checkbox"/>	<input type="checkbox"/>
Involvement of dietitian or person with nutrition training	<input type="checkbox"/>	<input type="checkbox"/>
Training or professional development for foodservice staff related to food allergies	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1: Selected Questionnaire Items: Policy Content

operation. This was the sum of accommodation practices reported in the departmental food allergy policy (11 questionnaire items depicted in Figure 1) and operational aspects (5 questionnaire items). Therefore, the maximum practice score was 16. Practice scores were only computed for participants who reported policies were in place at the departmental level. Then, pooled sample t-tests were used to determine whether mean practice scores differed based on the two examined demographic characteristics.

Phase Two: Interviews

One-on-one telephone interviews were used to provide deeper explanations for food allergy accommodation policies and practices at CUs. Participants were recruited from the questionnaire respondent pool.

Sample: The sample consisted of participants from phase one who indicated willingness to participate in a follow-up interview. Eleven foodservice professionals representing the six NACUFS regions participated in the interviews.

Interview guide: An interview guide was developed based on the review of literature and phase one results; after development, the guide was reviewed by experts for clarity and comprehensiveness. Interview guides are useful to ensure consistency between interviews, and to facilitate efficient analyses (Krueger, 1998). Questions were open ended and follow up questions were asked during the interviews to help elicit more in-depth responses, clarifications, and examples (Rossman & Rallis, 2012).

Data analysis: All interviews were audio recorded and an experienced transcriptionist converted the audio to textual transcripts. Researchers analyzed data as interviews were conducted and transcribed enabling researchers to recognize when no new themes emerged from the data. Transcripts were sent to interview participants (n=11) who were asked whether interview transcripts were an accurate depiction of their experience. This member checking process was used to ensure trustworthiness of the data as recommended by Creswell and Clark (2007). Three researchers independently coded transcripts by hand and then agreed upon codes and themes prior to final analysis as recommended by Creswell and Clark (2007). Illustrative quotes from the interviews were used throughout the results and discussion section; participants were identified by pseudonyms.

RESULTS AND DISCUSSION

Profile of Respondents and Institutions

Questionnaire: Three hundred forty-two e-mail invitations were delivered yielding 81 responses (22.6%). Five questionnaires were unusable due to early survey attrition; incomplete questionnaires were retained for analyses if more than half of the items were completed. Therefore, 76 questionnaires (22.2%) were deemed usable for analysis. As depicted in Table 1, most participants were age 41-60 years (n=47, 61.9%) and female (n=46, 60.5%). Participants reported a wide range of educational levels ranging from a high school diploma to a PhD; however, most participants held a bachelor's degree (n=38, 50%). About half of the participants (n=35, 46%) had worked in CU foodservice 10 years or less. A majority (n=67, 88.1%) were certified in food safety through a course approved by the Conference for Food Protection (i.e. ServSafe[®]).

Forty-five (59.2%) participants worked in public CUs (Table 2) and the most represented geographic region was the Midwest (n=26, 34.2%). Institution size, indicated by reported enrollment numbers, ranged from under 1,000 to greater than 50,000. Because the public

Table 1: Questionnaire Participants' Demographics (n=76)

Category	Frequency (n)	Percent (%)
Age		
Less than 40 years old	22	28.9
41-50 years old	23	30.3
51-60 years old	24	31.6
Over 60 years old	7	9.2
Gender		
Female	46	60.5
Male	30	39.5
Highest Level of Education		
High school	5	6.6
Associates or culinary degree	8	10.5
Bachelor's degree	38	50.0
Master's degree	22	29.0
Doctorate	2	2.6
Non response	1	1.3
Time Worked in College or University Foodservice		
0-10 years	35	46.0
11-20 years	17	22.4
21-30 years	14	18.4
Over 30 years	10	13.2
Time Worked in Current Operation		
Less than 1 year	3	3.9
1-3 years	25	32.9
4-7 years	16	21.1
8-12 years	13	17.1
13-20 years	7	9.2
Over 20 years	12	15.8
Food Safety Course ^a	67	88.1
Registered Dietitian Credentials ^a	31	40.8

^aYes responses

institutions that were represented had larger enrollments (predominantly 20,000 and more) and private institutions that were represented had smaller enrollments (predominantly less than 20,000), institution type (i.e. public, private) was used as a proxy for institution size. Most participants (n=62, 81.6%) reported their foodservice departments were self-operated and 14 (18.4%) reported their foodservice departments were managed by contracted companies.

Interviews: Eleven foodservice professionals agreed to participate in the follow up interview representing each of the six NACUFS regions as follows: Southern region (n=3); Mid-Atlantic region (n=1), Pacific region (n=2); Continental region (n=1); Midwest region (n=2); and Northeast region (n=2) (see Table 3). Seven interview participants represented public institutions and four represented private institutions. The Fall 2014 enrollment for represented institutions ranged from about 2,800 to 35,500 with an average of 18,388 students. Seven interview participants were nutritionists or Registered Dietitians; three were in a management role (e.g. manager, director); and one was a marketing manager. The length of time participants had held their positions ranged from 8 months to 22 years. All participants reported direct involvement with food allergy accommodations efforts at their CUs.

Presence of Food Allergy Policies

It appears improvements have been made in the development and implementation of food allergy accommodation policies relative to previous research findings. Of questionnaire respondents, 55 (72.4%) reported food allergy accommodation policies in place at the

Table 2: Questionnaire Participants' Departmental and Institutional Characteristics (n=76)

Category	Frequency (n) ^a	Percent (%) ^b
Foodservice Management Type		
Contract	14	18.4
Self-operated	62	81.6
Type of Institution		
Public	45	59.2
Private	30	39.5
Geographic Region		
Continental	7	9.2
Mid-Atlantic	5	6.6
Midwest	26	34.2
Northeast	7	9.2
Pacific	15	19.7
Southern	13	17.0
Student Enrollment Fall 2014		
Less than 1,000 students	5	6.6
1,001 to 5,000 students	16	21.1
5,001 to 10,000 students	12	15.8
10,001 to 20,000 students	12	15.8
20,001 to 30,000 students	11	14.5
30,001 to 50,000 students	18	23.7
More than 50,000 students	1	1.3
Time accommodating students with food allergies		
Less than one year	2	2.6
1-3 years	7	9.2
4-7 years	23	30.3
8-12 years	22	28.9
13-20 years	10	13.2
More than 20 years	8	10.5

^aSome sections may not equal 76 due to non-response

^bPercentages may not sum to 100% due to non-response

departmental level while 25 (32.9%) respondents reported their CUs had food allergy accommodation policies at the institutional level; note it was possible for participants to report policies at both levels, or neither level. A 2011 study found only 43% (n=41) participating CU foodservice directors reported policies at the departmental level and 24% (n=23) reported policies at the institutional level (Rajagopal & Strohbehn, 2011). At that time, about half reported no policies at either level indicating policy development was in progress.

Differences in the presence of food allergy policies at the departmental level were examined based on demographics. Differences in the presence of food allergy policies at the institutional level were not analyzed statistically due to the small number (n=25) of participants that reported institutional policies and inability to achieve statistical power.

Private and public institutions: Two sample population proportions were used to analyze whether public CUs had greater presence of formalized departmental food allergy accommodation policies than private CUs. Results revealed this association was significant at the $p < .1$ level ($z = 1.39, p = .087$). Thirty-six (80%) participants from public institutions and 19 (63%) from private institutions reported food allergy policies in place at the departmental level. Research supports the notion public and private organizations differ on a number of dimensions (Scott & Falcone, 1998). One study found core organizational values differed by sector (public or private) such that the top public sector values included accountability, effectiveness, incorruptibility, and reliability whereas the top private sector values included profitability, accountability, expertise, and reliability (Van Der Wal, 2008). The greater presence of food allergy policies in public

CUs appears to align with the top four organizational values of public organizations – policies represent an effective, non-prejudiced (incorruptible), and reliable approach to accommodating students with special dietary needs (Van Der Wal, 2008).

Contract managed and self-operated foodservices: Analysis of population proportions also revealed contract managed foodservice operations had statistically greater presence of formalized food allergy accommodation policies than self-operated foodservices ($Z = 2.32, p = .010$). Foodservice departments run by contract managed companies have the advantage of learned insights from foodservice professionals across institutions to inform development of policies or provide access to policy templates that may be customized for individual operations. Harold, from a contract managed operation in a private institution, discussed the influence the contracted company had on the development of food allergy policies, and how corporate policy was amended for use at the CU department level:

“As a management company, we do everything from nursing homes where they’ve been dealin’ with allergens since the beginning of time as a dietary-type concern, all the way to [business corporations] where they don’t understand the need for it. So, we have to make our general corporate policy somewhat flexible so... we make it fit, whichever model that we’re overseeing... we spent the better part of four months taking the systems ...and applying them to our operations.”

Motivating Factors for Allergen Accommodations

Increased presence of formalized policies, in relation to years past, may be attributed to several factors. About half (n=6) of the interview participants reported institutional requirements for students to live on campus and purchase meal plan for a designated period of time (i.e. one or two years). Because the meal plan is required for those students, every effort is made to make

Table 3: Interview Participants' Personal, Departmental, and Institutional Characteristics (n=11)

Characteristic	Frequency (n) ^a
Job Title	
Registered Dietitian or Nutritionist	7
Foodservice Manager or Director	3
Marketing Manager	1
Management Type of Operation	
Contract	2
Self-operated	8
Type of Institution	
Public	7
Private	4
NACUFS Geographic Region	
Continental	1
Mid-Atlantic	1
Midwest	2
Northeast	2
Pacific	2
Southern	3
Student Enrollment Fall 2014	
1,001 to 5,000 students	3
5,001 to 10,000 students	1
10,001 to 20,000 students	1
20,001 to 30,000 students	2
30,001 to 50,000 students	4

^aSome sections may not equal 11 due to non-response

accommodations instead of releasing students from the meal plan. Releasing students from meal plan requirement bears financial implications for the foodservice unit, therefore adequate justification may be needed for a release to be considered. Katy, from a public institution, stated:

“To be released from an actual...dining facility, a required plan, they have to provide medical documentation that they are physically at risk by purchasing and eating on campus. So that is quite lengthy of a process.”

In 2013, legal action was brought against Lesley University related to non-compliance with the Americans with Disabilities Act (ADA) due to insufficient accommodations for students with special dietary needs at a university requiring on campus students purchase meal plans (U.S. Department of Justice, 2013). The case set a legal precedent, marking the first time a CU and the Department of Justice settled an alleged violation of the ADA pertaining to special dietary accommodations (HSE Legal Currents, 2013). The details of the settlement had practical implications for CU foodservice professionals as it outlined ways in which compliance with ADA may be ensured (HSE Legal Currents, 2013). Participants appeared to have heightened awareness of food allergy accommodations and compliance with the ADA. An interview participant, Betty, from a private institution said:

“Because of the Lesley case, we now have forms that students have to fill out if they’re request different housing accommodations or getting off the meal plan.”

Foodservice professionals are recognizing food allergies may be considered a disability requiring accommodations under the ADA, and are therefore inciting involvement of relevant university departments in the process. Though departments such as Residence Life, Admissions, and Health Services may be involved in accommodating students with food allergies, interview participants discussed their collaborative efforts with Disabilities Services most frequently. Six foodservice professionals described how students must first register with the Disabilities Office before any accommodations are provided by the foodservice department. Dina, from a public institution, explained:

“If the students register with the disability center or the special accommodation, then we talk with them. They [disabilities center professionals] are the ones who actually gather the medical information to make the determination that we do need to make an accommodation.”

Gail, from a public institution said:

“We work very closely with Disability Services... they are involved when a student files a 504 plan based on a food allergy. We work with Disability Services to make sure that we’re doing what the ADA says we should be doing.”

This research supports the notion that the Lesley University Settlement may have heightened the awareness of potential legal action against CUs by not providing reasonable accommodations to students with special dietary needs (Grasgreen, 2013). Judy, from a private institution, illustrated this point when she said:

“I think it is very important to have administrative support from the top down, understanding how important it is from a responsible, ethical, legal point of view, and the Lesley ruling was very good for impressing that upon people all the way up.”

Accommodation Policies and Procedures

Researchers have suggested CU foodservice operations may accommodate students with food allergies inconsistently in comparison to other foodservice operations due to the lack of formalized policies (Rajagopal & Strohhbehn, 2011). A high percentage of participants from this study reported formalized food allergy policies, however the content of the policies varied greatly. Among the 55 institutions with department level food allergy accommodation policies represented in questionnaire phase (Table 4), the most common elements included in the policies were: 1) training for staff (n=53), 2) involvement of dietitian or nutritionist (n=47), and 3) contact person for food allergy accommodation inquiries (n=45). Among the institutions represented in the questionnaire phase, the most common operational aspects available to food allergic students was menus designated with major allergens (72.6%) followed by designated allergen-safe food production area (55.6%) and designated allergen-safe food storage area (50.7%) (Table 5).

Medical documentation requirements

Medical documentation requirements included departmental food allergy policies was reported by 32 (58.2%) participants. Five interview participants who reported formal food allergy policies at their respective institutions said medical documentation was collected from students requesting accommodations. Varying degrees of leniency with collecting medical documentation was noted among these five participants. For example, Ivy, from a public institution, described the detailed documentation students must submit to the disabilities office when requesting accommodations:

Table 4: Questionnaire Results: Food Allergy Accommodation Policy Content

Category	Institution (%) ^a	Department (%) ^a
Training or professional development for foodservice staff related to food allergies	4(16.0)	53(96.4)
Involvement of dietitian or person with nutrition training	11(44.0)	47(85.5)
Contact person for food allergy accommodation inquiries	18(72.0)	45(81.8)
Outline of qualifications and eligibility criteria	11(44.0)	37(67.3)
Person responsible for ordering allergen-free products	6(24.0)	37(67.3)
Required medical documentation of food allergy	16(64.0)	32(58.2)
Required development of emergency action plans	15(60.0)	28(50.9)
Outlined evaluation of quality of food allergy accommodation efforts	5(20.0)	26(47.3)
Required multiple departments’ coordination of accommodation efforts	19(76.0)	22(40.0)
Required documentation of disability due to life-threatening food allergy	22(88.0)	21(38.2)
Required students to sign a release of liability waiver	6(24.0)	6(10.9)

^aPercentages based on the number of respondents reporting policies in place at the indicated level: n=25 at institutional level, n=55 at departmental level

Table 5: Questionnaire Results: Operational Aspects Available to Food Allergic Students

Category	Frequency (%)
Menus designated with major allergens (n = 73)	53 (72.6)
Designated allergen-safe food production area (n=72)	40 (55.6)
Designated allergen-safe food storage area (n=71)	36 (50.7)
Designated allergy-friendly dining area (n=72)	10 (13.9)
Access to ingredient lists for all menu items offered (n=73)	63 (86.3)

“We [foodservice] do *not* take the medical documentation. I know that there’s a letter from the doctor describing what happens to the person [when allergens are ingested]. There’s the test results showing proof that the person is ... food allergic... Because sometimes they just bring a letter that says, “This person needs to not be around... catfish. And that’s not adequate. It has to be detailed.”

Gail (from a public institution) reported request for medical documentation is a standard procedure, however leniency with fulfillment of the request is allowed – especially depending on the food allergy:

“We do ask for medical documentation, but I don’t always follow up with it because if somebody tells me they have a peanut or tree nut allergy, I’m going to believe them.”

Varying procedures related to submission of medical documentation existed among institutions without food allergy policies as well. There appeared to be a continuum from no documentation requirement at all to highly specified documentation requirement. When asked whether students are required to submit medical documentation, Judy (from a private institution) said:

“No, we’re pretty lenient... We’re trying to balance taking a scientific or a legal point of view with a holistic we-want-to-take-care-of-the-student point of view.”

Contrarily, two interview participants reported accommodations are contingent upon students providing medical documentation. Katy (from a public institution) described procedures followed at her institution:

“If [students] actually have a medical condition or they claim to have a medical condition associated with food, we require an actual medical documentation from a long-term medical doctor that has been providing care for more than four months.”

Among these cases, participants from private institutions discussed greater degrees of leniency whereas participants from public institutions discussed more specific and deliberate procedures when asked about medical documentation.

Training: Questionnaire participants were asked whether training was provided for them, non-student employees, and student employees. The majority of questionnaire participants (n=72, 94.7%) reported employees received training related to food allergy accommodations. Cross contact prevention training was most frequently reported for foodservice professionals (n=57, 75%), non-student employees (n=65, 85.5%), and student employees (n=46,

60.5%). Training employees about food substitutions based on allergies was the least reported training topic for foodservice professionals (n=49, 64.5%), non-student employees (n=48, 63.2%), and student employees (n=20, 26.3%).

All interview participants (n=11) reported some type of food allergy training was provided to foodservice employees, regardless of whether formal food allergy policies were in place at their institutions. Participants reported food allergy training was provided to employees upon hire, and annually, or twice per year. Training content described by interview participants can be categorized in two ways 1) general food allergy knowledge, and 2) operation-specific procedures related to accommodations. Approaches for general food allergy knowledge training varied. For example, three interview participants noted foodservice employees on their campuses were ServSafe® certified, one of which reported employees had completed ServSafe Allergens™ training. One participant reported a third-party allergy training service, AllerTrain™, was used to train management and administrative staff about food allergies. Three interview participants were responsible for administering training at their operations.

A study examining food allergy training among child nutrition professionals in U.S. schools found food allergy training was provided in only 41.2% (140/340) schools represented (Lee, Kwon, & Sauer, 2013). The primary barrier to providing training was time constraint. A key difference between K-12 and CU foodservice environments is type of employment. Child nutrition employees are often part time, working only during breakfast and lunch hours on days when school is in session. In the CU environment, there may be more full time staff preparing meals for operations serving meals continuously throughout the day. These employees may work year round, even when school is not in session. Therefore time constraints may not have as great impact in the CU environment. Three CU foodservice professionals reported school breaks were used as opportunities to provide food allergy training. Harold (from a private institution) said:

“And it’s done annually every summer when we have time to get everybody together to do it.”

Protection from liability: The least common item included in both departmental level and institutional level policies was the requirement for students to sign a release of liability waiver (n=6). None of the interview participants discussed a release of liability waiver; however, it appeared CU professionals were aware of potential liability issues associated with serving students with food allergies. Three interview participants reported efforts to provide protection from liabilities related to risk of food allergic reactions from food eaten on campus. Interview participants reported disclaimers were posted on website and re-iterated personally by foodservice staff to ensure students understand risks involved with dining on campus. Carla, from a public institution, noted:

“We do put out disclaimers that... foods do have some form of cross-contamination.”

Emma, from a private institution, said:

“Ultimately [the students] are responsible for the food they consume.”

Institutional policies: Among the 25 questionnaire respondents who reported institution level food allergy policies, the most common elements included were 1) required documentation of disability related to food allergy (n=22); 2) multiple departments’ coordination for accommodation (n=19); and 3) contact person for accommodation inquiries (n=19). These findings are logical because when a food

Table 6: Questionnaire Results: Actions Students are Advised to Take in Absence of Policy (n=14)

Category	Frequency (n)
No advice given	0
Check with dining hall/foodservice unit manager each time before eating	10
Meet with dining services dietitian at the beginning of the term to explain allergy; dietitian will develop list of acceptable items	11
Verbally inform foodservice staff of specific dietary needs at the beginning of term; no further action taken by the foodservice department	4
Sign a disclaimer document that relieves the institution from legal liability in case the student suffers a mild or severe allergic reaction	1
Other action taken (e.g. register with disabilities office)	5

allergy accommodation program requires the coordination of professionals across the CU, an institutional level policy may help define roles and responsibilities of involved personnel. Three interview participants reported working closely with their respective Disabilities Services professionals, though the extent of the interaction varied greatly. For example, at one CU in the Southern region, the extent of their involvement is routing of students to the foodservice professional in charge of accommodations:

“[Students] would go to the Disability...Center and say, ‘I have this problem,’ and then they would send them to us.”

At another CU, Disabilities Services professionals are responsible for registering students; that is, they would collect documentation and make the determination whether accommodations were warranted. Ivy, from a public institution, said:

“The Disabilities... Center... What happens is they are the ones who actually gather all the medical information to make the determination that we do need to make an accommodation.”

Interview participants reported involvement of CU Health Services departments (n=3), predominantly related to prevention of adverse reactions on campus. Involvement of the CU Admissions professionals were reported (n=3), though their involvement was predominantly to route self-identified students to the appropriate contact person. Residential Services and Student Life professionals were also reported to have involvement in accommodating students with food allergies (n=6) by helping identify students who may need special housing accommodations related to their food allergies.

Accommodation Practices by Demographics

Pooled sample t-tests were used to determine whether food allergy accommodation practices differed by institution type (public or private) and foodservice management type (contract managed or self-operated). Out of a maximum of 16, the mean food allergy accommodation practice score for public institutions was 8.89 (SD=2.79), and for private institutions was 9.2 (SD=2.79). There was no statistically significant difference ($p=.365$) in mean practice scores for private and public institutions. The mean accommodation practice score for contract managed foodservice operations (n=12) was 8.25 (SD=2.2) and 9.2 (SD=2.9) for self-operated foodservice operations. There was no significant difference ($p=.151$) in practice scores between contract-managed and self-operated foodservice operations.

Accommodation Efforts in the Absence of Policy

Of the 19 questionnaire participants who reported no policy at the department level, 10 (52.6%) indicated they were in the process of developing formal policies. Of the 49 participants who reported no policy at the institutional level, five (10.2%) indicated they were in the process of developing formal policies to put in place. A total of

fourteen questionnaire participants reported no policies at both the institutional and departmental levels. Table 6 illustrates ways in which students with food allergies are accommodated at CUs without published policies. Most commonly, students at these institutions meet with the dining services dietitian, and the dietitian develops list of acceptable items (n=11); and students are advised to check with foodservice staff each time before eating (n=10).

Five interview participants reported no formal food allergy policy in place at their respective institutions. Despite the absence of policy, participants reported informal procedures were in place to accommodate students. At these institutions, menus were used as an informative tool enabling students with food allergies to self-select appropriate menu items. For example, Carla (from a public institution) indicated:

“... working on going through all of the menus, and then identifying all of the allergens and trying to post those during regular service hours so that the students can identify if they can eat the food or not.”

Other institutions had more extensive accommodation efforts in place in the absence of formalized policies. For example, Betty (from a private institution) reported a food allergy friendly station was available to students at lunch and dinner:

“...it’s an allergen-free station...so students with food allergies can go to that station and it’s a chef-attended station. And they can easily put together like a protein, a starch and a vegetable at every meal, except for breakfast.”

CONCLUSIONS AND APPLICATIONS

The purpose of this study was to examine formal food allergy accommodation policies and to determine whether food allergy policies and practices differed by certain demographic characteristics (e.g. institution type, foodservice management type). From questionnaires, it was revealed many CUs had published policies in place at the departmental level (74%), and/or at the institutional level (34%), however variation in policy content and the approach to accommodation existed.

The majority of participating CUs with institutional policies included multiple departments’ coordination of accommodation efforts (76%). As gleaned from interviews, interdepartmental coordination efforts were most common between foodservice professionals and Disabilities Services. This may have been influenced by the 2013 litigation against Lesley University which heightened awareness for potential liability issues related to students with food allergies. Future research could explore knowledge of the Lesley settlement and its direct impact on food allergy accommodation attitudes and practices.

Considerable attention has been paid to food allergy accommodation in the K-12 school environment previously, and the *Voluntary Guidelines for Managing Food Allergies in Schools and Early Care and Education Program* were released in 2013 by the Centers for Disease Control and Prevention (CDC, 2013). The *Voluntary Guidelines* is a comprehensive guide providing procedural and policy recommendations for reducing the risk of food allergic reactions in the school environment. Though no such equivalent has been federally released targeting the CU environment, the guidelines have practical applications for CU foodservice professionals accommodating students with food allergies. However, industry and stakeholders have recognized that CU foodservice operations may benefit from development of a food allergy policy template tailored specifically to the environment and therefore have begun taking action. In 2015, FARE began implementation of the College Food Allergy Program with the objective of developing food allergy policies specific to the CU foodservice environment. After the initial research phase of the Program, “Pilot Guidelines for Managing Food Allergies in Higher Education” were released. Subsequent phases of the Program will involve evaluating effectiveness of implementing the guidelines.

Questionnaire data did not reveal any significant differences in practice scores based on the examined variables, however, the interview data showed differences in individual accommodation practices between institutions. Organizational culture may be a useful theoretical framework to investigate differences in accommodation practices and policies. Findings from this line of inquiry will be reported elsewhere.

This study examined whether differences in policies could be explained by two particular demographic variables including institution type and foodservice operation type. Future research may further explore variables associated with the presence of formalized accommodation policies such as history of adverse reactions to food eaten on campus as these experiences may impact CU professionals’ attitudes toward food allergies and accommodations.

There were limitations to this study, one of which was the low questionnaire response rate (22.2%). Even though at least one foodservice professional from each qualifying (i.e. four-year) NACUFS member school was invited to participate in the study, non-response bias may be inherent such that only those who had either implemented food allergy accommodation programs or had an interest in the topic participated. However, the data revealed participants reporting a wide range of food allergy accommodation efforts (e.g. minimal, undocumented accommodations to complex formalized policies). Given the small sample size, findings may not be generalizable to all four-year institutions. Although, the mixed methods design provided opportunity for greater depth of understanding for food allergy accommodations in CUs.

Future studies examining food allergy accommodations may use a similar, mixed methods approach. An explanatory design enables researchers to capitalize on advantages of both quantitative and qualitative approaches. For example, summative assessments of accommodation practices, hypothesis testing, and generalizable results can be achieved with quantitative methods while descriptive, explanatory production of knowledge may be achieved using qualitative methods.

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USE OF MODIFIED PROBLEM BASED LEARNING IN AN UNDERGRADUATE QUANTITY FOOD PRODUCTION COURSE

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ABSTRACT

Problem-Based Learning (PBL) is a case-driven, student-centered, small group instructional strategy that encourages learning through the use of “real-world” examples. PBL was implemented in an undergraduate quantity food production course (n=75) to enhance student understanding of basic foodservice management principles while developing students’ soft skills such as problem solving and critical thinking. Overall, PBL was perceived as an engaging and collaborative learning environment. When implemented properly, students agreed that PBL can reinforce course learning outcomes. Group time management and group communication were identified as challenges with completing the PBL assignment.

Keywords: Problem based learning; foodservice education; problem solving; critical thinking

INTRODUCTION

The foodservice industry is one of the largest employers in the United States (US), accounting for over 10% of all US jobs (National Restaurant Association [NRA], 2015). The NRA (2015) forecasts over 1.7 million new foodservice jobs in the US alone by 2025. The need for qualified foodservice professionals continues to increase as the industry grows. Additionally, the foodservice industry is facing critical operational challenges with a reduction in the supply of qualified employees transitioning into the workforce, coupled with an increase in the number of baby boomers retiring (Richardson & Thomas, 2012).

Foodservice companies review knowledge, skills, abilities, and previous experience of applicants in the hiring process (Alonso & O'Neill, 2011; Kwok, Adams, & Price, 2011). To ensure graduating foodservice professionals are prepared for the workplace, hospitality programs must review prerequisite hard and soft skills for employment in the foodservice industry as well as review their teaching methods to facilitate learning these skills (Chacko, Williams, & Schaffer, 2012; Gursoy, Maier, & Chi, 2008). Though companies often have training programs in place for hard skills, soft skills are a prerequisite required to be successful in the foodservice industry (Weber, Crawford, Lee, & Dennison, 2013). Soft skills, such as critical thinking and problem solving, are defined as the interpersonal or behavioral skills needed to apply hard skills on the job (Kantrowitz, 2005).

Research has shown a disconnect between the skills hospitality employers seek and the skills hospitality graduates perceive they possess (Maier & Thomas, 2013). Bridging the gap of skills needed by the foodservice industry and the skills foodservice graduates possess can be achieved in part through the use of “real-world” situations and collaborative learning in the classroom. “Real-world” situational collaborative learning is the foundation of the instructional method, Problem-Based Learning (PBL) (Zwaal & Otting, 2015).

PBL can be used to bridge the gap between lecture-based learning (teacher-centered) and real-world situational learning (student-centered). PBL was developed in the 1960s as an educational approach used to help medical students apply knowledge learned through practical “real-world” situations (Barrows & Tamblyn, 1980; Schmidt, 1982; Taylor & Mifflin, 2008). PBL guides students’ existing knowledge and inquiry process toward discovering meaningful solutions to “real-world” issues. Additionally, learning collaboratively through problem-based situations is much more effective than memory-based learning because it creates a more easily retained functioning body of knowledge (Goto & Bianco-Simeral, 2009).

Since its introduction over five decades ago PBL has received positive recognition in university settings (Barrows & Tamblyn, 1980; Taylor & Mifflin, 2008), especially within the realm of medical education. Previous research has shown the value of PBL in the following courses of study: food & beverage (Kivela & Kivela, 2005), food safety (Rajagopal, Bernstein, & Trost, 2012), food science (Liceaga, Ballard, & Skura, 2011), nutrition (Lee, 2015), hospitality management (Zwaal & Otting, 2015), and tourism (Huang, 2005). However, PBL has not gained widespread use as a teaching method in hospitality management education. This could be attributed to the lack of knowledge on how to incorporate PBL into hospitality courses.

Zwaal and Otting (2015) summarized that the success of a PBL assignment relies on three factors: 1) students’ prior knowledge, 2) the ability of the facilitator/tutor/instructor, and 3) the quality of the PBL assignment. One of the challenging aspects of incorporating PBL into a course of study is the instructor’s ability to act as a facilitator of learning. Yew and Yong (2014) identified three major attributes of an effective facilitator: 1) use of expertise, 2) social congruence, and 3) cognitive congruence. The use of expertise is displayed through content knowledge, such as being able to demonstrate theoretical and practical knowledge, as well as stretching students’ learning by raising challenging questions (Yew & Yong, 2014).

Social congruence, such as communication and emotional skills, is essential in the facilitation of PBL. Yew and Yong (2014) identified five significant themes that emerged within social congruence: facilitator personality, the ability to relate to students, professionalism, the ability to motivate students, and the ability to create a positive learning environment. Cognitive congruence is the ability to explain concepts in a manner that is easily understood by students (Cornwall, 1979).

An effective PBL assignment starts with a flawed open-ended scenario with no single correct answer (Gallagher, 1997). First, the problem must be developed and tailored to course objectives while remaining realistic to situations students will encounter in the “real-world.” This will strengthen the realism of the assignment within the hospitality context. The task assigned can reference past experiences or current situations found in the hospitality field. Most importantly, the assignment must be interesting and engaging in nature so as to

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facilitate peer discussions and increase students' line of inquiry (Blake, Hosokawa, & Riley, 2000).

The format and length of the PBL assignment can vary depending upon the targeted learning objectives. Previous studies have shown several formats to be effective: multiple classes (Duffrin, 2003), half semester (Lee, 2015), full semester (Chng, Yew, & Schmidt, 2011) and the entire academic curriculum (Kivela & Kivela, 2005; Otting & Zwaal, 2011). The purpose of this study was to demonstrate the use of PBL in an undergraduate quantity food production course and assess student feedback on PBL as a teaching method. The quantity food production course was selected for this study because students need to employ all aspects of foodservice management concepts learned during the semester in order to solve the PBL problem. A PBL assignment was used during the second half of the semester during lecture periods.

METHODOLOGY

The University Institutional Review Board of the Office of Research Compliance approved the study. Students completed informed consent forms before beginning the study.

Population

Eighty-two undergraduate hospitality students enrolled in the Quantity Food Production course at a Southern US university in Spring 2015 were invited to participate in this study.

Course Format

The Quantity Food Production course is a lower-level foodservice prerequisite for upper-level courses in the hospitality management degree program. The main objective of the course is to introduce and educate students on foodservice management concepts. The three-credit course required 50-minute class sessions twice a week over a 14-week period. The course also contained a lab component that met once a week for three hours, however, this portion of the course was not altered by the inclusion of PBL. The first eight weeks of class sessions were used for lecture-based instruction to build background knowledge about the history and origins of world cuisines, food safety, recipe development, menu planning and pricing, food costing, scheduling, management, finance, etc.

The second half of the semester's class sessions were used to implement PBL into the course. One session each week was devoted strictly to group collaboration, while the other weekly session continued to be used for traditional lectures. The PBL for this study was structured to facilitate the application of management concepts in the development of quantity food production critical thinking and "real-world" problem solving skills. During the implementation of the PBL assignment, the instructor would check-in with each group and facilitate group problem solving. Students were also encouraged to collaborate outside of the classroom to enhance their learning.

Similar to other teaching methods, the learning outcomes of PBL assignments need to be reviewed and aligned with the course learning objectives. Because this study occurred in a lower-level course, learning outcomes based on Bloom's Taxonomy (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) focused on comprehension and application. Upon completion of the PBL assignment, students were expected to apply various methods of recipe and menu planning, recipe development, develop accurate menu pricing and food cost; demonstrate critical thinking, problem solving, and self-directed learning skills; and exhibit group-based collaborative learning skills. The PBL scenario required students to identify components of a failing restaurant and detail how to improve these failing components as illustrated below:

You have just been hired as the general manager of a failing independent restaurant in Columbia, South Carolina. Your goal is to improve aspects of the failing restaurant and create a profitable restaurant. The restaurant only has 60 seats. The owner is open to any changes, starting with a new restaurant name. However, before these changes can be implemented, you must prepare a presentation for the owner detailing your plan to improve the restaurant. Develop a financially sound and practical proposal. The presentation must be between 8-10 minutes. You will also present the owner with a hard copy of your proposal.

The 200-point PBL assignment was worth 20% of the students' overall grade in the course. Students were required to work in groups of four to prepare a 150-point written proposal and a 50-point, 8-10 minute presentation on how to "turn around" a failing restaurant. The written portion of the PBL assignment consisted of several parts: introduction of the new restaurant concept (40 points), development of recipes/cost control (30 points), menu design/pricing (30 points), staffing schedule (30 points), and sufficient group-collaboration (20 points). To determine the group-collaboration score, each student was asked to evaluate themselves and the other members of their group from 0 (weak) to 5 (strong) on the amount of effort those members displayed while working within a group setting.

Once the PBL scenario is developed, it should be pilot tested with a small group of students to ensure the quality and relevance of the assignment and to be certain the assignment encourages group-based collaboration. The assignment should also be reevaluated after the completion of the pilot test to guarantee the course learning objectives are being met (Zwaal & Otting, 2015). Prior to this study, the PBL assignment was pilot tested with a similar group of students (n=54) during the 2014 Fall semester. The PBL assignment was also reviewed by two experts in foodservice management for content validity. Based on results of the pilot test and feedback from foodservice experts, it was determined that students needed more specific guidelines in order to complete the assignment successfully. With the addition of these specific guidelines, the assignment became a modified PBL assignment, as traditional PBL is open-ended without specific guidelines (Gallagher, 1997). The following additional guidelines were added to the PBL assignment:

- Form groups of 4 students
 - Define member roles: leader, scribe, researcher, speaker
- Rename restaurant
 - Determine style of cuisine
 - Identify meal period(s) serving
- Design menu layout
 - Minimum of 3 appetizers, 5 entrées, 5 side dishes, and 3 desserts
 - Assign a selling price for menu items
- Write recipes
 - Use standardized format for each menu item
- Cost each recipe
- Consult a major food distribution vendor website for pricing (i.e. US Foods, Sysco)
- Develop staffing schedule (two week period for lunch or dinner service)
 - 1-week current guest numbers
 - 1-week projected busy guest numbers
- Write minimum 5-page proposal
- Present an 8-10 minute standup group presentation using PowerPoint™

Implementation of PBL

During the 2015 Spring semester, the PBL assignment was incorporated and structured as a final assignment. The first eight weeks of class sessions utilized lecture-based instruction to build foodservice management background knowledge. At the beginning of week seven, the PBL scenario and assignment criteria was introduced. Students formed self-assigned groups of four for the PBL assignment. No specific direction for solving the assignment was given by the instructor. During the next six weeks of class sessions, the instructor acted as a facilitator for student questions and provided additional clarification. Different approaches toward solving the scenario were expected, as this is a key result of the open-ended PBL scenario – allowing for student analysis and synthesis.

A previously validated survey instrument developed by Rajagopal et al. (2012) was used to assess student perceptions of PBL as a teaching method. Completing the PBL assignment survey was an optional extra credit assignment worth 15 points and consisted of three sections: one item on demographics, 14 items assessing student perceptions of PBL on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*), and two open-ended questions which assessed the strengths and challenges of PBL as a teaching method. The survey was administered during final exams after all PBL presentations were completed. The electronic-based questionnaire was distributed using Qualtrics™, an online survey management program.

RESULTS AND DISCUSSION

Eighty-two students were enrolled in the course and completed the PBL assignment. Seventy-five students (92%) completed the optional survey. Participants were sophomores (n=18) (24%), juniors (n=41) (54%), and seniors (n=16) (22%). The high response rate could be due to extra credit that was offered for completing the optional survey assessing PBL as a teaching method. However, the sample size was too small to analyze the results using advanced statistical analysis that could be generalized.

Student Perceptions of PBL

Student perceptions of PBL as a teaching method are shown in Table 1. Overall, PBL was perceived by students as an engaging process (4.24 ± 0.73). This could be attributed to the appeal of small group collaboration centered on solving a “real-world” problem. Students also perceived an increase in their critical thinking (4.24 ± 0.74) as a result of the use of PBL. These findings align with previous research on PBL which showed students perceived the PBL experience as one with an interesting learning environment and an effective format that

promoted collaboration in small group settings facilitated by a tutor/instructor (Loyens, Rikers, & Schmidt, 2006; Zwaal & Otting, 2004).

Students agreed that PBL can reinforce course material covered during lectures (4.24 ± 0.80). This was accomplished through providing lectures on the material being assessed in the PBL assignment and asking questions that facilitate group collaboration and scaffolding on prior knowledge. Providing feedback throughout the assignment helps students achieve positive learning outcomes (Goto & Bianco-Simeral, 2009; Lee, 2015). This is important to note as in the current study, PBL was used only during the second half of the semester to reinforce management topics introduced in the initial part of the course. Additionally, students agreed the lectures provided them with sufficient background knowledge to comprehend and solve the PBL case (4.30 ± 0.78). These results imply a need for some lecture-based learning (teacher-centered) before the introduction of PBL (student-centered).

The majority of students (n=57) (76%) in this study were juniors or seniors and perceived PBL as an interesting way to learn course content (4.24 ± 0.90). While sophomores (24%) had slightly less interest in PBL as a way to learn course content (3.99 ± 0.90). The high percentage of interest in PBL from upper classman could be due to a lack of exposure to PBL as a learning method in lower level courses and the appeal of “real-world” situations. One student explained: “I enjoyed creating a company and making the menu. It was nice to use creativity in a project instead of just writing about facts and statistics.” In a recent study, Otting and Zwaal (2011) showed that hospitality management students’ perceptions of teaching and learning methods shifted dramatically from freshman year to senior year.

Students did not view this project as a burden, unlike students who participated in a study by Levitt and Desbrow (2013). Students in the current study explained, “It was very helpful to have lecture times allotted for [PBL project] discussion.” Another student stated, “Having more than one week to complete the project was ideal.” The dissatisfaction of students in the Levitt and Desbrow’s study could be attributed to the amount of time students were given to complete the PBL assignment. In previous studies, little to no class time was allotted for PBL assignment work. However, in this study, students were allotted time during lecture periods to collaborate with their groups and obtain guidance from the facilitator, as needed. Additional time was also spent to work on the PBL outside of the classroom.

Table 1: Student’s Evaluation of PBL Assignment (n =75)

Items	Mean	SD
The lectures provided me with sufficient background knowledge to understand and solve the PBL case.	4.30	0.78
If given a choice, I would prefer to participate in similar types of PBL exercises in the future in other classes.	4.28	0.91
PBL engaged me in the learning process.	4.24	0.73
PBL reinforced course material covered during the lectures.	4.24	0.80
PBL is an interesting way to learn course content.	4.18	0.90
PBL helped me to understand the realities of solving real-world problems.	4.16	0.82
PBL taught me how to think critically about the subject matter.	4.14	0.74
PBL helped me to view the relationships between complex content.	4.09	0.79
PBL helped me to think differently about the content.	4.08	0.77
PBL encouraged me to make learning connections with other students.	4.00	0.97
PBL helped me to develop my reasoning skills about the subject matter.	3.99	0.95
PBL increased my ability to effectively work in a team.	3.89	1.03
I would prefer the PBL format of learning over lecture to understand the content.	3.89	0.96
I would have been able to understand and solve the PBL case without the lectures.	3.45	1.05

Scale: (1 = Strongly Disagree, 5 = Strongly Agree)

Our findings showed similar results to Loyens et al. (2006) in which students positively perceived PBL experiences as containing an interesting learning environment. In the current study several students explained: “[PBL provided] *Real life applications of our learning objectives*” and, “*It gave me a hands-on learning experience so I could better understand the way a restaurant is run, rather than just listening to lectures about it that gave me no personal experience.*” Overall, students found the assignment to be enjoyable. “*This class was not like others I have taken before. We as students were directly immersed into the subject matter.*” Similar to previous findings by Lee (2015), the majority of students did not find the assignment to be overwhelming, as it was incorporated into several weeks of the course. This is important to note as the length of the PBL assignment should be in line with the allotted time to complete the assignment. In this study, the PBL scenario required students to identify components of a failing restaurant and detail how to improve these failing components, this process could not be completed in one or two classes.

Strengths and Challenges of PBL

Student feedback highlighting the strengths and challenges of PBL as a teaching method was analyzed using the inductive data analysis procedure (Thomas, 2006). The researchers gained an understanding of the feedback from students through commonalities that emerged from the initial coding. Table 2 shows these commonalities of students’ perceptions of the strengths and weakness of PBL as a teaching method.

Similar to Duffrin (2003), some challenging issues dealt with group time management: “*I think that fitting all the pieces of this project were challenging, there are many parts that all have to fit together.*” Also, there were breakdowns in group communication: “*Sometimes working with a group can be challenging when communication becomes a problem.*” This was largely due to scheduling group meeting time outside of the course time period. Additionally, students identified a need for more structure within the PBL assignment, conflicting with results of a previous study (Wijnia, Loyens, & Derous, 2011): “*Provide more structure to the group assignment.*” The desire for more structure and guidelines could be attributed to a lack of experience with PBL as a teaching method, as well as feeling more comfortable with traditional group assignments. All of these challenges are common in recent PBL literature. Many studies, including this one, attribute these challenges to the unfamiliarity of students with this teaching method. These challenges can be reduced with the inclusion of PBL in more hospitality courses to allow students to gain understanding and feel more comfortable with PBL as a teaching method. However, it is not encouraged to incorporate this teaching method when introducing new concepts, as students need a strong base knowledge before PBL can be effective by scaffolding on previous knowledge.

Gielen, Dochy, and Onghena (2011) recommended incorporating a self- and peer- evaluation at the end of the assignment to help assess group member outcomes and collaboration. Additionally, when adopting a new teaching method, it is important to gather student feedback to help strengthen future results (Duffrin, 2003). Student

feedback reinforced PBL assignment learning outcomes of incorporating “real-world” situations, increased critical thinking, and student-centered self-directed learning. As one student explained: “*It gave me a hands-on learning experience so I could better understand the way a restaurant is run, rather than just listening to lectures about it that gave me no personal experience.*”

CONCLUSIONS AND APPLICATIONS

The purpose of this study was to demonstrate the use of PBL in an undergraduate quantity food production course and assess student feedback on PBL as a teaching method. Incorporating PBL into the quantity food production course allowed students to investigate “real-world” situations, develop their own synthesis of the problem, and apply critical thinking and problem solving skills. Prior to incorporating PBL into this course a group project was used which had a structured format detailing specifically what topic to research, and how results should be displayed. The same conclusions were always presented by students without any creativity or self-directed learning; it seemed that there could be a more engaging and influential way to cover the same material.

The main difference between the two teaching methods is, with PBL, the learning outcomes are within the student’s control, deciding what to research as well as how and what to present. PBL is characterized by its focus on contextual, collaborative, constructive and self-directed learning (Otting & Zwaal, 2011). The resulting PBL assignment presentations were far superior in quality and diversity than the previous group projects. Using the same PBL scenario students’ “restaurant concepts” varied dramatically (e.g. fast food, food truck, and fine dining); this creativity differed greatly from prior semester’s standard group-project.

During allotted PBL class sessions, students were more engaged with group discussions than in prior group project semesters. Students also initiated more discourse with the facilitator and asked questions of a higher-order thinking caliber. This differed greatly from previous semesters where students used class time to ask the instructor for answers, not for a higher-level discussion. These changes are similar to the findings presented by Zwaal and Otting (2015) who showed evidence that PBL is effective in improving students’ problem solving and critical thinking skills through connecting theories with “real-world” problems.

Overall, the success of a PBL assignment can be attributed to three factors: students’ prior knowledge, the facilitator/tutor, and the quality of the PBL design (Zwaal & Otting, 2015). First, ensuring students have prior knowledge of the content being incorporated into the PBL assignment is crucial. In this study, background knowledge was strengthened through lecture-based instruction prior to completing the PBL assignment; this prior knowledge is needed to scaffold upon when learning new concepts during the PBL assignment. This was shown in a recent study by Yew and Yong, (2014) who recognized scaffolding learning and communication skills as important for increasing interpersonal skills and problem solving.

Table 2: Students’ Perceptions of the Strengths and Weakness of PBL as a Teaching Method

Strengths	Challenges
<ul style="list-style-type: none"> Encouraged group collaboration Provided “real-world” experience in a classroom setting Encouraged creative thinking Stimulated problem solving skills 	<ul style="list-style-type: none"> Communicating with group members Managing/Finding time to work together as a group Inadequate structure of the PBL scenario Oral presentation of PBL findings

Facilitating students' independent learning and guiding critical-thinking is critical for PBL to be effective. When acting as a tutor/facilitator, it is imperative to be an expert on the content of the PBL assignment while also having the cognitive congruence to explain concepts in ways that students can easily understand. A facilitator does not simply provide answers to student's questions, but guides the student to synthesize the answer themselves. Additionally, the facilitator must create a nonthreatening collaborative environment and develop a rapport with the students in order to promote positive group collaboration. This was done in the current study during PBL designated lectures, the facilitator would "check-in" with each group and ask open-ended questions to stimulate group creativity. Previously, Papinczak (2010) showed medical students and facilitators perceived an ideal PBL facilitator as displaying high student-teacher rapport.

Finally, successful implementation of PBL also relies on a flawed open-ended "real-world" scenario which engages students and develops the soft skills of critical thinking and collaboration. To improve the study, interviewing or conducting focus groups with students could provide in-depth information on students' perceptions of PBL. This study design only used a survey instrument to collect student perceptions that may not gather rich narrative content to further describe the PBL assignment.

Using PBL as a teaching method needs further research through implementation in other areas of hospitality management including marketing, finance, and human resources. Similar to Lee (2015), the implementation of the PBL assignment was conducted over half of the semester and used as a final project. However, PBL can be used during a single class period, for the duration of one week, or for an entire semester. It is encouraged for a novice of PBL to start with a single PBL assignment until comfortable with the flow and style of this teaching method.

PBL has previously been shown to be an effective teaching method in foodservice (Lee, 2015; Liceaga et al., 2011; Rajagopal et al., 2012) and this study has added to this body of literature. Future research could focus on developing PBL assignments for easy implementation into a variety of hospitality courses. Instructors could incorporate PBL throughout the semester after completion of different modules to assess student comprehension of material taught. PBL can also be utilized in other courses (e.g. cost controls, nutrition, food science, and dietetics courses) within foodservice education to reinforce course concepts. The PBL assignment was shown to be successful in engaging students and incorporating "real-world" experiences, which is not possible through lecture alone. The inclusion of PBL as a teaching method should be reviewed by foodservice instructors to increase students' critical thinking, problem solving, and group collaboration skills in their courses. If the strategies used in this study are followed, successful implementation of PBL into any course is possible.

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Appendix A

Quantity Food Production PBL Assignment

Read the scenario and guidelines below. Form groups of 4 members. Each Wednesday lecture will now be used for group-collaboration to work on your PBL assignment. During these lecture times the instructor will be available to facilitate problem solving. However, this time will not be used to ask questions and except answers from the instructor. Additionally, group-collaboration outside of the course time is encouraged. The PBL scenario requires you to identify components of a failing restaurant and detail how to improve these failing components. During the final week of the semester each group will submit a minimum of a 5-page proposal and present an 8-10 minute standup group presentation.

PBL Scenario

You have just been hired as the general manager of a failing independent restaurant in Columbia, South Carolina. Your goal is to improve aspects of the failing restaurant and create a profitable restaurant. The restaurant only has 60 seats. The owner is open to any changes, starting with a new restaurant name. However, before these changes can be implemented, you must prepare a presentation for the owner detailing your plan to improve the restaurant. Develop a financially sound and practical proposal. The presentation must be between 8-10 minutes. You will also present the owner with a hard copy of your proposal.

PBL Guidelines

- Form groups of 4 students
 - Define member roles: leader, scribe, researcher, speaker
- Rename restaurant
 - Determine style of cuisine
 - Identify meal period(s) serving
- Design menu layout
 - Minimum of 3 appetizers, 5 entrées, 5 side dishes, and 3 desserts
 - Assign a selling price for menu items
- Write recipes
 - Use standardized format for each menu item
- Cost each recipe
- Consult a major food distribution vendor website site for pricing (i.e. US Foods, Sysco)
- Develop staffing schedule (two week period for lunch or dinner service)
 - 1-week current guest numbers
 - 1-week projected busy guest numbers
- Write minimum 5-page proposal
- Present an 8-10 minute standup group presentation using PowerPoint™