JOURNAL OF FOODSERVICE MANAGEMENT & EDUCATION

Volume 16, Issue 1

RESEARCH CONTRIBUTIONS:

JOURNAL OF FOODSERVICE MANAGEMENT & EDUCATION

Published jointly by the Foodservice Systems Management Educational Council and the National Association of College & University Food Services

Volume 16, 1, 2022

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Employee Interest in Participation in a Reusable Container Program to Increase Hospital Cafeteria Sustainability

Food establishments generate a substantial amount of waste through packaging. Approximately 12,500 pounds of waste was created annually from containers disposed of in a military medical treatment facility cafeteria. This study evaluated the interest of employees in participating in a reusable container program at a military medical center. An anonymous survey queried demographics, cafeteria usage, and interest in participating in the program. Over half of respondents reported they would be very likely to participate in the program. Key reasons for participation included the positive environmental impact and convenience. Based on employee interest, a reusable container program could be utilized to increase the sustainability of this hospital cafeteria.

Reducing Food Waste in a Large Metropolitan Hospital through Engagement with Food Service Leadership and Personnel

In hospital food service settings, food waste often occurs due to inconsistent patient census, poor food forecasting and/or a lack of communication within the food service staff and leadership. The purpose of this paper is to describe methods used to address food waste in the Department of Nutrition Services (DNS) of a large Metropolitan hospital. First, causes of food waste were identified through interviews with DNS leadership in the hospital. After the interviews, two interventions, an educational session with DNS personnel and adjustment of food waste logs, were implemented. From baseline to post-intervention, there was a 69.1% decrease of reusable food. Addressing causes of food waste in food service institutions can have a positive economic and environmental impact.

College Students' Food Choices in a University Dining Hall Using a Traffic Light Labeling System

The purpose of this study was to determine if implementing a traffic light labeling system would affect students' food choices in a university dining hall. Data collection occurred in two phases, 28 days apart. Survey questionnaires were completed by 165 participants and 177 participants in the pre-implementation and post-implementation phases of the study, respectively. Overall, participants in the post-implementation phase chose significantly healthier foods than participants in the pre-implementation phase. The results from this study reflected those from prior research, which found that implementation of a traffic light labeling system affected participants' food choices.

Research Contribution

Journal of Foodservice Management & Education, Volume 16, Number 1, Pages 1– 7 . ©2022
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MANAGEMENT AND FOODSERVICE KRDNS: HOW ARE THEY MET IN DIETETICS EDUCATION?

Kaylee Hickman[1]; Emily Vaterlaus Patten, PhD, RDN, CD[1]; Nathan Stokes, PhD[1*]
[1]Department of Nutrition, Dietetics and Food Science, Brigham Young University, Provo, UT, USA

ABSTRACT
Curriculum in Didactic Programs in Dietetics (DPDs) must prepare students for Knowledge Requirements for Registered Dietitian Nutritionist. DPD directors (n=47) were surveyed to identify if foodservice and management related KRDNs are taught through coursework and/or laboratory experience. Results indicated that these KRDNs are taught more abundantly through coursework than laboratory experience. DPD directors are improving foodservice and management education in programs through "*expertise and leadership*," "*course curriculum reallocation and revision*," and "*resources and experiential learning.*" Better utilizing laboratory experiences to include more foodservice and management KRDNs may increase the benefits of experiential learning for students in DPDs.

Keywords: KRDN, foodservice management, lab experience, coursework, dietetics

INTRODUCTION

The Accreditation Council for Education in Nutrition and Dietetics (ACEND) is the accrediting agency for dietetics programs that prepare students for careers as Registered Dietitian Nutritionists (RDN; ACEND Mission and Vision, 2020). To become an RDN, students must complete an ACEND accredited program for coursework, 1,200 hours of supervised practice, and take the Registration Examination for Dietitian Nutritionists. Beginning in 2024, students will also be required to complete a graduate degree in order to become an RDN. Currently, the most common path utilized by students is to complete an undergraduate Didactic Program in Dietetics (DPD) followed by a Dietetic Internship or an Individualized Supervised Practice Pathway (ACEND, 2021). DPDs provide required didactic coursework to prepare students for a Dietetic Internship or Individualized Supervised Practice Pathway. Once accepted into a Dietetic Internship or Individualized Supervised Practice Pathway, students complete 1200 hours of supervised practice in various settings including foodservice, education, counseling, management, clinical, research, and community (Dietetic Internships, 2020). Although this is the most common pathway currently, there are other options available for becoming an RDN (e.g., future education programs or coordinated programs).

The ACEND 2017 accreditation standards require that all DPDs design coursework to meet "the breadth and depth of requisite knowledge needed for entry into supervised practice to become a registered dietitian nutritionist" (ACEND, 2018, pp. 9). One of ACEND's required standards is for DPD curriculum to have "Knowledge Requirements for Registered Dietitian Nutritionist" (KRDNs). KRDNs are written statements indicating what a student must know or do after completing the program. Each DPD is required to indicate which courses and learning activities are used to meet each KRDN (ACEND, 2019). ACEND uses KRDNs as a way to determine if programs are sufficiently addressing curriculum topics required for accreditation.

*Corresponding Author: Phone: (801) 422-6676; E-mail: Nathan_stokes@byu.edu

Foodservice and management are two practice areas for RDNs and as such there are specific KRDNs related to both foodservice and management (Academy of Nutrition and Dietetics, 2019). However, management principles are often thought of, and taught, alongside foodservice topics (Scheule, 2000; Holik, 2021; Academy of Nutrition and Dietetics, 2019). According to the 2019 Compensation and Benefits Survey of the dietetics profession, 9% of RDNs who responded to the survey work in food and nutrition management which includes positions such as School Foodservice Director, Director of Clinical Nutrition, and Nutrition Informatics Specialist (Academy of Nutrition and Dietetics, 2019). According to the Academy of Nutrition and Dietetics Scope of Practice Standards, RDNs working in foodservice management are required to be competent in menu and recipe management; equipment purchasing; food receiving, storage, preparation, and safety; financial management; and kitchen design (Anderson et al., 2018). Outside of foodservice management, Clinical Nutrition Managers also need management skills such as managing financial resources, products, and people (Howells et al., 2020). These competencies are taught in DPDs and Dietetic Internship to ensure students are prepared to work in foodservice and/or management practice areas.

KRDNs are categorized into four domains of learning: Domain 1) scientific and evidence base of practice, Domain 2) professional practice expectations, Domain 3) clinical and customer services, and Domain 4) practice management and use of resources (ACEND, 2018). Each domain has KRDNs that can be relevant to foodservice and management topics such as "KRDN 1.3 Apply critical thinking skills," "KRDN 2.4 Discuss the impact of health care policy and different health care delivery systems on food and nutrition services," "KRDN 3.4 Explain the delivery process of food/nutrition services," and "KRDN 4.2 Evaluate a budget and interpret financial data." Although these KRDNs are broad, the coursework meeting these requirements helps prepare students to fill foodservice and management positions in many different settings such as schools, hospitals, long term care facilities, universities, and private practice (Anderson et al., 2018).

Although all DPDs are required to meet the same KRDNs, each program can choose the specific courses and coursework they will utilize to meet these requirements. Over the years, research has been conducted which explores the types of courses that programs are utilizing to meet curriculum requirements. Deskins and Spricher (1989) explored food science classes in undergraduate dietetic education and found that the majority of the programs had at least one advanced food science course. Hynak-Hankinson et al., (1997) investigated research activities in dietetics curriculum and found that many did not have teaching modules specific to research. Gates and Sandoval (1998) learned that dietetic programs with supervised practice curriculum were more likely to teach multitasking skills to students while Scheule (2000) surveyed foodservice management instructors and found most dietetics programs had three to four courses that address food safety. Short and Chittooran (2004) found that more than half of DPDs surveyed had a dedicated course specific

to nutrition education. Finally, Taylor and Holben (2017) explored the use of Student-Operated Restaurants in DPDs and found that they can be a successful tool in meeting some ACEND required standards.

It is clear that research exploring types of courses utilized in dietetics education is limited and dated. To our knowledge, no studies have explored current curriculum in terms of KRDNs. Foodservice and management principles are an important part of DPD curriculum and can be found across all four KRDN domains. Research exploring foodservice and management KRDNs and related curriculum activities would assist DPD directors in evaluating and improving program curriculum to meet the needs of students and maintain accreditation. As such, the purpose of this study was to assess how DPDs are meeting KRDNs related to foodservice and management. The specific objectives of the study were to 1) identify how DPDs are using foodservice and management courses to address KRDNs specific to foodservice and management and 2) identify how many programs use laboratory experience as part of their strategy for teaching foodservice and management KRDNs.

METHODS

An electronic survey with 29 questions was developed using Qualtrics (Provo, UT) survey software. Survey questions were created using the researchers' expertise and previous studies related to dietetics programs (Deskins & Spicher,1989; Gates & Sandoval, 1998; Hynak-Hankinson et al., 1997; Scheule, 2000; Short & Chittooran, 2004). To ensure validity of the survey instrument, experts in foodservice and management in dietetics and survey methodology were recruited via email to review the survey. Five experts with at least five years of experience in dietetics education, research, and practice completed an expert review by evaluating each survey question for importance, relevancy, and phrasing. A scale of 1-10 was used on all survey questions, with scores of 10 indicating high importance, relevancy, and proper phrasing (Mackison et al., 2010). Survey items that received an average score of less than six were determined to be irrelevant to the purposes of this study. Following expert reviews, four KRDN items (2.3, 3.1, 3.3, 3.5) that had an average relevancy score of less than six were considered unrelated to the study and were removed (e.g. KRDN 3.5 "describe basic concepts of nutritional genomics"). Minor adjustments for clarification in phrasing and answer choices were also made. Cognitive interviews (n=3) were conducted via Zoom technology with DPD directors to test face validity of the survey instrument prior to recruiting participants. Directors were recruited via email and asked to read each survey question aloud while taking the survey and to verbally describe their understanding of the item and the thought process they had while responding to the items. Through this process, directors provided insight and suggestions to improve readability of the survey questions. Based on comments from cognitive interviews, minor changes in grammar and phrasing were made. One item was removed from the survey because it was confusing to interviewees, and it was determined by researchers to be irrelevant to the study.

Questionnaire Content

The final survey instrument consisted of 28 multiple choice and free response items. The primary purpose of the instrument was to determine how accredited DPDs were meeting KRDNs through foodservice and management coursework and/or laboratory experience. Items regarding type of program (on campus vs. online), number of foodservice and management credits, foodservice and management courses taught, and expertise of faculty were included in the survey instrument. Participants were also asked to identify whether each KRDN related to foodservice and/or management were addressed through coursework and/or laboratory experience. Survey items presented foodservice and management as two separate topics, however, it was acknowledged that some programs do not differentiate between foodservice and management in their program. Therefore, they did not double dip, but simply indicated the foodservice related credits assuming that if they did not differentiate then management topics were covered in a "foodservice management course" rather than separate courses. Basic program and DPD Director demographics were also gathered.

Recruitment and Distribution

The contact list publicly available through the Academy of Nutrition and Dietetics website was used to gather contact information for all ACEND accredited DPD directors in the United States. Directors (n=215) were sent the link via email inviting them to participate in the study by completing the Qualtrics (Provo, UT) survey. An informed consent was included as the first page of the survey and completion of the survey indicated consent to participate. Each director was offered a $15 Amazon gift card to encourage completion of the survey. The Institutional Review Board at [blinded for review] approved the study prior to recruitment and data collection.

Data Analysis

Participant responses were downloaded from Qualtrics (Provo, UT) to an Excel spreadsheet. The data was cleaned by removing nine incomplete surveys of the total 56 responses received. The 47 usable responses were then uploaded to SPSS version 24. Basic descriptive statistics including means and frequencies were calculated and then summarized in tables.

The written responses to three open-ended questions were analyzed using qualitative thematic analysis procedures outlined by Braun and Clarke (2006). Three researchers individually immersed themselves in the textual data and met to discuss potential themes. After discussion, the researchers agreed on three themes. Two researchers then independently coded the data within the determined themes and the interrater agreement was calculated to be 87.5% which indicated inter-rater reliability (Portney & Watkins, 2000). Following the independent coding, researchers discussed discrepancies and came to an agreement. Codes were counted and reported within each theme.

RESULTS AND DISCUSSION

Director and DPD Characteristics

From the 215 emails sent, a total of 47 useable responses were received for an overall response rate of 28.9%. Of the 47 respondents, 10 indicated having less than 3 years (21.3%), 11 (23.4%) had 3-5 years, and 1 (2.1%) greater than 20 years of experience as DPD director. Additionally, 20 (42.6%) directors held a master's degree 20 (42.6%) held a doctorate degree, 2 (4.2%) were pursuing a doctorate degree and 5 (10.6%) did not indicate their level of education. When asked their area(s) of expertise, most participants indicated "Education" (n=21, 44.6%) or "Clinical Nutrition" (n=20, 42.5%). Results showed 28 (59.6%) participants felt foodservice in dietetics education was extremely important or very important to students' long-term career success. Further, 33 (70.2%) DPD directors were satisfied or extremely satisfied with their program's current foodservice and management curriculum.

All 47 DPD programs were taught on-campus with one also indicating a distance/online option. The majority of DPDs were at public universities (n=34, 72.3%) with 19 (40.4%) located in suburban, 14 (29.8%) in rural, and 9 (19.1%) in urban areas. DPDs ranged in number of graduates from less than 10 (8.4%) to greater than 50 (16.9%) each year. However, 10-20 graduates each year was the most common

Table 1: Demographic Characteristics and Views of Didactic Program in Dietetics (DPD) Directors (n=47)

	n	%
DPD Directors Satisfaction with Foodservice and Management Curriculum[a]		
Extremely Satisfied	5	10.6
Satisfied	28	59.6
Neither	4	8.5
Dissatisfied	9	19.1
Extremely Dissatisfied	1	2.1
Years as DPD Director[a]		
Less than 3 years	10	21.3
3-5 years	11	23.4
6-10 years	9	19.1
11-15 years	9	19.1
16-20 years	3	6.4
Greater than 20 years	1	2.1
Director's Area(s) of Expertise[b]		
Education	21	44.7
Clinical Nutrition	20	42.6
Community	13	27.7
Food and Nutrition Management	9	19.1
Research	9	19.1
Other	6	12.8
Consultation and Business	4	8.5
Importance of management and foodservice for dietetics students' long-term career success[a]		
Not at all important	0	0
Slightly important	3	6.4
Moderately important	11	23.4
Very important	17	36.2
Extremely important	11	23.4

[a]Totals may not equal 47 and percentages may not equal 100 due to missing data.

[b]Total responses may exceed 47 and percentages may not equal 100 due to multiple responses

graduating class size (n=16, 34.0%) with 21-30 graduates (n=11, 23.4%) being the second most common. See table 1 for additional director and DPD characteristics.

DPDs most commonly (n=20, 42.6%) had 6-10 credit hours related to foodservice, while other DPDs had 3-5 credits (n=14, 29.8%) or 11-15 credit hours (n=11, 23.4%) related to foodservice. In terms of management courses, 20 (42.6) programs had 3-5 credit hours and 16 (34.0%) had 6-10 credit hours related to management. The majority of faculty members who taught management and foodservice related courses had faculty appointments in "Dietetics" (n=38, 80.8%), "Nutritional Science" (n=17, 36.2%) or "Hospitality Management" (n=12, 25.5%) programs. Faculty who taught foodservice and management courses were most commonly full-time, tenured/tenure-track (n=41, 87.2%), with full-time non-tenure/ lecturer (n=35, 74.5%), and adjunct faculty members (n=28, 59.6%) teaching in those areas as well (see table 2).

Coursework

DPD directors indicated whether or not they used foodservice and/or management coursework to teach/apply principles from specific management or foodservice related KRDNs in each domain (1-4). Overall, programs indicated using coursework to teach foodservice and management related KRDNs from Domain 4 more than all other domains. This could likely be due to the topic area of Domain 4, "practice management and use of resources" which is closely related to foodservice and management topics. In relation to specific KRDNs within Domain 4, DPD directors indicated that foodservice and/or management coursework was most commonly used to "apply the principles of human resource management to different situations" (KRDN 4.4, n=46, 97.9%), and "evaluate a budget and interpret financial data" (KRDN 4.2, n=45, 95.7%). Sneed et al. (1992) explored the importance of 50 specific financial management competencies for entry and advanced level dietitians and determined that "quantity food production" and "foodservice management" courses are often used to teach important financial management concepts (Sneed et al., 1992). Their findings support the idea that financial management principles are taught by DPDs through foodservice and management coursework. More recently, McKnight et al., (2002) surveyed DPD directors regarding financial management education and found that DPDs largely used foodservice management courses. However, many programs in that study also covered financial principles in community and medical nutrition therapy courses (McKnight et al., 2002). Further, participating DPDs also reported using foodservice and management coursework to apply principles from KRDNs 4.1 (n=44, 93.6%), 4.3 (n=19, 40.4%), 4.5 (n=43, 91.5%), and 4.6 (n=41, 87.2%). See table 3 for additional results.

Table 2: Didactic Program in Dietetics Characteristics (n=47)

	n	%
Total DPD Foodservice Related Courses[a]		
No courses	0	0
1-2 courses	19	40.4
3-4 courses	23	48.9
5-6 courses	4	8.5
7 courses	1	2.1
Total DPD Foodservice Related Credit Hours[a]		
Less than 3 credit hours	1	2.1
3-5 credit hours	14	29.7
6-10 credit hours	20	42.5
11-15 credit hours	11	23.5
16-20 credit hours	1	2.1
Greater than 20 courses	1	2.1
Total DPD Management Related Courses[a]		
No courses	1	2.1
1-2 courses	29	61.7
3-4 courses	6	12.8
5-6 courses	1	2.1
7-8 courses	0	0
9-10 courses	1	2.1
More than 10 courses	1	2.1
Total DPD Management Related Credit Hours[a]		
Less than 3 credit hours	3	6.4
3-5 credit hours	20	42.6
6-10 credit hours	16	34.1
Greater than 10	0	0
Faculty from these Programs Teach Managment and Foodservice Courses[b]		
Nutritional Science	17	36.2
Dietetics	38	80.9
Hospitality Management	12	25.5
Business Management	8	17.0
Food Science	6	12.8
Family and Consumer Science	4	8.5
Other	5	10.6

[a]Totals may not equal 47 and percentages may not equal 100 due to missing data.

[b]Total responses may exceed 47 and percentages may not equal 100 due to multiple responses

Table 3: KRDNs Addressed in Foodservice and Management Related Courses or Laboratory Experiences (n=47)

	n(%)				
	Course	Laboratory	Other	None	Unsure
Domain 1 KRDNs					
1.1 - Demonstrate how to locate, interpret, evaluate and use professional literature to make ethical, evidence-based practice decisions.	27 (30)	9 (19.1)	0 (0)	16 (34)	3 (6.4)
1.2 - Use current information technologies to locate and apply evidence-based guidelines and protocols.	25 (53.2)	11 (23.4)	0 (0)	17 (36.2)	0 (0)
1.3 - Apply critical thinking skills.	30 (63.8)	24 (51.1)	2 (4.3)	10 (21.3)	1 (2.1)
Domain 2 KRDNs					
2.1 - Demonstrate effective and professional oral and written communication and documentation.	33 (70.2)	22 (46.8)	1 (2.1)	11 (23.4)	0 (0)
2.2 - Describe the governance of nutrition and dietetics practice, such as the Scope of Nutrition and Dietetics Practice and the Code of Ethics for the Profession of Nutrition and Dietetics; and describe interprofessional relationships in various practice settings.	22(46.8)	4 (8.5)	1 (2.1)	20 (42.6)	2 (4.3)
2.4 - Discuss the impact of health care policy and different health care delivery systems on food and nutrition services.	23 (48.9)	4 (8.5)	2 (4.3)	21 (44.7)	1 (2.1)
2.5 - Identify and describe the work of interprofessional teams and the roles of others with whom the registered dietitian nutritionist collaborates in the delivery of food and nutrition services.	31 (66.0)	12 (27.7)	2 (4.3)	13 (27.7)	1 (2.1)
2.6 - Demonstrate an understanding of cultural competence/sensitivity.	25 (53.2)	13 (27.7)	1 (2.1)	18 (38.3)	0 (0)
2.7 - Demonstrate identification with the nutrition and dietetics profession through activities such as participation in professional organizations and defending a position on issues impacting the nutrition and dietetics profession.	14 (29.8)	4 (8.5)	1 (2.1)	28 (59.6)	0 (0)
2.8 - Demonstrate an understanding of the importance and expectations of a professional in mentoring and precepting others.	15 (31.9)	5 (10.6)	2 (4.3)	28 (59.6)	0 (0)
Domain 3 KRDNs					
3.2 - Develop an educational session or program/educational strategy for a target population.	23 (48.9)	11 (23.4)	3 (6.3)	20 (42.6)	0 (0)
3.4 - Explain the processes involved in delivering quality food and nutrition services.	42 (89.4)	27 (57.4)	1 (2.1)	0 (0)	1 (2.1)
Domain 4 KRDNs					
4.1 - Apply management theories to the development of programs or services.	44 (93.6)	17 (36.2)	0 (0)	0 (0)	0 (0)
4.2 - Evaluate a budget and interpret financial data.	45 (95.7)	20 (42.6)	1 (2.1)	0 (0)	0 (0)
4.3 - Describe regulation system related to billing and coding, what services are reimbursable by third party payers, and how reimbursement may be obtained.	19 (40.4)	2 (4.3)	1 (2.1)	23 (48.9)	0 (0)
4.4 - Apply the principles of human resource management to different situations.	46 (97.9)	12 (25.5)	2 (4.3)	0 (0)	0 (0)
4.5 - Describe safety principles related to food, personnel and consumers	43 (91.5)	25 (53.2)	1 (2.1)	0 (0)	0 (0)
4.6 - Analyze data for assessment and evaluate data to be used in decision-making for continuous quality improvement.	41 (87.2)	18 (38.3)	0 (0)	3 (6.4)	0(0)

The principle related to billing and coding (KRDN 4.3, n=19, 40.4%) was applied through coursework much less than other KRDN principles in Domain 4. However, recent research explored knowledge among RDNs specific to billing and coding and found that they lack knowledge in this subject (Jortberg et al., 2020). Researchers compared those results to a similar study conducted in 2013 and found no improvement in RDNs' billing and coding knowledge from 2013-2020 (Jortberg et al., 2020). Researchers have also discussed ethical and legal concerns associated to RDNs' lack of knowledge in billing and coding (Jortberg et al., 2020). Teaching billing and coding principles in management coursework may increase RDN knowledge on the subject and help eliminate any ethical or legal concern. However, the present study only assessed the level to which billing and coding is taught in foodservice and management coursework. It is likely that many programs address this topic in other clinically focused courses.

As for Domain 3, expert reviewers determined that only two Domain 3 KRDNs were relevant to foodservice and management and should be included in the final survey. Directors reported using foodservice and management coursework to "explain the processes involved in delivering quality food and nutrition services" (KRDN 3.4, n=42, 89.4%) and to "develop educational sessions or program/educational strategy for a target population" (KRDN 3.2, n=23, 48.9%). Other research has found clinical nutrition managers have responsibilities such as in-service/program development which can be considered closely related to KRDN 3.2 (Rusali et al., 2020). Further, Sauer et al. (2012) found clinical managers have additional tasks that included managing nutrition services, products, financial resources, and people. Consequently, the results of the present study suggest management coursework can include curriculum related to responsibilities of clinical RDNs such as those found by Sauer et al. (2012) and Rusali et al. (2020). Programs should consider presenting management principles in a variety of practice areas rather than solely in foodservice courses.

In regard to Domain 2 KRDNs, program directors indicated that foodservice and management coursework was used to develop student skills in "effective and professional oral and written communication" (KRDN 2.1, n=33, 70.2%), and to "Identify and describe the work of interprofessional teams…in the delivery of food and nutrition services" (KRDN 2.5, n=31, 66.0%). Interprofessional education is important for dietetics education to ensure quality patient-centered care (Davis & Affenito, 2017). Results from a previous study indicate Interprofessional education is commonly associated most often with clinical dietetics (Davis & Affenito, 2017). However, it is positive to note the present results show foodservice and management coursework is being utilized to teach concepts of Interprofessional education such as interprofessional teams. Interprofessional education is also important outside dietetics programs and is taught through culinary nutrition medicine to students in medicine, nursing, and physician assistant programs (Musick et al., 2020). Further, participating DPDs also indicated using foodservice and management coursework to teach all other KRDNs in Domain 2 including 2.2 (n=22, 46.8%), 2.4 (n=23, 48.9%), 2.6 (n=25, 53.2%), 2.7 (n=14, 29.8%), and 2.8 (n=15, 31.9%). See Table 3 for further details. Interestingly, less than 15 programs used foodservice and management coursework to teach the principles "participation in professional organizations/defending position in nutrition related issues" (KRDN 2.7, n= 14, 29.8%), and "mentoring/precepting others" (KRDN 2.8, n=15, 31.9%). These two principles were also the least common principles taught through foodservice and management coursework across all domains (see Table 3).

DPDs used foodservice and management coursework to teach principles included in all three KRDNs of Domain 1 including "Apply critical thinking skills" (KRDN 1.3, n=30, 63.8%), "evaluate and use professional literature…" (KRDN 1.1, n=27, 30.0%), and "use current information technologies to locate and apply evidence-based guidelines and protocols" (KRDN 1.2, n=25, 53.2%). Critical thinking is taught across disciplines, particularly in science, and can be difficult to teach (McNamara et al., 2019). However, employers seem to value critical thinking skills over academic success (McNamara et al., 2019). Research conducted by McNamara et al. found that online modules in semester-long nutrition courses can encourage students to use critical thinking skills such as decision making and supporting decisions with evidence-based reasons (McNamara et al., 2019). Such online modules could potentially be implemented in foodservice and management course work to help teach KRDNs in Domain 1.

Laboratory Experience

In addition to coursework, participating DPD directors were asked which KRDNs were taught through foodservice and management laboratory experience. Overall, DPDs used foodservice and management laboratory experience much less frequently than coursework to meet KRDNs. However, "explain the processes involved in delivering quality food and nutrition services" (KRDN 3.4, n=27, 57.4%), "describe safety principles related to food, personnel and consumers" (KRDN 4.5, n=25,53.2%), and "apply critical thinking skills" (KRDN 1.3, n=24, 51.1%) were taught by over half of DPDs through laboratory experience. Historically, Dietetic Internship have been used to teach similar foodservice management principles such as budgeting, cafeteria management, and recipe costing (Sneed et al., 1992). Teaching principles such as quality food production, food safety, budgeting, and other foodservice and management principles in DPDs via laboratory experience may help students better prepare for Dietetic Internship.

Several KRDNs had less than 6 programs using foodservice and management laboratory experience [KRDNs 4.3 (n=2, 4.3%), 2.2 (n=4), 2.4 (n=4, 8.5%), 2.7 (n=4, 8.5%), and 2.8 (n=5, 10.6%)]. Most of these principles are included in Domain 2 "professional practice expectations." Yet also in Domain 2 the principle to "demonstrate effective and professional oral and written communication and documentation" (KRDN 2.1, n=22, 46.8%) was one of five principles taught through laboratory experience by 20 or more DPDs. A recent study found students believe communication is important for patient satisfaction and collaborative relationships with patients (Knight et al., 2020). After implementing a simulated patient learning experience, students' confidence in their communication skills increased 13.4 percent. This would suggest teaching written and oral communication (KRDN 2.1) through foodservice and management laboratory experiences may help build students' confidence in developing communication skills. Further, Holik et al. (2021) found experiential learning in DPDs help students connect theoretical and applied learning to improve skills such as critical thinking, teamwork, and independence. DPDs can better utilize laboratory experiences by incorporating more foodservice and management related KRDNs into experiential learning curriculum and help students connect applied learning to theoretical concepts.

Open-Ended Questions

Lastly, DPD directors were also asked the following three open-ended questions as part of the survey: 1) "In the last 3 years, what (if any) significant changes have been made to management and foodservice education in your program?", 2) "In the next 3 years, what (if any) significant changes are you planning on making to management and foodservice education in your program?", and 3) "Please share any additional thoughts regarding management and food service education in dietetics." Analysis of data gathered from these questions revealed the following themes: "*expertise and leadership*" (n=34, 72.3%), "*course curriculum reallocation and revision*" (n=29, 61.7%), and "*resources and experiential learning*" (n=18, 38.3%). A summary of these themes is presented in Table 4.

The first theme that emerged was "*expertise and leadership*." This theme included comments about changes in faculty, collaboration with other education departments, entire program changes, opinions of DPD directors, and other similar topics. For example, one participant describing faculty changes stated, "We have hired a PhD whom [*sic*] has a chef background, and also a PhD with a food research background." Another stated, I am a "brand new DPD director, so I am in the process of making changes…" Other participants expressed opinions within the "*expertise and leadership*" theme such as, "I personally feel like foodservice education is not a critical component of dietetics education. It would be more beneficial for students to choose a path- clinical, community, foodservice, etc." Educators can use these opinions by experts and leaders in dietetics education to improve how foodservice and management principles are taught throughout DPD curriculum.

"*Course curriculum reallocation and revision*" was the second theme revealed in the data. This theme largely included any participant comment on changes in credit hours or a specific course. It also included comments about change in teaching styles and added case studies or assignments. One participant highlighting this theme stated, "…changed the senior-level management course to cover management across practice, renamed 'Nutrition and Foodservice Systems Management' and incorporated a business/ program plan in the course learning activities." One participant described changing DPD courses by stating, "added application in foodservice math and application exercises, added content related to management and

Table 4: Results from Thematic Analysis of Open-Ended Comments Regarding Changes to and Opinions of Foodservice and Management Curriculum

Theme	Illustrative Quotes
Expertise and Leadership (n^{*}=34)[a]	"Possibly bringing in a adjunct professor to teach the management side of the course, one who has an expertise in the area, since neither of the full time faculty consider it her strength."
	"I continue to work with Hospitality Management and the understanding the DPD students will be able to be ServSafe certified at the end of quantity food management"
Reallocation/Revision (n^{*}=29)[a]	"We removed the business management course, which was management 320, from the DPD curriculum. All management principles are now covered in the two foodservice management courses."
	"Management course was removed from curriculum"
Resources and Experiential learning (n^{*}=18)[a]	"We have a brand new kitchen. Took 2 years to complete."
	"The SOR [student operated restaurant] class changed their assignment to where students have to manage the rest of the students in the class to plan the restaurant menu, forecast, assign duties, run the restaurant on two separate days, and analyze the outcomes of their "day" they ran the restaurant"

leadership development." Another statement such as, "…reduced the number of SCH [student credit hours] dedicated to management and foodservice related curriculum" was included in this theme. Similar research by Scheule (2000) also found that DPDs planned to make course changes and revisions to increase food safety competencies for graduates. Other research has also looked at DPD directors' opinions toward change in dietetics curriculum. Sneed et al (1992) found 50% or more dietetic educators and practitioners rated financial management principles as very important and recommended dietetic programs revise curriculum to emphasize financial management principles (Sneed et al., 1992). More recently, research by Palermo et al., (2009) explored learning styles of dietetic students and suggested curriculum adjustments to better meet student needs. The current study and previous research support the idea that DPDs are currently and should continue to regularly update curriculum as needed by the changing education environment.

Further, a "*resources/experiential learning*" theme emerged from directors' comments describing new equipment, addition and/or removal of lab experience, preceptor experiences, and hands on food preparation. Within this theme one DPD director stated their program added and then took away a foodservice and management laboratory. Another participant described a learning experience for students by stating, "the Food Service Systems Management class integrated a 500-person benefit dinner into the curriculum. Students plan and carry out all phases of the dinner, such as recipe testing, menu selection, production scheduling, purchasing, service, labor, budget, public relations, etc." Some programs described equipment resources by stating, "We are working on an initiative to build a teaching kitchen." Student Operated Restaurants are one type of teaching kitchen used in some dietetics and hospitality programs to teach quantity food production and other foodservice and management principles (Nies, 1993; Stokes et al., 2018). Student Operated Restaurants are potentially one of the laboratory experiences DPDs add or remove from their curriculum to improve foodservice and management teaching.

CONCLUSIONS AND APPLICATIONS

Foodservice and management principles are an important part of DPD curriculum to prepare dietetic students for various practice areas after graduation. KRDNs are used to ensure foodservice and management principles are being taught in DPD education. Overall, KRDNs related to foodservice and management are being met more frequently through foodservice and management coursework compared to foodservice and management laboratory experience. Specifically, all principles included in Domain 4 were taught through foodservice and management coursework except for billing and coding (KRDN 4.3). Billing and coding (KRDN 4.3) was not found to be taught by many programs through foodservice and management coursework or lab experience. However, previous research has concluded billing and coding as a weakness in practicing RDNs and was indicated by expert reviewers to be related to foodservice and management. As such, DPDs may strengthen future RDNs' knowledge by incorporating billing and coding into management coursework or lab experiences.

Further, three themes emerged from analysis of three open-ended questions to reveal that DPDs are continuously working to improve foodservice and management curriculum. Directors were most frequently improving DPDs through course and credit revisions such as adding or removing a class. Faculty changes were also highlighted by many directors to improve foodservice and management education within the program. Most faculty changes were in hiring or plans to hire someone more qualified for teaching foodservice and management principles. Most DPD directors are making changes to provide hands on learning experiences for students. Many programs are using some type of laboratory experience to help students prepare food, plan menus, and/or manage events. It is interesting that several programs have these learning experiences to teach foodservice and management principles yet KRDNs related to foodservice and management were taught more through coursework. With DPDs already having and improving on these laboratory type experiences, including more foodservice and management KRDNs may help students gain the benefits of experiential learning.

One limitation of the study is that details concerning how coursework or laboratory experience were being used was not acquired. As such, future research should investigate what method of coursework and laboratory experiences are being utilized to meet KRDNs such as case studies, Student Operated Restaurants, lectures, and project work. Such research would provide DPD directors with several methods to improve foodservice and management curriculum for students. Future research should also investigate why less than half of programs indicated using laboratory experiences to address KRDNs. This research would allow educators to adapt curriculum offerings to better utilize laboratory experiences.

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Research Contribution

Journal of Foodservice Management & Education, Volume 16, Number 1, Pages 8– 11. ©2022
Published jointly by the Foodservice Systems Management Educational Council and the National Association of College & University Food Services

EMPLOYEE INTEREST IN PARTICIPATION IN A REUSABLE CONTAINER PROGRAM TO INCREASE HOSPITAL CAFETERIA SUSTAINABILITY

Jessica Wonn, MS, RD*; Joetta Khan, PhD, MPH, RD
Education & Research Department, Nutrition Services Division, Walter Reed National Military Medical Center, Bethesda, MD, USA

ABSTRACT
Food establishments generate a substantial amount of waste through packaging. Approximately 12,500 pounds of waste was created annually from containers disposed of in a military medical treatment facility cafeteria. This study evaluated the interest of employees in participating in a reusable container program at a military medical center. An anonymous survey queried demographics, cafeteria usage, and interest in participating in the program. Over half of respondents reported they would be very likely to participate in the program. Key reasons for participation included the positive environmental impact and convenience. Based on employee interest, a reusable container program could be utilized to increase the sustainability of this hospital cafeteria.

Keywords: Reusable Container, Hospital Cafeteria, Sustainability, Waste Management

Acknowledgements: The authors would like to thank Emily Chapman, MS, RD; Donna Goodson, MHA, RD; Katie Garske, RD; Jennifer Lopera, MS, RD; Cara Adams, MS, RD; and Anna Smith, MS, RD, for their assistance with the study.

Disclaimer: The views expressed in this manuscript are those of the authors and do not necessarily reflect the official policy of the Department of Defense or the U.S. Government.

INTRODUCTION

Food establishments generate a substantial amount of waste. The Environmental Protection Agency (EPA) estimates that food and packaging/containers make up almost 45% of the landfilled materials in the U.S. (United States EPA, 2015). All containers and packaging were estimated to make up 29.9% of total municipal solid waste generated in 2017, equating to approximately 80.1 million tons annually (United States EPA, n.d.). Waste generated broadly includes food waste (scraps from production, leftovers from overproduction, and plate waste), solid waste (product packaging, single-use to-go containers and cutlery), and energy and water waste. Within the United States, concerns over the environmental impacts of solid waste, specifically single-use food packaging and take-out containers has prompted the development of various types of packaging (e.g. biodegradable, compostable, paper) and the encouragement to minimize the use of single-use packaging. Techniques to reduce single-use packaging include 1) allowing personal reusable containers 2) providing reusable containers for take-away foods (e.g. china, plastic), and 3) offering discounted prices to individuals using reusable containers (e.g. forego the cost of the disposable product for individual bringing their own container).

Military federal food establishments include traditional post dining facilities and dining facilities within medical treatment facilities. Currently, the choice of packaging is not standardized across government facilities and varies by geographical region, budgets and availability of packaging from approved vendors. The current regulation, Tri-Service Food Code outlines specific guidelines for sanitation and the prevention of foodborne illness in the medical treatment facility food service setting. Additionally, this regulation sets pricing for food sales therefore offering discounts for the use of personal multi-use containers is not legally allowed (Headquarters, Department of the Army, 2019). However, Executive Order 13834, which is supported by the Department of Defense Sustainability Report and Implementation Plan of 2019, was written to encourage all governmental agencies to uphold the established statutory for sustainability, including eliminating the "unnecessary use of resources" (Executive Office of the President, 2018). To support these initiatives and decrease the amount of waste generated, the food operations division of a large military medical treatment facility in the U.S. northeast is considering establishing a reusable container program. Such a program could potentially assist with meeting sustainability goals of the military and installation command by limiting the use of single-use disposable to-go containers while dining-in the dining facility.

The food operations division offers multi-use plates and utensils for dining in and compostable to-go containers and utensils for customer take out. In 2019, the food operations division completed a waste audit of all disposable containers that were returned to the dish room for disposal (this waste was generated from individuals who selected a to-go container but ate in the dining room) for one lunch period (averaging 1,200 customer transactions Monday-Friday). Information collected included the number of containers that were sent to the landfill, the associated cost and estimated weight. During a 3-hour lunch period, 660 to-go containers in various forms (e.g. three compartment, bowls, and pizza boxes) were deposited in the tray return for disposal in the facility. Specifically, 350 biodegradable 3-compartment containers, 150 clam shell containers, 75 soup containers, and 85 pizza boxes, contributing to approximately 46 pounds of landfill waste daily. Based on these numbers, over one year, the dining facility contributes approximately 12,500 pounds of waste to the landfill from customers using disposable containers while dining in. The cost of disposable containers utilized in the dining facility during the lunch period equates to approximately $70,445 of paper products annually. These findings over a single lunch period demonstrate a need to further evaluate mechanisms to decrease the use of single-use disposable containers for dining in.

Although multi-use to-go containers (referred to as reusable, throughout the paper) may reduce the waste associated with single-use disposable containers (referred to as disposable, throughout the paper), they may also end up as waste. This highlights the need to understand the number of uses in the lifecycle of a reusable container and will allow for the identification of the transition point at which the environmental impact of producing and maintaining the reusable product matches that of its disposable counterpart. A study at the University of Berkley found that it took 15 uses of a single reusable polypropylene container to equal the environmental burdens of the

*Corresponding Author: Phone: (301) 400-3905; E-mail: jessica.r.wonn.mil@mail.mil

equivalent number of compostable containers (Harnoto, 2013). Reusable containers were also found to have a lower global warming potential impact than the non-reusable alternatives made of plastic and cardboard. Additional research into the impact of single use aluminum and extruded polystyrene containers concluded that it would take approximately 16 uses of a reusable container to balance out the environmental impact of aluminum containers and 24 uses to balance out the effects of extruded polystyrene (Gallego-Schmid et al., 2019). However, reusable containers specific for commercial operations boast ranges of 300 to 1000 uses, which well exceeds the number of uses required to equal the environmental impact of disposing of disposable containers (Ozzi, 2020; G.E.T. Enterprises, 2020).

There are limited studies that have evaluated waste reduction or environmental improvements derived from using reusable containers in other large-scale food service operations. Comparisons between studies is difficult as a majority of studies were conducted in university settings, many had differing methods of collection, and evaluated different reusable containers.

Although, minimal research has examined the likelihood to use reusable containers, cost of the container and perception of the environmental impacts appear to be two reasons that increase likelihood of use. A study among Hawaiian consumers found that 81% were supportive of a ban against extruded polystyrene and found an increase in their willingness to pay for a more sustainable to-go product (Barnes et al., 2011). Another study in a civilian university sample found 71% of respondents were moderately to very likely to use a reusable container program if the container was free, and 69% of respondents were willing to use the reusable container if the container was free and there was a $0.50 fee on disposal (Curtin et al., 2016) To our knowledge, this would be the first study evaluating the interest in and motivation to participate in a reusable container program at a military medical treatment facility.

Implementation of the multi-use to-go food container system could support the government wide and Department of Defense goals and vision in reference to sustainability, specifically in its plan to "continue to optimize its natural resources and avoid generating new waste" but only if patrons are willing to participate in such a program. Given the limited information on the use of reusable containers and the cost burden that would be associated with implementing such a program, the purpose of this project was to assess interest and motivation of dining facility patrons to participate in such a program.

METHODS

From December 2019 to February 2020, an internal project was conducted in the food operations division at a large military medical treatment facility in the northeast to determine the interest of hospital staff members in participating in a reusable container program. An anonymous dining facility reusable container survey was developed to collect simple demographics (e.g. hospital employee type), consumption patterns in the dining facility (e.g. if participants eat in the dining facility, how often and what they typically use [china vs. to-go container]) and an assessment of motivation and interest in the use of a reusable container program at this medical treatment facility (e.g. how likely they would be to use a reusable to-go container and how much money they would be willing to spend for a container). The survey was developed by the department dietetic interns and was approved by two registered dietitians from the food operations department management team from December 2019 to late-January 2020. The survey was administered for the month of February 2020 and available to all employees (~5,000). The study was determined to be exempt from full IRB review.

The survey was administered both in-person and online in February 2020. It was available for one day during the lunch period to be taken hardcopy in-person (to prevent the likelihood of duplication of participation) and turned in via a box to preserve anonymity. Additionally, an electronic link was made available throughout the dining facility via a quick response code and on the hospital's internal intranet for three weeks. The survey would automatically terminate if the participant selected, they were not a hospital employee or did not eat in the hospital dining facility.

Quantitative statistical analysis was performed using R Core Team software, version 3.6.1 (R Foundation for Statistical Computing, Vienne, Austria). Means and standard deviation were calculated for demographic data and consumption patterns. Motivation and interest question responses were counted. Survey free text responses were reviewed and coded independently for themes and subthemes by two independent research team members. Free text coding included 1) all survey answers with free text were reviewed by a research team member and specific themes were derived, 2) a second trained researcher reviewed all survey answers with free text independently of the first team member and also coded the answers for independent themes, and 3) the coders collectively verified the codes by reviewing the coding of each answer and arriving at a consensus on the theme.

RESULTS

In total, the survey yielded 444 responses (response rate 9%), 403 online and 41 hardcopies. Of the 444 collected, 10 were excluded for not being employed at the facility and 49 were excluded for not consuming meals in the dining facility. The remaining 386 participants reported eating an average of 1.3 ± 0.5 meals per day for an average of 3.3 ± 1.4 days per week in the dining facility. Over three-quarters of respondents reported using the compostable to-go containers currently offered (86.2%), while 13.8% of respondents reported use of ceramic dishes. On average, 1.2 ± 0.7 to-go containers (e.g. pizza slice container, soup bowl, compostable 3-compartment container) were utilized per customer per meal.

Reasons for using to-go containers are outlined in Table 1 with a majority (74%) reporting they normally "take their food to-go and eat elsewhere" followed by "concerns for cleanliness" at 13%. Individuals who responded 'other' were given the option for a write-in response. Major themes of the write-in responses included lack of availability for dine-in options, the need to return to work or eat in personal workspace, cleanliness, and to-go containers helping to keep their food warm before consumption.

Survey respondents were asked how likely they would be to utilize a reusable to-go container (picture provided) on a scale of 1 to 3 with one being not at all likely and three being very likely. 61.6% of respondents selected that they would be very likely to utilize the to-go containers. Free text reasons for using or not using a reusable container, resulted in the following main themes. Reasons for use

Table 1. Hospital Employee Reported Reasons for Using a To-Go Container (n = 386)*

Response	Number of Responses
I take my meal to-go and eat it elsewhere	287
Concerns for Cleanliness	49
No Reason	26
Other (with write in option)	25
Non-Applicable	24
Portion Sizes are Bigger in Containers	13

*Respondents could select more than one reason

included decrease the impact of waste, an environmentally friendly to -go option, increased quality for transporting food (e.g. decreased leaking). Reasons for not using included cost of the container, lack of availability of the container, not understanding how the program would work or how to turn back in the container, lack of a location to store the container.

When asked if participants would be likely to use the reusable container if the dining facility staff cleaned it for the consumer, 62.9% responded yes, 24.1% maybe, and 14.0% no. Most customers reported they were willing to pay a one-time fee for the container, with 73.6% of respondents indicating that they would be willing to pay a one-time fee of $5.00.

DISSCUSSION

The majority of employees of the medical treatment facility stated that they currently utilized to-go containers while dining in the dining facility. Many participants reasoned that they utilize the containers to take their meal elsewhere for consumption. This is supported by the free responses that included "I tend to get interrupted with work during lunch, so when I get ceramic I find I end up throwing away half of my lunch." As well, some respondents stated that they did not know there were ceramic plates available in the dining facility or that they feel the department staff encourages the use of to-go containers. This includes one respondent who stated, "cashiers requested weighed food to be placed in those (to-go) containers." The current standard operating procedure allows food be weighed in either to-go containers or on ceramic dishes, the scale is tarred by selecting the appropriate button on the cash register. While the implementation of a reusable container program may decrease the amount of solid waste produced based on the majority of respondents using to-go containers, these findings illustrate that it is important to also provide consumers and staff members with information on changes to dining facility operations related to such a program.

The results demonstrate that over half (61.6%) of customers in the hospital dining facility would be very likely to utilize a reusable to-go container, and the likeliness of participating increases slightly (62.9%) when the container is cleaned by the dining facility staff. The results demonstrate a high interest in the reusable to-go container program, which is further supported by the large number of responses stating desire for a more environmentally friendly option. Furthermore, the limited increase in interest should it be cleaned in-house is reflected in the qualitative responses that customers would forego the reusable ceramic dinnerware for the current compostable to-go containers due to concerns about cleanliness and that participants in a reusable container program would be interested in cleaning it themselves. It should be noted that the dining facility follows all Tri-Service Food Code for sanitation of dishes (Department of the Army, 2019).

Free response comments that were in support of the reusable to-go containers include the convenience factor of utilizing a to-go container and the hypothesis that the product would be more leak resistant than the current containers. As well, one respondent stated that "this initiative was already started in (a second military medical treatment facility) and I would like to see it applied here as well." This provides evidence that a small subset of the population may already have some familiarity with the program and feel comfortable using it upon initiation.

The themes against using a reusable container program included that the participants would not have a place to clean or store the reusable container, they already own an excess of reusable containers, and concerns about the location and convenience for returning the container. Specifically, comments included that the "return process may be too much for busy schedule" and "they already have available at home, and don't need more." These concerns should be addressed in the development of a marketing scheme including information graphics on dining facility screens and on the intranet nutrition services page, tabling events, and "frequently asked questions" handouts near the reusable to-go container equipment to inform consumers on use of a reusable container program. The information provided should increase the acceptability of the program and answer all questions about the program.

Despite the potential of a $5.00 entrance fee to the program, our interested clientele (73.6%) mirrors the percentages of the civilian sector respondents (71%) that were likely to participate only if the program was free (Curtin et al., 2016). This provides further support for initiating a reusable container program, as a potentially higher percentage of customers would utilize the program, even with an associated one-time cost.

A limitation of this study was that only individuals who were customers at the dining facility were allowed to participate in the survey. This excludes new consumers from participating and this could include individuals that may desire to eat at the dining facility or who may increase their likelihood of eating in the facility if a program is incorporated. Additionally, in advertising the survey on the hospital intranet homepage, a picture of a reusable to-go container was used. This may have encouraged those that use to-go containers to respond, which could have inflated both the ceramic versus to-go container number as well as the interest in such a program. Future research should incorporate the interest and motivation of a more diverse population. Although this survey was reviewed by several professionals, the survey developed was not validated therefore, results might differ if the survey was administered in another setting.

As many respondents stated they were interested in the program for its lower environmental impact, further investigation should be done on the environmental impact of implementing a reusable to-go container program at medical treatment facilities and other settings.

CONCLUSIONS AND APPLICATIONS

Results from this study suggest that employees of a large medical treatment facility are interested in the implementation of a reusable to-go container program. The primary motivation appears to be the environmental friendliness such a program would provide. Furthermore, employees would be willing to pay a $5.00 fee to participate in a reusable to-go container program. Although such a program would have an initial substantial start-up cost, in the long run, it could promote cost savings and meet the intent of the Department of Defense Sustainability Report and Implementation Plan and has the potential to lower the environmental impact of the facility once implemented and adopted by staff. Future endeavors should include, identifying specific containers systems that would best fit the facility, development of an employee education program to facilitate diffusion of such a program, and measurement methods to substantiate the effectiveness the program in improving sustainability through container waste reduction.

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Applied Solutions

Journal of Foodservice Management & Education, Volume 16, Number 1, Pages 12– 16 . ©2022
Published jointly by the Foodservice Systems Management Educational Council and the National Association of College & University Food Services

REDUCING FOOD WASTE IN A LARGE METROPOLITAN HOSPITAL THROUGH ENGAGEMENT WITH FOOD SERVICE LEADERSHIP AND PERSONNEL

Abigail Hill, MDN[1]; Diana Cuy Castellanos, PhD, RD[2*]; Karyn Catrine, MS, RDN, LD[3]; Erin Seiter, MS, RD, LD[4]

[1]School of Education and Health Sciences, Health and Sport Science, University of Dayton & Premier Health, Miami Valley Hospital, Dayton, OH, USA
[2]School of Education and Health Sciences, Health and Sports Science, University of Dayton, Dayton, OH, USA
[3]Nutrition Services, Premier Health, Miami Valley Hospital, Dayton, OH, USA
[4]Nutrition Services, Premier Health, Miami Valley Hospital, Dayton, OH, USA

ABSTRACT

In hospital food service settings, food waste often occurs due to inconsistent patient census, poor food forecasting and/or a lack of communication within the food service staff and leadership. The purpose of this paper is to describe methods used to address food waste in the Department of Nutrition Services (DNS) of a large Metropolitan hospital. First, causes of food waste were identified through interviews with DNS leadership in the hospital. After the interviews, two interventions, an educational session with DNS personnel and adjustment of food waste logs, were implemented. From baseline to post-intervention, there was a 69.1% decrease of reusable food. Addressing causes of food waste in food service institutions can have a positive economic and environmental impact.

Keywords: Food waste reduction, hospitals, food waste interventions, reusable food

INTRODUCTION

In the United States (US), it is estimated that 30-40% of food is wasted (U.S. Department of Agriculture [USDA], 2010). Globally, each person generates approximately between 428--858 pounds of food loss or waste per year (Corrado & Sala, 2018). By 2030, the US has a goal to reduce food waste and loss by half (Whitacre, Kameyama & Carrero-Martinez, 2019). In the past, food waste reduction efforts may have not taken priority within the food service industry (Goonan, Mirosa, & Spence, 2013). However, this may be changing as more food service industries are developing initiatives to address food waste produced in their institutions (Environmental Protection Agency [EPA], 2020).

For this paper, food waste is defined as all kitchen waste that could have been avoidable or possibly avoidable (Hanssen, Syversen, Sto, 2016). Avoidable kitchen waste includes food and drink that is edible before discarded, whereas possibly avoidable kitchen waste includes food and drink that some people eat but others do not, like bread crusts. There are various food waste categories. The categories include out of date or damaged raw ingredients, unavoidable kitchen scraps, potentially avoidable kitchen scraps, service line leftovers, unavoidable plate waste, and potentially avoidable plate waste. Those simplify into four different waste categories for each step of the food service process: pantry loss (raw ingredients, usually out of date produce), cooking loss (waste made during the cooking process), prepared food surplus (food not served but already cooked), and plate waste (food not eaten but served; Derqui & Fernandez, 2017). In industry, food waste may be viewed as a part of food service that is in a sense unavoidable. However, this mindset could lead to a decrease in interventions to address the issue.

*Corresponding Author: Phone: (801) 422-6676; E-mail: Nathan_stokes@byu.edu

Food waste is a concern as it has overall negative financial and environmental impact. The USDA estimates that 31% of food wasted in 2010 resulted in the loss of $161 billion (USDA, 2010). Annually, US households loss due to food waste is approximately $1,300 (Conrad, 2020). Furthermore, the EPA estimated that 20% of solid municipal waste was food-related and was associated with handling or dumping fees costing roughly $2 billion (EPA, 2017).

The EPA developed preferred methods to decrease the amount of food waste or loss that goes directly into landfills. From most preferred to least, their solutions include “feeding people through food banks and other donation programs, use as animal feed, industrial uses such as rendering and fuel conversion, composting, and, as a last resort, landfill or incineration” (Whitacre et al., 2019).

Addressing Food Waste in Food Service Institutions

Due to the financial and environmental impact of food waste, food service institutions (i.e. healthcare, schools, and restaurants) are exploring methods to decrease it. Methods used include improving staff communication, awareness and attitudes regarding food waste, encouraging food waste prioritization, quantifying food waste, and ingredient forecasting (Almdal et al., 2013; Corrado et al., 2019; Derqui & Fernandez, 2017; Eriksson et al., 2019; Goonan et al., 2014; Ishanguly & Lee, 2019; Ofei et al., 2015). In the healthcare sector, Ofei and colleagues (2015) explored interventions addressing food waste as well as barriers in successfully reducing food waste. Participants within the study reported a reduction of food waste once it was prioritized as an issue, awareness was raised amongst the employees and improved ingredient forecasting implemented. Barriers identified included competing priorities and the habit of throwing away food. Eriksson et al., (2019) observed a 61% decrease in food waste after the implementation of better communication methods and the quantification of wasted food, Further, values within management level can influence the culture of the food service institution related to food waste (Derqui & Fernandez, 2017). Therefore, leaders or managers prioritizing and effectively communicating the importance of food waste reduction to the employees within the institution may facilitate decreases in waste.

Accurate forecasting of ingredients has also been shown as an effective intervention to decrease food waste (Ofei, et al., 2015; Goonan et al., 2014). Pirani and Arafat (2016) found inaccurate forecasting as a major driver of food waste and difficult to avoid as food service managers do not want to risk not having enough food and often overestimate food needed. However, multiple methods have been used to improve forecasting and include implementing an accountability system, updating forecasting systems, developing policies around stock monitoring and rotation, auditing meals and using portion-control tools (Almdal et al., 2003; Filimonau & Uddin,

2021; Goonan et al., 2013). Certain technology is also available to assist with forecasting in institutions. However, these technologies can be expensive or not accepted by food service managers as they would rather rely on their own experience when estimating food quantities (Filimonau & Uddin, Irani et al., 2018).

To decrease the environmental effect of food waste, food donations to food pantries or other food assistance programs can provide a means of curving the amount of food entering landfills and provides a social benefit (Bierma & Bazan, 2019). Within a food service institution, tracking food donations can be a food waste indicator and tracked overtime. Although the reusable food is diverted from entering the landfill, it counts as edible food waste for it was not used for its intended purpose. Furthermore, it results in wasted monetary and labor resources.

Statement of the Challenge

In this paper, we describe methods used to address food waste in the Department of Nutrition Services (DNS) of a 900-bed Metropolitan hospital in the Midwest US. In this acute care Level 1 trauma hospital, the DNS prepares approximately 5000 meals per day, serving 1500 patient meals and 3500 cafeteria meals with 162 kitchen/service staff. To measure and determine potential solutions for food waste in the DNS, a food waste reduction team was created consisting of a dietetic intern, a food service dietitian and a research dietitian. The team estimated food waste by measuring the reusable food donated to a local food assistance program and used it as an indicator for food waste in the DNS. The donation of edible food waste to the assistance program was established more than 20 years ago. The reusable food waste included expired but still safe to eat food, overproduced food in the kitchens, and leftover food from catering events. The total reusable food waste measured over a four-day period in May of 2020 was 389.29 pounds (Table 1).

To gain insight on possible causes and barriers of food waste, the food waste reduction team conducted seven in-person semi-structured interviews with DNS leadership including the food service managers, Director of Nutrition Services and the Executive Chef. During these interviews, the measures of the amount of reusable food were provided and open-ended questions used to gain insight on reasons for reusable food waste. Managers and the Executive Chef reacted with surprise when provided the amount of reusable food waste produced in the kitchen. The themes that emerged from the interviews related to causes for the reusable food waste included the lack of awareness of the amount of food wasted, inaccurate forecasting, varying hospital census and other staffing issues. The barriers identified were staffing issues, a lack of an effective food waste tracking system, lack of time, variation of customer flow and strict hospital guidelines. In the following, deeper description of each theme related to causes and barriers is provided.

Table 1: Data Collection Results of Weighed Reusable Food Pre- and Post-intervention

TR: July 28th - Aug. 6th - Before intervention implementation	
Date	Quantity (in pounds)
07/28/20	164.12
07/30/20	43.79
08/04/20	84.99
08/06/20	96.39
Total	389.29
TR: Oct. 13th - Oct. 22nd – After intervention implementation	
Date	Quantity (in pounds)
10/13/20	26.40
10/15/20	11.15
10/20/20	49.45
10/22/20	33.28
Total	120.28

*TR = Tuesday and Thursday

Causes of Food Waste

Lack of awareness. Lack of awareness was described as DNS leaders and staff not realizing the amount of reusable food produced as well as the lack of understanding of the financial and environmental impact of waste.

Expiration dates. The DNS leaders discussed how not all staff may know or understand how to properly interpret expiration dates. For example, at this hospital if a food item has an expiration date of 09/20/20 that food item can be used until 11:59pm of that date. However, some employees believe that food items must be discarded the day before 09/20/20 and proceed to donate or throw that food away when it could still be used by the hospital.

Forecasting. Forecasting was a reason identified and was caused by various factors. The DNS leaders indicated that forecasting error was often due to a lack of knowledge of the amount of leftovers or limited time. Furthermore, recipe errors were also identified as a possible cause due to incorrect yield in recipes leading to overproduction.

Varying hospital census. Varying hospital census was identified as a barrier to forecasting for patient food service. The patient food service manager stated that she tends to order more food than forecasted in case more patients are admitted to the hospital than expected. However, if not as many patients are admitted or there is a high discharge rate then the over-ordering or over-producing can lead to reusable food.

Other staffing issues. Another cause included the lack of food rotation and training. Also, lack of training can lead to staff not being adequately trained on how to correctly cook/prepare food, rotate food, or how to track reusable food. Multiple managers expressed the challenge to sufficiently training every new employee because of the high turn-over rate. All staff identified concerns of both the lack of food waste and reusable food knowledge as well as misunderstanding the effect of their actions on food waste and reusable food. The last identified cause was poor preparation, meaning that staff were not properly preparing food to the quality it should. Poor preparation can lead to the food item not selling as well as forecasted and therefore increases the amount of reusable food.

Causes the research team decided they could directly affect included overproduction, lack of training, lack of food rotation, lack of awareness, lack of staff education, forecasting errors, and recipe errors. Those themes which could not directly be affected with an intervention included time, expiration date policy, number of staff, variation of census, variation of customer flow in the cafe, and manager accountability.

Identified Barriers to Reducing Reusable Food

Staffing. Staffing barriers included lack of staff and staffed adequately. Due to the nature of foodservice and the size of this specific hospital, an adequate number of staff is crucial in order to complete all responsibilities. Specifically, patient food service in this hospital has over 100 staff members, 4 supervisors, and 1 manager. A common theme from the managers that emerged from the data was the difficulty in keeping staff.

Lack of time. During the interviews, every DNS leader acknowledged that they usually do not have enough time to go through all the food waste tracking logs or make adjustments to the forecasting system every week.

Variation of customer flow. Variation of customer flow was also a barrier due to the hospital staff not knowing how many customers to expect. During the interviews, the retail manager and Executive Chef both expressed that there is a very fine line between making sure there is enough food in the cafe for customers and not overproducing the food.

Strict expiration date guidelines. DNS leaders indicated that expiration date guidelines can be frustrating. They reported that at times food is still good and safe to eat but due to their guidelines they have to donate it or throw it out.

Lack of an effective food waste tracking system. The Executive Chef and the patient food service manager expressed that their tracking logs could be more effective. Problems with the current logs included staff not understanding how to complete correctly. Many staff were either filling out the tracking logs incorrectly or not filling them out at all. Some tracking logs also did not specify if food was being thrown out or donated and why.

While there are many barriers identified to reducing reusable food, only one common barrier the research team agreed could be directly affected: lack of an effective food waste tracking system. The agreement of focusing on "lack of an effective food waste tracking system" for reducing reusable food is due to the hospital currently not having an effective food waste tracking system at this time. The other barriers, staff complications, lack of time, variation of customer flow, and expiration date guidelines, are barriers that the research team agreed could not directly affect with an intervention.

Ideas to Overcoming Barriers

There were a total of seven common overcoming barriers identified from the interviews including bringing focus to the problem, staff education, manager accountability, recording food waste, better forecasting, hiring more staff, and improving staff training.

Bringing focus to the problem. One of the most common ideas was bringing focus to the problem within the Department. This was defined as bringing focus and attention to the amount of reusable food and the causes of it. Many managers expressed that they thought if their staff had to start recording all food waste, they would start being more conscientious of how much was being wasted.

Staff Education. Educating staff on how to properly cook/prepare food, how their actions affect food waste, and how much reusable food is being produced was a common theme from the interviews. The purchasing manager said that making the staff more aware of the cost and the amount of the food that is being wasted and how that affects the organization as a whole could be beneficial in reducing reusable food.

Manager accountability. Managers need to make reducing reusable food a higher priority for themselves and their staff. It was stated from one manager that food waste is "one of those things that kinda gets buried amongst all the other competing priorities that we have." Ensuring staff are recording food waste every day, making forecasting a primary focus, and improving staff training on how to prevent reusable food can help increase prioritization.

More Staff. Another overcoming barrier idea was hiring more staff. This meant hiring enough staff so managers would not need to leave their responsibilities to help their staff. This would make more time available for analyzing the food waste tracking records and making any necessary adjustments to forecasting.

Description of the Solution

Intervention Development

During a leadership meeting, the food waste reduction team discussed the causes and barriers identified in the interviews with the DNS leadership. From that discussion, two interventions were determined and agreed upon by the food waste reduction team and the DNS leadership: a food waste educational session to DNS management and employees and an adjustment of food waste tracking logs in the DNS.

Intervention Implementation

One educational session was provided to management and supervisory positions in September 2020. The session included the data collection results, a sample cost analysis, the identified causes, barriers, and ideas for overcoming barriers, and the interventions that were determined to be feasible with the potential to be most effective. The sample cost analysis included commonly donated food, usual food donation, and the financial losses of that food per day, per week, per month, and per year (Table 2). From the educational sessions, the managers and supervisors implemented assessment of donated food before it leaves the hospital each day through the use of food logs and reviewing the logs. Although some food logs were already in use by some of the food service areas, the supervisors or management were not reviewing the logs consistently or viewing the food listed as food wasted and revenue waste. The review of the logs provided information on the type of reusable food and increased awareness and communication between the employees and management regarding food not utilized within the facility.

Patient food service and production were the two areas in the DNS that required a revision to their actual food logs. The tracking logs were designed to be better understood by the staff completing the logs and to the managers that analyzed the logs. Required information in the tracking logs included the date, type of food, reason for waste, quantity, and donated potential. The new food waste tracking logs were created through individual discussion with the executive chef and the patient food service manager.

CONCLUSIONS AND APPLICATIONS

Two weeks after the intervention was implemented, reusable food was re-measured (October 2020) and showed a decrease of 70% (Pre-intervention = 389.23 pounds; Post-intervention = 120.28 pounds).

A decrease in food waste can provide a positive financial and environmental impact to institutions. The two interventions implemented in this paper; raising food waste awareness amongst employees and addressing issues around forecasting, led to food waste reduction in the present setting and has been shown to be successful in other institutional food service settings (Erikkson et al., 2019; Ofei et al., 2015). For example, in a 2019 study, 61% of catering units decreased their food waste per guest after they were made aware of the amount of food waste that was produced (Eriksson, et al., 2019). While this large metropolitan hospital had food waste tracking logs already, they were not well utilized and therefore awareness of the amount of reusable food waste produced was inaccurate. Managers also did not consistently communicate with each other about the amount of reusable food produced in each of

Table 2: Summary Cost Analysis of Reusable Food Found from Using CBORD					
Food Item*	**Quantity**	**$ Per Day**	**$ Per Week (x3)**	**$ Per Month (x4)**	**$ Per Year (x13)**
Bananas	30 servings	$11.40	$34.20	$136.80	$1,778.40
Deli Turkey Sliced	5 pounds	$18.20	$54.60	$218.40	$2,839.20
Deli Ham Sliced	5 pounds	$14.50	$42.45	$169.80	$2,207.40
Fresh Salad Fruit Deluxe	8 pounds	$19.10	$57.30	$229.20	$2,979.60
Red Diced Onion	10 pounds	$19.70	$59.10	$236.40	$3,073.20
Turkey Sandwiches	20 sandwiches	$18.60	$55.80	$223.20	$2,901.60
Cryovac Bags	9.1# - 1 gal	$11.50	$34.40	$137.60	$1,788.80
PFS Meatloaf	50 servings	$10.90	$32.60	$130.30	$1,693.90
PFS Roast Beef	50 servings	$11.40	$34.10	$136.30	$1,771.90
PFS Roast Turkey	50 servings	$10.50	$31.60	$126.30	$1,641.90
Total		$145.80	$436.20	$1,744.30	$22,675.90

*The foods chosen and the amounts listed were decided in consultation with the executive chef as they were the most common foods and amounts to be donated.

their areas. Through raising awareness and updating the reusable food tracking forms and procedures, managers began to pay more attention to the amount of reusable food that was produced. The managers more closely assessed the reusable food tracking forms and continued to go personally to see the food that was donated daily before that food left the hospital. Similarly, Ofei et al., (2015) found increased communication regarding food waste in a healthcare food service setting led to a change in policies and a reduction in food waste.

The reduction of reusable food waste in the facility can decrease economic losses. Although not tracked consistently and based on the three day reusable food waste measure, it was estimated the food service institution could decrease loss by approximately two-thirds. Environmentally, increased food waste utilizes resources such as water, land and gas to produce the food as well as create a need for waste transport and harmful gas production contributing to greenhouse gases once in the landfill. Incorporating small interventions that are efficient, effective and do not increase resource need, can provide both economic and environmental benefit by decreasing food waste. In this paper, only a reusable food production analysis occurred. However, future interventions measuring the economic cost of food waste in a hospital institution (food cost, hauling fees, and labor costs) and an environmental impact analysis (greenhouse gas emission associated with production, transport and decomposition) would provide a holistic view of the impact of food waste (Beretta & Hellweg, 2019; Yona et al., 2020)

The interventions to decrease reusable food waste identified in the institution may not be appropriate for other institutions. However, the methods outlined in the paper could be replicated to inform intervention development in other food service institutions.

In conclusion, identifying causes of food waste and feasible strategies to address it can possess both financial and environmental advantages. Further, in the current context, raising awareness of food waste and revising food-tracking forms were two simple strategies implemented and had a positive impact. Therefore, the intervention does not need to be complex or time intensive yet can benefit the institution as well as contribute to overall environmental health. In the end, we, the authors, encourage other food service institutions to prioritize food waste reduction for their own benefit and as well as to benefit the current and future generations.

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Research Contribution

Journal of Foodservice Management & Education, Volume 16, Number 1, Pages 17– 29 . ©2022
Published jointly by the Foodservice Systems Management Educational Council and the National Association of College & University Food Services

COLLEGE STUDENTS' FOOD CHOICES IN A UNIVERSITY DINING HALL USING A TRAFFIC LIGHT LABELING SYSTEM

Christina Maffiola, RDN[1]; David A. Olds, PhD[2*]

[1]Health Coach Dietitian, ActiveHealth Management/CVS Health, Phoenix, AZ, USA
[2]Department of Family and Consumer Sciences, Bradley University, Peoria, IL, USA

ABSTRACT

The purpose of this study was to determine if implementing a traffic light labeling system would affect students' food choices in a university dining hall. Data collection occurred in two phases, 28 days apart. Survey questionnaires were completed by 165 participants and 177 participants in the pre-implementation and post-implementation phases of the study, respectively. Overall, participants in the post-implementation phase chose significantly healthier foods than participants in the pre-implementation phase. The results from this study reflected those from prior research, which found that implementation of a traffic light labeling system affected participants' food choices.

Keywords: food choices, traffic light labeling, students, university dining hall

Acknowledgements: This research was supported by the Department of Family and Consumer Sciences, Bradley University, Peoria, Illinois. Bradley University Dining Services (Peoria, Illinois) provided additional support for this research, including the use of a university residence dining center for data collection.

Disclaimer: Selected parts of this manuscript were previously presented at the 2018 Annual ICHRIE summer conference:
Olds, D. A., & Sas, M. (2018, July 25). The effect of the traffic light labeling system upon students' food choices in a university dining center. In *Proceedings of the 2018 Annual International Council on Hotel, Restaurant, and Institutional Education summer conference* (pp. 144-152). Richmond, VA: ICHRIE.

INTRODUCTION

Nutrition labeling systems are used in onsite foodservice operations to help consumers make informed dietary food choices. Prior studies have identified the need for a nutrition labeling system that can be clearly understood by the average consumer to help them to make healthy food choices (Christoph et al., 2016; Defago et al., 2020; Gorski Findling, 2018; McCann et al., 2013; Roberto et al., 2012a). Christoph et al. (2016) found that among college students, nutrition label use was associated with beliefs towards healthy eating, self-efficacy, and the usefulness of labels in assisting with food choices. Nutrition education and awareness programs were also identified as important in encouraging college students' nutrition label use.

Research of university students' perceptions of food and healthiness has shown that university students have well-developed ideas of the healthiness of food that extended beyond simple calorie-counting, suggesting that additional labeling information may be useful to help guide students' food choices (Fernandes et al., 2015). Peterson et al. (2010) conducted an intervention using healthy choice indicators and signs in an onsite university dining center. The researchers found that their intervention helped increase the healthy choices of the university students, as evidenced by a self-reported increase in awareness and a significant increase in the consumption of healthful foods.

A study by Borgmeier and Westenhoefer (2009) examined four different nutritional labeling formats to see which one best assisted retail customers to differentiate healthier food products from less healthy ones. Of the four formats examined in the study (i.e., the simple tick format; the traffic light format; the monochrome Guideline Daily Amount format; and the color-coded Guideline Daily Amount format), the traffic light format was found to have the greatest effect upon participants' food choices. Borgmeier and Westenhoefer (2009) also found that the absence of a nutrition label resulted in a lower percentage of participants selecting healthy foods.

Other selected types of nutrition labeling systems include the "Smart Choices Program" front-of-package label and the physical activity equivalent nutrition label. The Smart Choices Program provides a symbol that helps customers recognize the smarter choices within various product categories; the program also includes calorie statistics on the front of packages, such as calories per serving and servings per bottle, with the goal of assisting people in meeting their daily calorie requirements. (Lupton et al., 2010). Nutrition requirements are defined as part of the program to help customers identify items within a food or beverage category as a "better-for-you" choice. In addition to providing calories per serving and servings per package details, products meeting nutrition guidelines receive a Smart Choices Program label containing a green checkmark and text that reads, "Smart Choices Program Guiding Good Choices" (Lupton et al., 2010; Roberto et al., 2012b). In a study by Roberto et al. (2012b), approximately twice as many participants accurately identified the number of calories per serving on boxes of cereal with Smart Choices Program labels than participants who received boxes of cereal without Smart Choices Program labels. Additionally, participants in the Smart Choices Program label group perceived the cereal to be healthier than participants in the group without labels.

Physical activity equivalent labels show how much physical activity is required to burn off the calories in a food item and provide calorie information for that given item (Swartz et al., 2013). In contrast to other labeling systems, the physical activity equivalent labels use an iconographic style rather than text or text with graphics. Swartz et al. (2013) found that when attempting to identify healthy food items, a physical activity equivalent label might be more influential than other labels solely indicating caloric information. Participants using physical activity labels were able to adapt caloric information to their life and, as a result, their food choices. It was also notable that participants' perceptions shifted from calories as an abstract idea to a tailored fitness evaluation in connection to a label. However, the physical activity equivalent label was also shown to be confusing to some participants (Swartz et al., 2013). The labels provided a widely applicable physical activity equivalent for caloric details, but did not

*Corresponding Author: Phone: (309) 677-3242; E-mail: dolds@bradley.edu

account for factors such as age, gender, and body weight, all of which are crucial in deciding the actual metabolic results for anyone attempting to use the label. As a result, the labels may have been too simplistic, causing confusion among some participants attempting to balance calorie consumption with physical activity (Swartz et al., 2013).

Previous studies have shown that of the many nutritional labeling systems available, the traffic light labeling system is potentially the most effective in providing information to consumers trying to make healthy food choices (Borgmeier & Westenhoefer, 2009; Food Standards Agency, n.d.-a; Gorski Findling, 2018; Roberto et al., 2012a). The traffic light labeling system uses red, amber, and green symbols to indicate whether a product is high, medium, or low in fat, saturated fat, sugars, and salt at a glance, allowing customers to make healthy food decisions by selecting items with green or amber lights rather than red lights (Faculty of Public Health, 2008). The Food Standards Agency developed core concepts for traffic-light labels, used by producers and retailers on a range of food items (Faculty of Public Health, 2008). For front-of-pack labeling, retailers should adhere to the Food Standards Agency's traffic-light labeling guidelines (Faculty of Public Health, 2008). These guidelines include (a) giving separate information about salt, sugar, saturated fat, and fat contents; (b) using traffic lights (red, amber, or green color codes) to specify whether nutrient levels are high, medium, or low; (c) determining color codes using nutritional standards established by the Food Standards Agency; and (d) providing information on nutrient levels per portion of food product (Faculty of Public Health, 2008).

Traffic light labels were shown to be effective at signaling the nutritional characteristics of a single product, which included color-coded descriptors to help categorize the level of individual nutrients in a food as high, medium, or low (Food Standards Agency, n.d.-a). The words, "high," "medium," and "low" were well received by customers, who thought they were useful and insightful. Customers also thought the words, in combination with color-coding, easily communicated the nutritional message about the relative quantities of nutrients in the product (Food Standards Agency, n.d.-a). Foods with a green-colored label (recommended to consume often) are determined to be healthier than foods with an amber-colored label (recommended to consume in moderation) or foods with a red-colored label (considered the least healthy) (Faculty of Public Health, 2008; Food Standards Agency, n.d.-a, n.d.-b, 2007). Foods with red-colored labels do not need to be completely eliminated from one's diet; instead, they should be considered as a treat and consumed only occasionally (Faculty of Public Health, 2008; Food Standards Agency, n.d.-a, n.d.-b, 2007). The traffic light labeling system can aid individuals in quickly making more informed and healthier food choices (Babio et al., 2013). Consumers may have a better perception of the healthiness of foods when, for example, comparing a red label to an amber label, or an amber label to a green label (Hieke & Wilczynski, 2012). Because the traffic light labeling system can be used in real life buying situations, it is important to understand how this system could help increase the knowledge and general awareness of consumers while making food choices.

Traffic light systems have been used to examine consumer choices in onsite foodservice operations. Chen et al. (2017) implemented a traffic light labeling intervention in an Asian worksite cafeteria. Following the intervention, the percentage of customers who chose green-labeled entrees increased from 13% to 63%; conversely, the percentage of customers choosing red-labeled entrees decreased from 36% to 21%. Sonnenberg et al. (2013) found that implementing a traffic light system at the point of purchase helped to increase awareness of the healthiness of foods in a hospital cafeteria. Multiple longitudinal studies conducted by Thorndike et al. (2012, 2014, 2019) in a large hospital cafeteria found that the traffic light labeling system had a sustained improvement upon healthy versus unhealthy food and beverage purchases, with a decrease in calories from food and beverages purchased by employees over a 2-year period. The biggest change occurred with beverage choices, which showed a 22% decrease in calories from beverage purchases from baseline during the span of the study; furthermore, the largest reduction in calories came from red-labeled items (Thorndike et al., 2019). Another study found that when using a traffic light system, there was a possible aversion to foods that possessed red labels (Balcombe et al., 2010). Similarly, a study by Snelling and Kennard (2009) found that there was a decrease in the sale of red-labeled food items after implementing a traffic light labeling system.

Multiple studies conducted by Pettigrew et al. (2012a, 2012b, 2014) explored the impact of a traffic light food labeling system in primary and secondary schools and also examined children's understanding of the traffic light classification system following implementation in the schools' cafeterias. Retno and Fatmah (2019) evaluated the effect of the Front-of-Package Traffic Light labeling format on high school students' comprehension of nutrition labels. Arrúa et al. (2017) studied the effect of two front-of-package labeling systems, including the traffic light system, on schoolchildren's choices between two snack foods.

During a pilot study of a traffic light labeling system implementation in a university cafeteria, food items students considered healthy actually turned out to be some of the unhealthiest items in the cafeteria (Davis & Prakash, 2013). Seward et al. (2016) explored whether or not several weeks of traffic-light labeling interventions would affect dietary choices among students' food choices at a university in the northeastern United States. It was determined that although students used the traffic light labeling consistently, the interventions did not show a marked improvement in dietary quality upon students' food choices. Seward et al. (2018) also assessed students' perceptions of traffic light labeling implemented within college cafeterias. The majority of students found traffic light labeling to be helpful, but they also indicated that labels should provide nutritional information, while avoiding judgment of students' food choices and/or conveying negative messages.

The purpose of this study was to determine if implementing a traffic light labeling system would affect college students' food choices in an onsite foodservice operation, specifically, a university residence dining center using a cycle menu. Gregoire (2017) provides the following definition for a cycle menu:

> A cycle menu is a series of menus offering different items each day on a weekly, biweekly, or some other basis, after which the cycle is repeated. In many onsite foodservice operations, seasonal cycle menus are common. Cycle menus typically are used in healthcare institutions and schools and offer variety with some degree of control over purchasing, production, and cost. (p. 45).

To the best of the authors' knowledge, no prior studies conducted in university dining centers had utilized a cycle menu in conjunction with a one-meal implementation of a traffic light labeling system. Consistency and comparability in data collection was realized by the study's design, which used a cycle menu in the university residence center. Specifically, it permitted the same menu that was used prior to implementing a traffic light labeling system to be used/repeated again 28 days later, which was the day that the traffic light labeling system was implemented in the dining center. This design served as

the basic framework for the study, which is discussed in greater detail in the following methods section.

METHODS

Research Design

This research study was conducted in a mid-sized private university located in the Midwestern region of the United States. The study was approved by the university's institutional research board. Permission to use an on-campus residential dining center for two days of data collection was obtained from the General Manager of Dining Services at the university. Data collection was performed in the largest of the university's two residence dining centers. A mean population of approximately 400 students typically visited this dining center for dinner from 5:00 p.m. – 8:00 p.m. each evening, seven days per week, during the regular academic school year (i.e., August – May). Students selected food items from the cafeteria buffet line in the dining center, which used a self-serve, all-you-can eat style of service.

Research Instrument Used in Study. While eating dinner at the dining center, potential participants were offered the opportunity to complete paper and pencil surveys that contained a series of open-ended and multiple-choice questions. Individuals who agreed to be participants in the research study were given a survey after they had gone through the cafeteria buffet line and had already made their food choices for the evening. Participants then completed their surveys while eating their dinner. The surveys included questions about participants' food and beverage choices and the factors that may have influenced their choices. Participants also responded to questions pertaining to their perceived weekly stress levels, and how healthy they normally ate.

Survey data were collected in the dining center on two separate days in two phases: before implementing a traffic light labeling system (i.e., the pre-implementation phase), and exactly 28 days later, which was the day that the traffic light labeling system was actually implemented, immediately prior to data collection (i.e., the post-implementation phase). The dining center used a cycle menu, which repeated after 28 days. The two phases of survey data collection were conducted on the same day of the week (Wednesday), in the same dining center, using the same dinner menu. This helped to ensure that data from both phases were sufficiently comparable. Survey instruments were pilot tested in the dining center a week prior to each phase of data collection. Based on relevant feedback from 15 university students during each pilot test, grammatical modifications were made to the survey instruments. Survey data collected during pilot testing were sequestered and not included in the subsequent formal data collection phases.

Participants and Procedures

Potential participants included university students who ate in the dining center during dinner meal service. Individuals who were not students or under 18 years of age were excluded from data collection. Potential participants were asked if they would be interested in completing a paper and pencil survey, and were also informed of the option to participate in a subsequent drawing for three gift cards following data collection as an incentive for completing the survey. Individuals who agreed to participate in the study were instructed to complete the surveys in the dining room and return them directly to the researchers. Two phases of formal data collection were conducted in the dining center, 28 days apart. For all phases of data collection activity, including pilot testing, participants were not individually identifiable and their survey responses were kept confidential.

Intervention Used in Study. During the pre-implementation phase of the study, the dining center used nutritional food identifier cards during meal service (Figure 1). These were laminated 3" x 5" index cards containing nutrition information, which were placed next to the respective food items offered during each dinner meal. This was the normal, standard operating procedure and the food identifier cards were regularly used during dinner throughout the school year for all main food items. A pre-implementation survey assessed if participants noticed the food identifier cards and if the cards had an effect upon their food choices.

During the post-implementation phase of the study (which occurred 28 days later), a traffic light labeling system was implemented immediately prior to data collection (i.e., about an hour before the dining center opened its doors for dinner). This was accomplished by simply affixing a ¾-inch circular green, yellow, or red-colored sticker (i.e., a traffic light label) to the regularly-used nutritional food identifier cards (Figure 2). In addition, a 2' x 3' informational poster describing the traffic light labeling system was prominently displayed on an easel at the entrance to the dining center (Figure 3). All

Figure 1: Nutritional food identifier card

Figure 2: Nutritional food identifier card with an affixed ¾-inch circular green-colored sticker (traffic light label)

participants in this study walked through the doors of the dining center and passed the conspicuous informational poster before going through the cafeteria buffet line to make their food choices.

The survey was administered post-implementation (i.e., on the day of the traffic light labeling system implementation), in part, to assess if participants noticed the newly-implemented traffic light labeling system and/or informational poster and if those items had an effect upon their food choices. It was postulated that the traffic light labeling system, implemented by affixing colored stickers on the food identifier cards, along with the prominently displayed 2' x 3' informational poster would influence participants' food choices.

Statistical Analyses

Survey data were entered into SPSS (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corporation) and verified for accuracy. Data analysis procedures included chi-square tests, descriptive statistics, independent samples *t*-tests, one-way analysis of covariance (ANCOVA), and one-way analysis of variance (ANOVA). An alpha level of .05 was used for all statistical tests.

RESULTS AND DISCUSSION

Demographics

During the pre-implementation phase of data collection, 165 participants (56.4% male, 43.6% female) ranging in education level from freshman to graduate students completed the survey instrument. During the post-implementation phase of data collection, 177 participants (48.0% male, 52.0% female) ranging in education level from freshman to graduate students completed the survey instrument. Surveys were excluded from data analysis if there was missing or incorrect data such as two or more answers filled in for single-answer questions, or surveys that had multiple questions which were not completed.

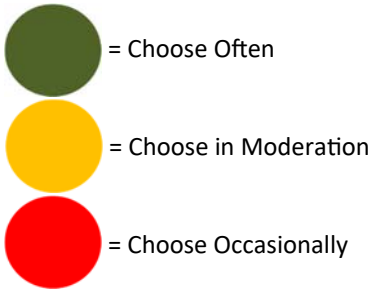
A chi square test revealed that there were no significant differences between the gender of participants in the pre-implementation and post-implementation phases of the study, $c^2(1, N = 342) = 2.38$, $p = .123$. In addition, there were no significant differences between the education level of participants in the pre-implementation and post-implementation phases of the study, $c^2(4, N = 342) = 3.64$, $p = .458$. Finally, there were no significant differences between the number of times a week participants ate dinner at the dining center in the pre-implementation and post-implementation phases of the study, $c^2(6, N = 342) = 4.56$, $p = .601$, concluding that there were no significant differences in demographics of participants between either phase of the study. Further results are shown in Table 1.

Survey Responses

For the majority of the pre-implementation and post-implementation surveys, identical questions were asked of respondents for both phases of the study. Survey questions unique to the pre-implementation or post-implementation phases of the study are identified in parenthesis immediately following the respective questions. Comparisons of participants' responses to selected questions between the pre-implementation and post-implementation surveys are included. Participants' questions for the pre-implementation and post-implementation phases of the study, along with results, are as follows:

How Many Times a Week Do You Eat Dinner at the Dining Center?
Following data collection, participants' responses were categorized on a seven-point Likert-type scale with a value of "1" being "1 time per week" to "7" being "7 times per week." From the pre-implementation survey ($n = 165$), participants reported eating at the dining center an average of 4.92 times per week (male: $M = 5.19$, $SD = 1.81$; female: $M = 4.56$, $SD = 1.80$). From the post-implementation survey ($n = 177$), participants reported eating at the dining center an average of 4.95 times per week (male: $M = 5.24$, $SD = 1.72$; female: $M = 4.72$, $SD =$

Traffic Light Label Information



Food Entree

Substance	Green	Yellow	Red
Calories	Less than 200 kcal	Between 200 and 350 kcal	More than 350 kcal
Total Fat	Less than 3g	Between 3 and 17.5g	More than 17.5g
Saturated Fat	Less than 2g	Between 2g and 5g	More than 5g

Side Dish and Dessert

Substance	Green	Yellow	Red
Calories	Less than 100 kcal	Between 100 and 200 kcal	More than 200 kcal
Total Fat	Less than 2g	Between 3g and 10g	More than 10g
Saturated Fat	Less than 1g	Between 2g and 4g	More than 4g

Drinks and Condiments

Substance	Green	Yellow	Red
Calories	Less than 50 kcal	Between 50 and 100 kcal	More than 100 kcal
	Less than 2.5g	Between 2.5g and 11g	More than 11g

Figure 3: Traffic light labeling informational poster, displayed at the dining center entrance

Table 1: Participant Demographics from Pre-implementation Survey and Post-Implementation Survey (N = 342)

	Pre-implementation (*n* = 165)*		Post-Implementation (*n* = 177)*	
Characteristics of Participants	**Male**	**Female**	**Male**	**Female**
Gender	93 (56.4%)	72 (43.6%)	85 (48.0%)	92 (52.0%)
University Level of Education				
Freshman	45 (27.3%)	46 (27.9%)	46 (26.0%)	59 (33.3%)
Sophomore	30 (18.2%)	21 (12.7%)	22 (12.4%)	21 (11.9%)
Junior	10 (6.1%)	4 (2.4%)	9 (5.0%)	4 (2.2%)
Senior	6 (3.6%)	1 (0.6%)	7 (4.0%)	7 (4.0%)
Graduate Student	2 (1.2%)	0 (0.0%)	1 (0.6%)	1 (0.6%)
Number of Times Per Week Eating Dinner at the Dining Center				
1 time	3 (1.8%)	7 (4.2%)	2 (1.1%)	4 (2.3%)
2 times	6 (3.6%)	2 (1.2%)	5 (2.8%)	6 (3.4%)
3 times	11 (6.7%)	11 (6.7%)	8 (4.5%)	11 (6.2%)
4 times	12 (7.3%)	10 (6.1%)	12 (6.8%)	20 (11.3%)
5 times	11 (6.7%)	21 (12.7%)	17 (9.6%)	22 (12.4%)
6 times	18 (10.9%)	8 (4.8%)	11 (6.2%)	8 (4.5%)
7 times	32 (19.4%)	13 (7.9%)	30 (17.0%)	21 (11.9%)

*Percentages listed for each phase

1.71). Most participants who ate at the dining center were on a residential meal plan; these results reflected the regular use of those meal plans, with the greatest percentage of participants in both phases of data collection reporting that they ate dinner at the dining center seven times per week. Further results are shown in Table 1.

A one-way analysis of variance (ANOVA) was conducted for both phases of the study to determine if there were any differences between the number of times participants ate dinner each week upon their food choices. There were no statistically significant differences between group means of the number of times participants ate dinner each week and their food choices in the pre-implementation phase (F (6, 158) = 0.86, p = .530). Further results are shown in Table 2. Likewise, there were no statistically significant differences between group means of the number of times participants ate dinner each week and their food choices in the post-implementation phase (F(6, 170) = 0.94, p = .470). Further results are shown in Table 3. Further results of participants' food choices are shown in Table 4.

Do You Think there Is a Variety of Healthy Choices for Dinner in the Dining Center? From the pre-implementation survey (n = 165), 79.4% of participants (47.9% male, 31.5% female) said that there were a variety of healthy choices and 20.6% of participants (8.5% male, 12.1% female) said that there were not a variety of healthy food choices. From the post-implementation survey (n = 175), 76.6% of participants (37.7% male, 38.9% female) said that there were a variety of healthy choices and 23.4% of participants (10.3% male, 13.1% female) said that there were not a variety of healthy food choices. A chi-square test revealed that there was a near-significant difference in variety of healthy choices between pre-implementation participants and post-implementation participants, $c^2(1, N = 340) = 3.40$, p = .065. Additional chi-square tests revealed a significant difference in variety of healthy choices between male and female participants in the pre-implementation phase, $c^2(1, N = 165) = 4.02$, p = .045, but no significant difference in variety of healthy choices between male and female participants in the post-implementation phase, $c^2(1, N = 175) = 0.36$, p = .548.

What Were Your Food Choices Today? Twenty of the main food items from the cafeteria were listed on the surveys. Following data collection, participants' reported choices were categorized based upon nutritional information on a six-point Likert-type scale, with a value of "1" being "all green" items to "6" being "all red" items. Following the implementation of the traffic-light labeling system, a greater percentage of participants in the post-implementation phase chose healthier food items (classified as "all green" or "mostly green") and a smaller percentage of participants chose unhealthier food items (classified as "all red" or "mostly red") than participants in the pre-implementation phase. Further results are shown in Table 4.

An independent samples t-test revealed that post-implementation phase participants chose significantly healthier foods (M = 3.05, SD = 1.27) than pre-implementation phase participants (M = 3.64, SD = 1.29), t(340) = 4.27, p < .001. In the pre-implementation phase, an independent samples t-test revealed that female participants chose significantly healthier foods (M = 3.18, SD = 1.18) than male

Table 2: One-way Analysis of Variance (ANOVA) Between the Number of Times Participants Ate Dinner Each Week Upon Their Food Choices in the Pre-implementation Phase (N = 165)

Source	Sum of Squares	df	Mean Square	*F*	Sig.
Between Groups	8.556	6	1.426	.855	.530
Within Groups	263.626	158	1.669		
Total	272.182	164			

Note: Participants were asked the following questions: *"How many times a week do you eat dinner at the dining center?"* and *"What were your food choices today?"* Following data collection, participants' responses were categorized on a seven-point Likert-type scale with a value of "1" being "1 time per week" to "7" being "7 times per week." There were no statistically significant differences between group means of the number of times participants ate dinner each week and their food choices in the post-implementation phase of the study.

Table 3: One-way Analysis of Variance (ANOVA) Between the Number of Times Participants Ate Dinner Each Week Upon Their Food Choices in the Post-Implementation Phase (N = 177)

Source	Sum of Squares	df	Mean Square	*F*	Sig.
Between Groups	9.082	6	1.514	.937	.470
Within Groups	274.556	170	1.615		
Total	283.638	176			

Note: Participants were asked the following questions: *"How many times a week do you eat dinner at the dining center?"* and *"What were your food choices today?"* Following data collection, participants' responses were categorized on a seven-point Likert-type scale with a value of "1" being "1 time per week" to "7" being "7 times per week." There were no statistically significant differences between group means of the number of times participants ate dinner each week and their food choices in the post-implementation phase of the study.

Table 4: Participants' Food Choices

Intervention Phase	All green	Mostly green	Mostly yellow	All yellow	Mostly red	All red
Pre-Implementation	Male: 1.8%	Male: 4.3%	Male: 19.4%	Male: 0%	Male: 29.1%	Male: 1.8%
(*n* = 165)	Female: 1.8%	Female: 10.3%	Female: 20.6%	Female: 0%	Female: 10.9%	Female: 0%
	Total: 3.6%	Total: 14.6%	Total: 40.0%	Total: 0%	Total: 40.0%	Total: 1.8%
Post-Implementation	Male: 1.7%	Male: 9.0%	Male: 24.3%	Male: 0.0%	Male: 11.9%	Male: 1.1%
(*n* = 177)	Female: 6.8%	Female: 18.1%	Female: 15.8%	Female: 1.1%	Female: 10.2%	Female: 0.0%
	Total: 8.5%	Total: 27.1%	Total: 40.1%	Total: 1.1%	Total: 22.1%	Total: 1.1%

Note: Participants were asked the following question: *"What were your food choices today?"* Following data collection, participants' responses were categorized on a six-point Likert-type scale based upon nutritional information and assigned classifications of all green, mostly green, mostly yellow, all yellow, mostly red, or all red. An independent samples *t*-test revealed that post-implementation phase participants chose significantly healthier foods (M = 3.05, SD = 1.27) than pre-implementation phase participants (M = 3.64, SD = 1.29), $t(340) = 4.27$, $p < .001$.

participants (M = 3.99, SD = 1.26), $t(163) = 4.20$, $p < .001$. Likewise, in the post-implementation phase, an independent samples *t*-test revealed that female participants chose significantly healthier foods (M = 2.80, SD = 1.29) than male participants (M = 3.31, SD = 1.21), $t(175) = 2.67$, $p = .008$.

What Affected Your Food Choices Today? From the pre-implementation survey (n = 165), 34.6% of participants reported appearance of food affected their food choices, followed by food cravings (30.9%), nutrient content or health (30.3%), convenience (18.2%), stress (9.0%), and other factors (12.2%). Other factors identified included being on a soft foods diet, allergies, and that food choices were better than the other dining center on campus. From the post-implementation survey (n = 177), 39.5% of participants reported appearance of food affected their food choices, followed by nutrient content or health (34.4%), food cravings (28.9%), convenience (24.3%), stress (5.1%), and other factors (8.5%). Other factors identified included food allergies, diet changes due to surgery, and vegetarian items. Further results are shown in Table 5.

Chi-square tests revealed that there were no significant differences between the pre-implementation phase and post-implementation phase in factors affecting participants' food choices, including appearance of food, $c^2(1, N = 342) = 0.92$, $p = .339$; food cravings, $c^2(2, N = 342) = 1.29$, $p = .525$; nutrient content or health, $c^2(2, N = 342) = 1.69$, $p = .430$; convenience, $c^2(1, N = 342) = 1.90$, $p = .168$; and stress, $c^2(1, N = 342) = 2.10$, $p = .147$.

Did You Notice the Food Identifier Cards (Pre-Implementation)? From the pre-implementation survey (n = 165), 81.8% of participants (44.2% male, 37.6% female) reported that they noticed the existing food identifier cards containing nutrition information, which were placed next to the respective food items offered during each dinner meal. The remaining 18.2% of participants (12.1% male, 6.1% female) did not notice the food identifier cards.

Did You Notice the Traffic Light Labeling System (Post-Implementation)? From the post-implementation survey (n = 177), 60.5% of participants (24.9% male, 35.6% female) reported that they noticed the implemented traffic light labeling system and 39.5% of participants (23.1% male, 16.4% female) did not notice the traffic light labeling system. A chi-square test revealed that there was a significant difference between participants that noticed the food identifier cards in the pre-implementation phase and participants that noticed the traffic light labeling system in the post-implementation phase, $c^2(1, N = 342) = 18.84$, $p < .001$. A possible explanation for this significant difference is that participants were already familiar with the food identifier cards, as they were normally used in the cafeteria throughout the school year, in comparison to the traffic light labeling system, which was only implemented for just one day.

Do You Know What the Different Colors in the Traffic Light Labeling System Represent (Post-Implementation)? From the post-implementation survey (n = 176), 50.0% of participants (21.6% male, 28.4% female) said that they did know what the different colors in the implemented traffic light labeling system represented, and 50.0% of participants (26.7% male, 23.3% female) said that they did not know what the different colors in the implemented traffic light system represented. The fact that the traffic light labeling system was only implemented for one day may have contributed to half of the participants not knowing what the different colors represented. A longer implementation time (i.e., a week, month, or longer) could have allowed students more time to learn what the different colors in the traffic light labeling system represented.

Did You Read and Understand the Nutritional Information Provided on the Food Identifier Cards (Pre-Implementation)? From the pre-implementation survey (n = 165), 52.1% of participants (30.9% male, 21.2% female) said they understood the information on the food identifier cards, 30.9% of participants (13.9% male, 17.0% female) said they did not understand the information, and 17% of participants

Table 5: Factors Affecting Participants' Food Choices

Intervention Phase	Appearance of Food	Food cravings	Nutrient content or health	Convenience	Stress	Other Factors
Pre-implementation	Male: 18.8%	Male: 20.0%	Male: 14.5%	Male: 10.3%	Male: 4.8%	Male: 6.7%
(*n* = 165)	Female: 15.8%	Female: 10.9%	Female: 15.8%	Female: 7.9%	Female: 4.2%	Female: 5.5%
	Total: 34.6%	Total: 30.9%	Total: 30.3%	Total: 18.2%	Total: 9.0%	Total: 12.2%
Post-Implementation	Male: 16.9%	Male: 15.3%	Male: 14.1%	Male: 13.6%	Male: 2.8%	Male: 5.7%
(*n* = 177)	Female: 22.6%	Female: 13.6%	Female: 20.3%	Female: 10.7%	Female: 2.3%	Female: 2.8%
	Total: 39.5%	Total: 28.9%	Total: 34.4%	Total: 24.3%	Total: 5.1%	Total: 8.5%

Note: Participants were asked the following question: *"What affected your food choices today?"* Participants were given the options of stress, food cravings, convenience, appearance of food, nutrient content/health, and other factors to choose from. Chi-square tests revealed that there was no significant differences between the pre-implementation phase and post-implementation phase in factors affecting participants' food choices, including appearance of food, $c^2(1, N = 342) = 0.92$, $p = .339$; food cravings, $c^2(2, N = 342) = 1.29$, $p = .525$; nutrient content or health, $c^2(2, N = 342) = 1.69$, $p = .430$; convenience, $c^2(1, N = 342) = 1.90$, $p = .168$; and stress, $c^2(1, N = 342) = 2.10$, $p = .147$.

(11.5% male, 5.5% female) said that they did not notice the identifier cards.

Did You Read and Understand the Nutritional Information Provided with the Traffic Light Labeling System (Post-Implementation)? From the post-implementation survey (*n* = 165), 32.7% of participants (13.3% male, 19.4% female) said that they read and understood the nutritional information provided with the traffic light labeling system, 31.5% of participants (12.7% male, 18.8% female) said that they did not know what the different colors in the traffic light labeling system represented, and 35.8% of participants (20.0% male, 15.8% female) said that they did not notice the traffic light labeling system.

Did the Food Identifier Cards Encourage You to Pick a Healthy Food (Pre-Implementation)? From the pre-implementation survey (*n* = 165), 27.3% of participants (13.9% male, 13.4% female) said that the food identifier cards did encourage them to pick a "healthier" item, 54.5% of participants (29.7% male, 24.8% female) said the food identifier cards did not encourage them to pick a "healthier" item, and 18.2% of participants (12.7% male, 5.5% female) said that they did not notice the food identifier cards.

Did the Traffic Light System Encourage You to Choose a Green-Labeled Item (Post-Implementation)? From the post-implementation survey (*n* = 161), 24.8% of participants (9.9% male, 14.9% female) said that the traffic light labeling system did encourage them to pick a green labeled item, 33.0% of participants (14.9% male, 18.1% female) said that the labeling system did not encourage them to pick a green labeled item, and 42.2% of participants (23.0% male, 19.2% female) said that they did not understand what the different colors in the traffic light system represented.

Comparison of the Food Identifier Cards Versus the Traffic Light Labeling System in Encouraging Participants to Pick/Choose a Healthy/Green Labeled Food

A comparison was performed between the pre-implementation and the post-implementation phases of the study to determine which method (i.e., the food identifier cards or the traffic light labeling system) was the most effective in encouraging participants to eat more healthy food items. Data were modified prior to analysis to ensure that comparisons were conducted only using participants that read and understand the nutritional information provided on the food identifier cards and participants that read and understand the nutritional information provided on the traffic light labeling system. Thus, 35 participants from the pre-implementation phase that did not understand the nutritional information on the food identifier cards (or did not notice the food identifier cards) and 99 participants from the post-implementation phase that did not understand the nutritional information on the traffic light labeling system (or did not notice the traffic light labeling system) were removed from their respective data sets prior to comparison.

From the pre-implementation phase (*n* = 130), 34.6% of participants (17.7% male, 16.9% female) said that the food identifier cards encouraged them to pick a healthy food item and 65.4% of participants (36.2% male, 29.2% female) said that the food identifier cards did not encourage them to pick a healthy food item. From the post-implementation phase (*n* = 66), 48.5% of participants (18.2% male, 30.3% female) said that the traffic light labeling system encouraged them to choose a green-labeled food item and 51.5% of participants (25.8% male, 25.7% female) said that the traffic light labeling system did not encourage them to choose a green-labeled food item.

A chi-square test revealed that there was a near-significant difference between the food identifier cards and the traffic light labeling system in encouraging participants to pick/choose a healthy/green-labeled food item, $c^2(1, N = 196) = 3.53$, $p = .060$. This suggests that the traffic light labeling system may have been more effective than the food identifier cards in encouraging participants to choose healthy/green-labeled food items. It also suggests that positive reinforcement, such as encouragement, may have been sufficiently effective in convincing participants to select healthier food items.

Did the Food Identifier Cards Discourage You from Picking a Certain Type of Food (Pre-Implementation)? From the pre-implementation survey (*n* = 165), 24.8% of participants (10.3% male, 14.5% female) said that the food identifier cards discouraged them from picking a certain type of food, 55.8% of participants (32.7% male, 23.1% female) said that the food identifier cards did not discourage them from picking a certain type of food, and 19.4% of participants (13.3% male, 6.1% female) said that they did not notice the food identifier cards.

Did the Traffic Light Labeling System Discourage You from Choosing a Red or Yellow-Labeled Item (Post-Implementation)? From the post-implementation survey (*n* = 157), 13.4% of participants (6.4% male, 7.0% female) said that the traffic light labeling system discouraged them from choosing a red or yellow labeled item, 37.0% of participants (16.6% male, 20.4% female) said that the traffic light labeling system did not discourage them from choosing a red or yellow labeled item, and 49.6% of participants (24.8% male, 24.8% female) said that they did not understand what the different colors in the traffic light labeling system represented.

Comparison of the Food Identifier Cards Versus the Traffic Light Labeling System in Discouraging Participants to Pick/Choose a Certain Food Item

A comparison was performed between the pre-implementation and the post-implementation phases of the study to determine which method (i.e., the food identifier cards or the traffic light labeling system) was the most effective in discouraging participants from eating certain food items. Data were modified prior to analysis to ensure that comparisons were conducted only using participants that read and understand the nutritional information provided on the food identifier cards and participants that read and understand the nutritional information provided on the traffic light labeling system. Thus, 35 participants from the pre-implementation phase that did not understand the nutritional information on the food identifier cards (or did not notice the food identifier cards) and 99 participants from the post-implementation phase that did not understand the nutritional information on the traffic light labeling system (or did not notice the traffic light labeling system) were removed from their respective data sets prior to comparison.

From the pre-implementation phase (*n* = 130), 31.6% of participants (13.1% male, 18.5% female) said that the food identifier cards discouraged them from picking a certain type of food and 68.4% of participants (40.7% male, 27.7% female) said that the food identifier cards did not discourage them to pick a certain type of food. From the post-implementation phase (*n* = 66), 27.3% of participants (13.6% male, 13.7% female) said that the traffic light labeling system discouraged them from choosing a red or yellow-labeled food item and 72.7% of participants (30.3% male, 42.4% female) said that the traffic light labeling system did not discourage them from choosing a red or yellow-labeled food item.

A chi-square test revealed that there was no significant difference between the food identifier cards and the traffic light labeling system in discouraging participants to pick/choose certain food items, $c^2(1, N = 196) = 0.38$, $p = .538$. It is interesting to note that about 70% of both the pre-implementation and post-implementation participants indicated that either the food identifier cards or the traffic-light labeling system did not discourage them from choosing a red or yellow-labeled item. A possible explanation for this could be that red or yellow-labeled items (e.g., French fries or a rich dessert such as an ice cream sundae) are pleasurable to eat and the nutritional messaging may have not been compelling enough to convince participants to select alternative, green-labeled items (e.g., steamed vegetables or a light dessert such as fresh fruit). It also suggests that negative reinforcement, such as discouragement, may have not been sufficiently effective in convincing participants to avoid unhealthier food items.

What is Your Daily Intake of Fruit? From the pre-implementation survey ($n = 165$), 5.4% of participants reported zero servings of fruit, 38.2% of participants reported one serving of fruit, 35.2% of participants reported two servings of fruit, 16.4% of participants reported three servings of fruit, 4.2% of participants reported four servings of fruit, and 0.6% of participants reported five or more servings of fruit. From the post-implementation survey ($n = 176$), 8.0% of participants reported zero servings of fruit, 31.8% of participants reported one serving of fruit, 31.8% of participants reported two servings of fruit, 19.9% of participants reported three servings of fruit, 6.8% of participants reported four servings of fruit, and 1.7% of participants reported five or more servings of fruit.

An independent samples *t*-test revealed no significant differences in daily intake of fruit between pre-implementation participants ($M = 2.78$, $SD = 0.97$) and post-implementation participants ($M = 2.91$, $SD = 1.12$), $t(339) = -1.17$, $p = .243$. In the pre-implementation phase, an independent samples *t*-test revealed no significant differences in daily intake of fruit between male participants ($M = 2.82$, $SD = 1.05$) and female participants ($M = 2.71$, $SD = 0.86$), $t(163) = 0.78$, $p = .434$. Likewise, in the post-implementation phase, an independent samples *t*-test revealed no significant differences in daily intake of fruit between male participants ($M = 2.80$, $SD = 1.12$) and female participants ($M = 3.01$, $SD = 1.12$), $t(174) = -1.26$, $p = .209$. Further results are shown in Table 6.

What is Your Daily Intake of Vegetables? From the pre-implementation survey ($n = 165$), 8.5% of participants reported zero servings of vegetables, 30.9% of participants reported one serving of vegetables, 31.5% of participants reported two servings of vegetables, 18.8% of participants reported three servings of vegetables, 9.1% of participants reported four servings of vegetables, and 1.2% of participants reported five or more servings of vegetables. From the post-implementation survey ($n = 175$), 6.3% of participants reported zero servings of vegetables, 33.1% of participants reported one serving of vegetables, 32.6% of participants reported two servings of vegetables, 20.6% of participants reported three servings of vegetables, 5.7% of participants reported four servings of vegetables, and 1.7% of participants reported five or more servings of vegetables.

An independent samples *t*-test revealed no significant differences in daily intake of vegetables between pre-implementation participants ($M = 2.93$, $SD = 1.15$) and post-implementation participants ($M = 2.91$, $SD = 1.08$), $t(338) = 0.11$, $p = .914$. In the pre-implementation phase, an independent samples *t*-test revealed no significant differences in daily intake of vegetables between male participants ($M = 2.89$, $SD = 1.09$) and female participants ($M = 2.97$, $SD = 1.22$), $t(163) = -0.44$, $p = .659$. Likewise, in the post-implementation phase, an independent samples *t*-test revealed no significant differences in daily intake of vegetables between male participants ($M = 2.84$, $SD = 0.94$) and female participants ($M = 2.98$, $SD = 1.20$), $t(173) = -0.82$, $p = .412$. Further results are shown in Table 6.

What is Your Interest in Nutrition? From the pre-implementation survey ($n = 165$), 33.9% of participants said they were interested in nutrition, 40.6% of participants said they were somewhat interested in nutrition, 20.0% of participants said they were somewhat uninterested in nutrition, and 5.5% of participants said they were uninterested in nutrition. From the post-implementation survey ($n = 176$), 35.2% of participants said they were interested in nutrition, 46.0% of participants said they were somewhat interested in nutrition, 12.5% of participants said they were somewhat uninterested in nutrition, and 6.3% of participants said they were uninterested in nutrition.

A chi-square test revealed that there was no significant difference in nutrition interest between pre-implementation participants and post-implementation participants, $c^2(1, N = 341) = 3.68$, $p = .298$. Additional chi-square tests also revealed that there was no significant

Table 6: Participants' Self-reported Daily Intake of Fruits and Vegetables

Intervention Phase	Zero servings	One serving	Two servings	Three servings	Four servings	Five or more servings
Pre-Implementation	Male: 3.6%	Male: 20.0%	Male: 20.0%	Male: 8.5%	Male: 3.6%	Male: 0.6%
Fruit	Female: 1.8%	Female: 18.2%	Female: 15.2%	Female: 7.9%	Female: 0.6%	Female: 0.0%
($n = 165$)	Total: 5.4%	Total: 38.2%	Total: 35.2%	Total: 16.4%	Total: 4.2%	Total: 0.6%
Post-Implementation	Male: 4.6%	Male: 16.5%	Male: 15.3%	Male: 7.4%	Male: 3.4%	Male: 0.6%
Fruit	Female: 3.4%	Female: 15.3%	Female: 16.5%	Female: 12.5%	Female: 3.4%	Female: 1.1%
($n = 176$)	Total: 8.0%	Total: 31.8%	Total: 31.8%	Total: 19.9%	Total: 6.8%	Total: 1.7%
Pre-Implementation	Male: 3.6%	Male: 19.4%	Male: 18.2%	Male: 10.3%	Male: 4.2%	Male: 0.6%
Vegetables	Female: 4.9%	Female: 11.5%	Female: 13.3%	Female: 8.5%	Female: 4.9%	Female: 0.6%
($n = 165$)	Total: 8.5%	Total: 30.9%	Total: 31.5%	Total: 18.8%	Total: 9.1%	Total: 1.2%
Post-Implementation	Male: 1.1%	Male: 19.4%	Male: 14.9%	Male: 9.7%	Male: 2.3%	Male: 0.0%
Vegetables	Female: 5.2%	Female: 13.7%	Female: 17.7%	Female: 10.9%	Female: 3.4%	Female: 1.7%
($n = 175$)	Total: 6.3%	Total: 33.1%	Total: 32.6%	Total: 20.6%	Total: 5.7%	Total: 1.7%

Note: Participants were asked the following questions: *"What is your daily intake of fruit?"* and *"What is your daily intake of vegetables?"* Participants were given the options of zero servings, one serving, two servings, three servings, four servings, or five or more servings to choose from. An independent samples *t*-test revealed no significant differences in daily intake of fruit between pre-implementation participants ($M = 2.78$, $SD = 0.97$) and post-implementation participants ($M = 2.91$, $SD = 1.12$), $t(339) = -1.17$, $p = .243$. Likewise, an independent samples *t*-test revealed no significant differences in daily intake of vegetables between pre-implementation participants ($M = 2.93$, $SD = 1.15$) and post-implementation participants ($M = 2.91$, $SD = 1.08$), $t(338) = 0.11$, $p = .914$.

difference in nutrition interest between male and female participants in the pre-implementation phase, $c^2(3, N = 165) = 5.50$, $p = .138$, and no significant difference in nutrition interest between male and female participants in the post-implementation phase, $c^2(3, N = 176) = 4.07$, $p = .254$. Further results are shown in Table 7.

Have You Ever Taken a Course on Nutrition? From the pre-implementation survey ($n = 165$), 33.9% of participants (18.2% male, 15.7% female) had taken a course on nutrition and 66.1% of participants (38.2% male, 27.9% female) had not taken a course on nutrition. From the post-implementation survey ($n = 177$), 26.6% of participants (10.2% male, 16.4% female) had taken a course on nutrition and 73.4% of participants (37.8% male, 35.6% female) had not taken a course on nutrition. With values of "1" being "all green" items to "6" being "all red" items for participants' food choices, independent samples t-tests revealed there was no significant difference in food choices between participants who had taken a nutrition course ($M = 3.63$, $SD = 1.23$) and those that had not taken a nutrition course ($M = 3.64$, $SD = 1.32$) in the pre-implementation phase of the study, $t(163) = -0.08$, $p = .936$. Likewise, independent samples t-tests revealed there was no significant difference in food choices between participants who had taken a nutrition course ($M = 2.89$, $SD = 1.15$) and those that had not taken a nutrition course ($M = 3.10$, $SD = 1.31$) in the post-implementation phase of the study, $t(175) = -0.96$, $p = .341$.

Do you Classify Foods as "Good" or "Bad"? From the pre-implementation survey ($n = 165$), 86.1% of participants (47.9% male, 38.2% female) said that they did classify foods as "good" or "bad" and 13.9% of participants (8.5% male, 5.4% female) said that they did not classify foods as "good" or "bad." From the post-implementation survey ($n = 176$), 84.7% of participants (38.1% male, 46.6% female) said that they did classify foods as "good" or "bad" and 15.3% of participants (9.6% male, 5.7% female) said that they did not classify foods as "good" or "bad." A chi-square test revealed that there was no significant difference in classifying foods as "good" or "bad" between pre-implementation participants and post-implementation participants, $c^2(1, N = 341) = 0.13$, $p = .715$. Additional chi-square tests revealed that there was no significant difference in classifying foods as good or bad between male and female participants in the pre-implementation phase of the study, $c^2(1, N = 165) = 0.22$, $p = .639$, and no significant difference in classifying foods as good or bad between male and female participants in the post-implementation phase of the study, $c^2(1, N = 176) = 2.97$, $p = .085$.

What Would You Say Your Weekly Stress Levels are? From the pre-implementation survey ($n = 165$), 5.5% of participants reported their perceived stress levels as no stress, 59.4% of participants reported moderate stress, 27.2% of participants reported being very stressed, and 7.9% of participants reported being overly stressed. From the post-implementation survey ($n = 175$), 6.9% of participants reported their perceived stress levels as no stress, 57.1% of participants reported moderate stress, 26.2% of participants reported being very stressed, and 9.8% of participants reported being overly stressed. A chi-square test revealed that there was no significant difference in stress levels between pre-implementation participants and post-implementation participants, $c^2(3, N = 340) = 0.70$, $p = .873$. Additional chi-square tests revealed a significant difference in stress levels between male and female participants in the pre-implementation phase of the study, $c^2(3, N = 165) = 10.98$, $p = .012$, and a significant difference in stress levels between male and female participants in the post-implementation phase of the study, $c^2(3, N = 175) = 12.39$, $p = .006$. Further results are shown in Table 8.

How Healthy Would You Consider Your Regular Diet to be? From the pre-implementation survey ($n = 165$), 20.0% of participants said their regular diet was healthy, 60.0% of participants said their regular diet was somewhat healthy, 17.0% of participants said their regular diet was somewhat unhealthy, and 3.0% of participants said their regular diet was unhealthy. From the post-implementation survey ($n = 176$), 17.0% of participants said their regular diet was healthy, 61.9% of participants said their regular diet was somewhat healthy, 18.2% of participants said their regular diet was somewhat unhealthy, and 2.9% of participants said their regular diet was unhealthy. A chi-square test revealed that there was no significant difference in healthiness of diet between pre-implementation participants and post -implementation participants, $c^2(3, N = 341) = 0.54$, $p = .911$. Additional chi-square tests revealed that there was no significant difference in healthiness of diet between male and female participants in the pre-implementation phase of the study, $c^2(3, N = 165) = 1.08$, $p = .781$, and no significant difference in healthiness of diet between male and female participants in the post-implementation phase of the study, $c^2(3, N = 176) = 4.00$, $p = .262$. Further results are shown in Table 9.

Analysis of Covariance (ANCOVA)

A one-way Analysis of Covariance (ANCOVA) examined participants' food choices between the pre-implementation ($n = 165$) and the post implementation ($n = 174$) phases of the study, while controlling for reported stress levels and regular healthiness of diet. The covariate, regular healthiness of diet, was significantly related to participants' food choices, $F(1, 335) = 41.47$, $p < .001$. While controlling for reported stress levels and regular healthiness of diet, there was a significant effect of the phases of the study on participants' food choices $F(1, 335) = 20.89$, $p < .001$ (Table 8). Further results are shown in Table 10.

Table 7: Participants' Interest Level in Nutrition

Intervention Phase	Interested in nutrition	Somewhat interested in nutrition	Somewhat uninterested in nutrition	Uninterested in nutrition
Pre-Implementation ($n = 165$)	Male: 19.4%	Male: 20.0%	Male: 14.5%	Male: 2.4%
	Female: 14.5%	Female: 20.6%	Female: 5.5%	Female: 3.1%
	Total: 33.9%	Total: 40.6%	Total: 20.0%	Total: 5.5%
Post-Implementation ($n = 176$)	Male: 13.6%	Male: 23.9%	Male: 6.8%	Male: 4.0%
	Female: 21.6%	Female: 22.1%	Female: 5.7%	Female: 2.3%
	Total: 35.2%	Total: 46.0%	Total: 12.5%	Total: 6.3%

Note: Participants were asked the following question: "What is your interest in nutrition?" Participants were given the options of interested, somewhat interested, somewhat uninterested, and uninterested to choose from. A chi-square test revealed that there no significant difference in nutrition interest between pre-implementation participants and post-implementation, $c^2(1, N = 341) = 3.68$, $p = .298$. Chi-square tests revealed that there no significant difference in nutrition interest between male and female participants in the pre-implementation phase, $c^2(3, N = 165) = 5.50$, $p = .138$, and no significant difference in classifying foods as good or bad between male and female participants in the post-implementation phase, $c^2(3, N = 176) = 4.07$, $p = .254$.

Table 8: Participants' Perceived Stress Levels

Intervention Phase	No Stress	Moderate Stress	Very Stressed	Overly Stressed
Pre-Implementation (*n* = 165)	Male: 5.5% Female: 0.0% Total: 5.5%	Male: 35.2% Female: 24.2% Total: 59.4%	Male: 11.4% Female: 15.8% Total: 27.2%	Male: 4.3% Female: 3.6% Total: 7.9%
Post-Implementation (*n* = 175)	Male: 6.3% Female: 0.6% Total: 6.9%	Male: 28.0% Female: 29.1% Total: 57.1%	Male: 10.8% Female: 15.4% Total: 26.2%	Male: 2.9% Female: 6.9% Total: 9.8%

Note: Participants were asked the following question: *"What is your weekly stress level?"* Participants were given the options of no stress, moderate stress, very stressed, and overly stressed to choose from. Chi-square tests revealed a significant difference in stress levels between male and female participants in the pre-implementation phase, $c^2(3, N = 165) = 10.98$, $p = .012$, and a significant difference in stress levels between male and female participants in the post-implementation phase, $c^2(3, N = 175) = 12.39$, $p = .006$.

CONCLUSIONS AND APPLICATIONS

The purpose of this study was to determine if implementing a traffic light labeling system would affect students' food choices in a university dining center, while using a cycle menu. It was found that participants in the post-implementation phase (i.e., using the traffic light labeling system) chose significantly healthier foods than participants in the pre-implementation phase (i.e. using the regular food identifier cards). In addition, it was found that in both phases of the study, female participants chose significantly healthier foods and reported significantly higher stress levels than male participants did.

The results from this study reflected those from a longitudinal study by Thorndike et al. (2019), which found that the traffic light labeling system helped increase healthy versus unhealthy food and beverage purchases by reducing the number of calories purchased by employees over a 2-year period. Thorndike et al. (2014) also noted that food labeling does take time to change a person's food choices; however, this study demonstrated an impact on food choices following implementation of a traffic light labeling system in just in one meal. Previous studies have noted that a lack of knowledge can be a factor that contributes to unhealthy eating patterns (Elbel, 2011; Krukowski et al., 2006). However, this study found that there were no significant differences in food choices between students that had taken a nutrition course and those who had not taken a nutrition course in both the pre-implementation and the post-implementation phases of this study. The effect of participants' self-reported stress levels and perceived regular healthiness of diet were examined against their food choices, with regular healthiness of diet found to be a statistically significant covariate. Promoting nutritional information along with a traffic-light labeling system may help students to be better informed of the healthiness of the own diet, which may lead to improved food choices.

Barriers to implementing a traffic light labeling system potentially include the freedom (or lack thereof) that managers have in serving as change agents in their organizations. For example, a manager of a self-operated foodservice operation might have greater flexibility in choosing to implement a traffic-light labeling system in comparison to a corporate-managed operation, where the ability to effect change in policies and procedures may be more limited. Financial issues, such as the availability of labor to implement a traffic-light labeling system and the time needed to invest in such a process are important considerations. Pettigrew et al. (2012) stated that informative materials, well-designed policies, and relevant employee training can foster effective change in schools to improve student's diets without realizing large implementation costs.

In a study by Davis et al. (2013) testing the introduction of a traffic light labeling system in a large university cafeteria, it was found that the initial design of the system was time-consuming, requiring 40 hours to complete. In addition, each recipe used in the cafeteria took approximately 15-20 minutes to analyze by a manager or a student worker. The recipe analysis process also required access to software packages used for food analysis and graphic design, along with the associated software training. All of these issues are factors to consider when determining the feasibility of implementing a traffic light labeling system in a foodservice operation.

Related to the design of a traffic light labeling system may be the cultural perceptions of color and how especially international students, faculty, staff, or visitors of a dining center interpret the labels. Madden et al. (2000) stated that recognizing how colors are perceived across cultures is important to consider prior to product design; this may need to be evaluated before designing a traffic light labeling system. In a traffic light labeling intervention in a cafeteria in Taiwan, Chen et al. (2017) stated that colored food labels need to be understood by customers to avoid misinterpretation or confusion of the meanings of those colors. A study by Scarborough et al. (2015) in United Kingdom supermarkets found that red traffic light labels discouraged customers from choosing unhealthy food items more than green labels did in encouraging customers to choose healthy food items.

Converse to Scarborough et al. (2015), this study found that the traffic light labeling system significantly encouraged participants to select green-labeled food items, but it did not significantly discourage

Table 9: Participants' Perceived Healthiness of Regular Diet

Intervention Phase	Healthy	Somewhat Healthy	Somewhat Unhealthy	Unhealthy
Pre-Implementation (*n* = 165)	Male: 10.3% Female: 9.7% Total: 20.0%	Male: 33.3% Female: 26.7% Total: 60.0%	Male: 10.9% Female: 6.1% Total: 17.0%	Male: 1.8% Female: 1.2% Total: 3.0%
Post-Implementation (*n* = 176)	Male: 6.8% Female: 10.2% Total: 17.0%	Male: 29.5% Female: 32.4% Total: 61.9%	Male: 10.8% Female: 7.4% Total: 18.2%	Male: 0.6% Female: 2.3% Total: 2.9%

Note: Participants were asked the following question: *"How healthy would you consider your regular diet to be?"* Participants were given the options of healthy, somewhat healthy, somewhat unhealthy, and unhealthy to choose from. Chi-square tests revealed that there was no significant difference in healthiness of diet between male and female participants in the pre-implementation phase, $c^2(3, N = 165) = 1.08$, $p = .781$, and no significant difference in healthiness of diet between male and female participants in the post-implementation phase, $c^2(3, N = 176) = 4.00$, $p = .262$.

Table 10: One-way Analysis of Covariance (ANCOVA) of Food Choices Between the Pre-Implementation and Post-Implementation Study Phases, Controlling for Reported Stress Levels and Regular Healthiness of Diet (N = 339)

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.	Partial Eta Squared	Observed Power[b]
Corrected Model	91.383[a]	3	30.461	20.800	.000	.157	1.000
Intercept	102.486	1	102.486	69.981	.000	.173	1.000
Stress Levels	3.570	1	3.570	2.438	.119	.007	.344
Regular Healthiness of Diet	60.736	1	60.736	41.472	.000	.110	1.000
Pre- and Post-Implementation Phases	30.595	1	30.595	20.891	.000	.059	.995
Error	490.605	335	1.464				
Total	4362.000	339					
Corrected Total	581.988	338					

Note: A one-way Analysis of Covariance (ANCOVA) examined participants' food choices between the pre-implementation (*n* = 165) and the post implementation (*n* = 174) phases of the study, while controlling for reported stress levels and regular healthiness of diet. Participants were asked the following questions: (a) *"What were your food choices today?"* (b) *"What are your weekly stress levels?"*; and (c) *"How healthy would you consider your regular diet to be?"* The covariate, regular healthiness of diet, was significantly related to participants' food choices. While controlling for reported stress levels and regular healthiness of diet, there was a significant effect of the phases of the study on participants' food choices.

a. R^2 = .157 (Adjusted R^2 = .149)

b. Computed using alpha = .05

participants from selecting red or yellow-labeled food items. This supports finding in a previous study by Seward et al. (2018), which concluded that traffic light labeling systems should avoid negative messaging, while providing educational information about nutrition. For some participants in this study, the yellow and red messaging in large font shown on the traffic light labeling informational poster in Figure 3 (i.e., "choose in moderation" and "choose occasionally") may have been perceived negatively. This messaging could be reexamined prior to conducting future studies, while retaining the nutritional information for each traffic light color as shown at the bottom of the poster.

A study by Zhang et al. (2020) used fMRI (functional magnetic resonance imaging) techniques to analysis a traffic light label decision-making task between healthy and unhealthy foods. College-aged participants who viewed unhealthy foods with red labels during a food selection process showed activation in regions of the brain associated with enhanced decision-making and behavioral inhibition. This suggests that the visual cues of foods with red traffic light labels will signal participants to avoid choosing them (like stopping an automobile in response to a red traffic light), and negative messaging may not need to be included along with the red labels. However, in another study using traffic light labels in a college cafeteria, Seward et al. (2018) found that some students perceived red labels to be "jarring" and "in their face," which suggests that the labels themselves can be perceived negatively, even without messaging.

A study by Retno and Fatmah (2019) evaluating the effect of the Front-of-Package Traffic Light labeling format on high school students' comprehension of nutrition labels recommended that schools should conduct informative sessions on nutrition to effect positive improvement in students' knowledge of nutrition labeling. Therefore, in conjunction with the permanent implementation of a traffic light labeling system should also come effective communication from foodservice managers to ensure nutritional messaging is not only understandable and informative, but also positive and engaging. Additional informative posters in the cafeteria and dining area, along with table tent flyers on the dining tables could increase the visibility and understanding of the traffic light labeling system. Digital methods of communication could also be deployed to connect with students. Examples of various digital communication channels might include emails from foodservice managers, daily or weekly texts containing menus and nutritional information from the dining center, and mobile nutrition apps that include traffic light labeling information.

In a cafeteria buffet, traffic light labels can provide a beneficial and easy-to-use method to compare many food items quickly, in relation to which items are healthier than others. A study conducted in a large on-site corporate foodservice operation found that traffic light labels without numerical information were as effective in reducing calories as the same labels containing calorie counts (VanEpps et al., 2016). Students may use traffic-light labels as an expedient way to make their food choices; a benefit that could reduce time spent reading nutritional information. However, nutritional information should also be available for students who prefer detailed information to assist them with their food choices. Thorndike et al. (2012) found that improving the convenience and visibility of healthier food items helped augment the effectiveness of the labeling itself. In conclusion, the main benefit of traffic light labels is to facilitate students' ability to make quick, convenient, and informed healthy choices while selecting food.

Limitations and Suggestions for Future Research

Limitations

There were several limitations to this study. Participants were self-selected, the sample was relatively small, and the short implementation length of the traffic light labeling system for just one dinner meal were all limiting factors in this research study. This study used actual consumption data, with 40% of participants reporting that they did not notice the food identifier cards and 50% of participants reporting that they did not know what the different colors in the traffic light labeling system meant. Since participants' data was self-reported, those participants who knew what the green, yellow, and red labels meant could have marked potentially healthier food items on the survey to appease the researchers and make themselves appear to be healthier. It is also difficult to determine if participants changed their choices based on the food labeling systems or if there were other factors that affected changing their food choices; this could include items such as stress levels, regular healthiness of diet, or perhaps even a strong craving for an unhealthy but satisfying dessert item on that given day. There are multiple factors that can affect food choices, making it challenging to control for all of them. In addition, since participants were not individually identifiable, it was not possible to determine if changes occurred within a given individual.

The traffic light labeling system was based only on total calories, total fat, and saturated fat for food items. In addition, the traffic light labeling system only described the total calories for beverages. It is

not surprising that participants noticed the food identifier cards significantly more often than the traffic light labeling system, given that the food identifier cards were normally used during dinner throughout the school year in comparison to the traffic light labeling system, which was only implemented for one meal. The informational traffic light labeling may have not been visible enough and the small colored dot on the card may have not been noticeable. A larger traffic -light informational poster (or multiple posters) and larger, more attractive traffic light food labels might be more noticeable and help to promote change better in future studies.

Future Research

Future studies could perform additional replications and explore whether there would be a lasting effect upon students' food choices if the traffic light labeling system was extended for a greater length of time. The continued use of a cycle menu could help to better determine if the traffic light labeling system was effective in promoting change in students' food choices, with data collected over several months or years, using the same menus for comparison over time. In addition, future studies could explore the best methods for educating students about the food labeling system and what the different color codes mean to increase the number of students who notice the system and understand it. Further studies could also explore how the traffic light labeling system would affect customers' food choices in other types of onsite or retail foodservice operations. A study by Sacco et al. (2017) identified the need to explore the effect of menu labeling on improving food choices made by adolescents and children; the study also found that there was a paucity of research data regarding food choices of children and adolescents in real-world settings, such as cafeterias and restaurants.

Exploring the effect of stress levels, perceived healthiness of diet, and prior nutrition classes/education upon individuals' food choices while using a traffic-light labeling system could be expanded upon in greater detail. In addition, future studies could also explore how results might vary by individual, gender, or race/ethnicity. Future studies could also explore if the inclusion of protein, carbohydrates, sugars, and fiber in the traffic light labeling system would be of interest. In addition, future research could focus upon improved methods of delivering or marketing traffic light labeling system information (i.e., labels and posters) to help strengthen its message and increase visibility of the traffic light labeling system within foodservice operations.

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