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Effectiveness of Student Led Hunger Relief Project Towards Food Waste Recovery and
Nutritional Impact in Low Income Communities

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Abstract

Introduction: According to the USDA, 12.3% (15.6 million) of U.S. households were food insecure in 2016 due to contributing factors such as lack of food accessibility and the prevalent food waste in the U.S. An estimated 40% of food is thrown away each year and contributions to this food waste include an estimated 22 million pounds of unconsumed foods discarded in college campuses around the U.S. Programs have been developed to target this food waste epidemic while combatting Americans malnutrition. Campus Kitchens Project (CKP) is an innovative student led hunger relief program which recovers food from college campus kitchens and reallocates the nutritious foods to surrounding low income communities. *Research Question:* The purpose of this study was to evaluate to what extent CKP mitigated campus food waste and affected the diets of low income individuals visiting Cor Unum Meal Center in Lawrence, Ma. *Methods:* Participants included 66 individuals dining at Cor Unum Meal Center and 9 staff members. An initial needs assessment was provided to the staff followed by surveys given to both groups regarding the community's diet during the time CKP was providing dinner to Cor Unum meal center. Food waste recovery was measured from October 2017 – April 2018 in pounds (lbs.) per volume and a financial analysis was done to determine the amount in dollars saved. *Results:* Among the 66 participants, a strong majority (76%) reported observing a nutritional impact provided by the CKP meals and 85% reported feeling very satisfied with the meals provided. The staff members of Cor Unum reported the community members to have poor to average health outcomes due to main contributors such as lack of resources, money, food markets, and shelters. From these participants, 78% observed a nutritional impact from CKP meals. During the implementation of CKP, 1533.55 lbs. of food was recovered saving \$3,598. The most common food items were zucchini, summer squash, turkey, pork, and brown rice.

Discussion: Organizations such as CKP provide opportunities to decrease the food waste in the U.S. and the prevalence of malnutrition in surrounding low income communities. Future studies should focus on the malnutrition in food assistance programs and how hunger relief programs similar to CKP can be a part of the movement for a healthier population. Furthermore, studies should consider performing a nutritional analysis comparing the meals served at soup kitchens with the meals provided by programs such as CKP. *Conclusion:* Implementation of CKP at Cor Unum meal center in Lawrence, Ma was associated with an improved intake of nutritious foods and reduced food waste at Merrimack College. The observed impact shows the many possibilities colleges have in being a part of reducing the malnutrition and food waste in the U.S. as well as the opportunities such programs provide for raising awareness of the health concerns in our country.

Background

Campus Kitchens Project is a nonprofit organization based out of Washington, DC that has taken initiatives to end hunger in the U.S. through innovative approaches led by students. Developed in 2001, this program has partnered with high schools, colleges and universities to practice food recovery through the campus dining halls, encourage student engagement and leadership, and feed low income communities with nutritious meals. This program is now partnered with over 60 schools around the U.S. and has prepared over 3,354,047 meals since 2001.

The idea behind Campus Kitchens Project is student powered hunger relief including a mission to recycle food, provide meals, educate and engage with the community, and provide leadership opportunities for students (Campus Kitchens Project, 2017). Each campus kitchen is

developed with four common themes in mind: food recovery, meal preparation, meal delivery, and empowerment and education. The students recover foods through their campus dining services and any outside food donors willing to donate. The food donors can include local grocery stores, food banks, and farmers markets. Using the recovered food, students then prepare nutritious meals in the campus kitchen. Meals include anything from meal boxes and backpacks to prepared breakfast, lunch, and dinner. These meals are then delivered to organizations serving low income communities such as soup kitchens or food pantries. Depending on the school, students often stay to serve the meals, engage in conversations with the community, and educate the community. Along with this common model of food and nutrition recovery, students also hold healthy cooking classes for families, provide nutrition education seminars for kids, and even create farmers' markets to increase food accessibility.

Campus Kitchens Project philosophy is if we give young people the ability to use existing resources of their schools then they can create an effective national network of cooperative and adaptive anti-hunger programs, and in the process, develop as leaders for social change. (Campus Kitchens Project, 2017). With this philosophy in mind, Campus Kitchens Projects efforts are primarily based on producing large-scale awareness of the hunger in America and using the next generation of leaders to do so. By utilizing existing resources such as food, space, and individuals, Campus Kitchens Project is able to strengthen the bodies that are part of this movement. Campus Kitchens Project is providing leadership opportunities to the students as well as nutrition to low income communities. By fostering relationships between various socioeconomic classes and raising awareness of the preventable issues in America, Campus Kitchens Project is a movement towards a healthier society.

Literature Review

Malnutrition

Malnutrition is the inability to intake a sufficient amount of nutrients or energy needed to ensure the growth and maintenance of an individual's body. Malnutrition consists of three forms of conditions a person is at risk for developing which include undernutrition, micronutrient-related malnutrition, and overweight, obesity, and diet-related non-communicable diseases. Undernutrition pertains to sub-forms such as wasting, stunting, and underweight. Wasting is when a person has a low weight-for-height ratio indicating severe weight loss due to not consuming enough food or obtaining an infectious disease. Stunting occurs as a result from consistent undernutrition and having a low height-for-age ratio. Underweight affects those who have a low weight-for-age ratio and particularly is common in children. Children who experience this pose the risk to develop other forms of undernutrition. The second form of malnutrition is micronutrient-related malnutrition which is the result from inadequate intake of micronutrients, also known as vitamins and minerals, which play a vital role in the body for production of enzymes, hormones, and other essentials for one's proper growth and development. This is particularly common in children and pregnant women in low-income countries. The last is overweight and obesity which occurs when energy consumption exceeds energy expenditure. One is considered overweight when they have a BMI of 25 or more and obese with a BMI of 30 or more.

Prevalence of Malnutrition

The prevalence of malnutrition is growing at a concerning rate in the United States. In fact, 30 million individuals in America experience hunger and of those 3 million are children.

Obesity continues to be one of the leading public health concerns in the United States affecting more than two-thirds (68.5 percent) of US adults and 31.8 percent of children and adolescents (Ogden et al. 2014). The populations most affected by malnutrition include the elderly, children, and the homeless. Roughly, 13 million children in the US are malnourished and of those one in three children receive food assistance. Malnutrition in this population poses a high risk for developing illness and infection as well as potential mental and physical abnormalities during development. Malnutrition is just as common in elderly and according to the Centers for Disease Control and Prevention, elderly mortality rates are between 2,000-3,000 due to malnutrition.

According to the US Food and Drug Administration, 85% of Americans run the risk of malnutrition because of insufficient consumption of the recommended vitamins and minerals. A vitamin deficiency that has risen as a progressive health concern in the United States is vitamin D. In 2009, more than 75% of Americans did not obtain the appropriate amount of vitamin D in their everyday diets. Low amounts of vitamin D in one's body pose the risk of developing bone conditions, autoimmune diseases, various cancers, and obesity.

Impact of Malnutrition

Attention has been given to the impact malnutrition has on the population due to its rapid progression in the U.S. Malnutrition is partially responsible for the mortality rates in the U.S specifically in the rate of children dying from this illness. This public health problem affects a great number of individuals and depending on its severity, these effects may be short or long term. When an individual is malnourished, short term effects include fatigue, loss of fat, tissue, and muscle mass, decrease in mental and physical performance, and an overall decrease of maintenance to keep one's body healthy. If prolonged, long terms effects become more serious

and increase one's risk to develop chronic diseases. These chronic diseases are also referred to as diet-related noncommunicable diseases (NCDs) which include cardiovascular disease, certain cancers, and diabetes. General effects are an increased susceptibility to accumulate fat mostly in the central region of the body, lower fat oxidation, lower energy expenditure, insulin resistance and a higher risk of diabetes in adulthood, hypertension, dyslipidemia and a lowered working capacity of manual workers, among other physiological impairments (Martins et al., 2011). Children under the age of 6 especially are at risk of these long terms effects as well as poor mental development and behavioral abnormalities.

Recently, there has been discussion of these effects potentially being reversible. Studies conducted on children have shown evidence regarding children being treated for malnutrition before they reach 6 years of age. Those children who fully recovered in weight and height also developed normal body compositions, bone mineral densities, and insulin production and sensitivity. Alongside this, their test scores were similar to children who were nourished properly in both verbal vocabulary and quantitative testing. These positive effects resulted from the process of nutritional recovery to restore an individual's nutrients and vitamins; it is vital to consistently observe the individual's restoration of nutrients to avoid future metabolic disturbances. This process is also partially dependent on a person's past nutritional history and conditions that have developed during the time of malnutrition.

Factors Leading to Malnutrition

Malnutrition in the U.S persists from various contributions as well as multiple forms. One is considered malnourished if they are not consuming enough food. A person is also malnourished if they are consuming a high calorie diet full of energy-dense foods. This is

because there is a poor nutrient quality of vitamins and minerals which further increases the causes leading to malnutrition. Obesity, one of the leading causes behind malnutrition, prevents one's body from obtaining a sufficient amount of nutrients and in some instances nutrients are not able to reach the stomach. General causes of malnutrition include lack of food, limited knowledge about nutrition, loss of appetite due to illness or pain, age related malnutrition, non-prescribed drug use, eating disorders, prescribed medication altering one's ability to absorb nutrients, and premature birth (Mandal, 2017). Other causes pertaining to malnutrition are medical conditions and obesity. Conditions such as Celiac disease, chronic liver disease, Crohn's disease, and some cancers prevent proper absorption of sugars, fats, proteins, and vitamins.

Individuals Utilizing Food Assistance Programs

A population suffering from malnutrition are individuals receiving assistance from food pantries and soup kitchens in the U.S. Those seeking emergency food assistance include individuals and families who are employed, homeless individuals, victims of domestic violence, and those unable to pay their utility bills, or those who have lost their public benefits (Biggerstaff, et al., 2002). In previous years, the majority of this population included alcoholic men however the population has recently grown to heterogeneous subgroups which include families consisting of women and children, situationally distressed individuals (also considered as the "new poor"), and homeless people due to chronic mental or physical illness.

Unfortunately, the majority of individuals utilizing food assistance services include those who are homeless. Each year the U.S Department of Housing and Urban Development provides statistics of this community. As of 2013, there were 610,042 individuals who were homeless and

of this, 65% received assistance from shelters and transitional housing and 58% were children. Of the states in the US, New York experienced the largest increase in homelessness population followed by California, South Carolina, Massachusetts, and Maine (Wihbey, 2014). Second Harvest, one of the US largest private hunger relief programs, indicates contributions leading to food insecurity in the US to include cutbacks in government welfare and FSPs, low-paying jobs, and rising medical and child care expenses (Biggerstaff, et al., 2002). Alongside financial instability, other factors impacting this community's nutrition is the accessibility to healthful foods as many food pantry's and soup kitchens have a hard time seeking nutritious food donations.

Food Assistance Programs in the U.S.

Support systems are made available for low income individuals with the purpose to provide food accessibility, increase availability to nutrients, and stabilize the price of food according to the statistics of the overall populations socioeconomic status. Food assistance programs are often separated into ones that increase the accessibility to food and ones that are geared to an individual's nutrition. Federal food and nutrition assistance programs work to promote both the accessibility to food while focusing on nutrient rich food choices. Such programs include Supplemental Nutrition Assistance Programs (SNAP), Women, Infants, and Children (WIC), and Food Distribution Programs. In 2013, roughly 62% of food insecure households received assistance from a federal food assistance program including 46.2% from SNAP and 11% from WIC. SNAP works to increase the healthful food consumption through a monthly EBT card which can be used for purchasing food at the majority of grocery stores. WIC focuses on women, infants, and children up to the age of 5 and provides nutritious foods as well

as nutrition education and health care referrals. Food distribution programs provide food to specific populations such as CSFP which focuses on low income elderly persons of 60 years of age or older. Another approach towards food assistance is through food stamps which are coupons people are able to use as cash for food purchases. This counts for roughly 64% of the US population.

Another outlet available to low income populations are soup kitchens, also known as meal centers. These programs are generally located in lower-income neighborhoods and consist mainly of volunteers who work to provide food through donations and feed the community around them. Homeless shelters and soup kitchens – social institutions prevalent in most major cities across the USA – serve as the primary food source for the majority of homeless individuals (Koh et al., 2016). Soup kitchens allow those who are unsure of when their next meal will be to eat meals free of charge. Depending on the specific location, soup kitchens will provide breakfast, lunch, dinner, and sometimes prepared meals for the next day. The demand for food continues to increase along with the nutritional value in these communities. Soup kitchens will often times provide nutritious meals as the healthful foods are donated however this is not easily available due to lack of government funding and national standards set at these meal centers. Fortunately, further research is being conducted to gain a better understanding of the nutrition in these facilities.

One study was conducted in ten shelters in the Greater Boston area which included 60-minute in person interviews with the soup kitchen food directors. The interviewers goal was to ask questions to gain an understanding of the current practices, barriers, and ideas to improve this community's nutrition. The primary perceived barriers to accessing healthy foods were found to be budget and space constraints as well as nutrition education among staff members.

Out of the ten shelters, one shelter did provide food education and a basic nutrition understanding to the staff. Unfortunately, the most common food groups included white breads, pasta, and rice. Overall, this study's findings generated that shelters can in fact improve the food quality regardless of their budget and a nutrition education program would gain efficient results at shelter locations. By improving food quality, education, and policies in shelters and soup kitchens, we can help provide homeless individuals the dignity of opportunity to restore their health and quality of life (Koh et al., 2016).

Food Waste in America

Food is simply too good to waste (Gunders, 2012). This is a statement the majority of Americans can agree on as food is a primary source to our existence. Unfortunately, the importance of food to Americans does not prevent us from throwing away edible foods. It is estimated that 40% of food in the U.S is thrown away counting for 20 lbs. of food wasted per person and \$640 worth of food wasted per household which is the equivalence to \$165 billion thrown out each year. But why do Americans throw out this much food? If one asks this question, most consumers will state their food waste is due to food safety concerns and wanting the freshest foods for their family. The major reason for retail waste, roughly 55%, is due to poor environmental conditions of food storage areas in grocery stores. Several other causes of food waste in the U.S include aesthetic defects in the food (ie. not bright green, has some bruising), food manufacturing protocols that throw out foods in good condition, leftovers, and confusion between "best-before-dates" and "use-by-dates". The sad truth is if these losses were reduced by just 15%, the food recovered would be able to feed more than 25 million Americans a year. A food loss and waste reduction goal has been developed by the USDA to have a 50% reduction by

2030. The USDA and EPA plans for improvement include partnering with charitable organizations, faith organizations, private sectors, and local, state and tribal governments. The food waste in the U.S is responsible for a significant amount of nutrition deficits in Americans.

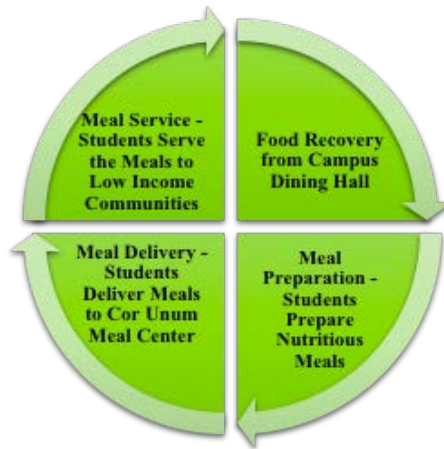
Food Waste in College Campuses

Not surprising, the abundance of food in America is also accompanied by the abundance of food that is wasted. Similarly, this scenario occurs in universities and college campuses through the U.S. The majority of dining halls serve their meals buffet-style and it is a common practice of the staff to have an excessive amount of food out rather than risking running out of food. This is partially why food waste is at an all-time high in universities around the U.S. An estimated 22 million pounds of uneaten food is discarded each year counting for an average of 142 pounds of food wasted by a single college student. Perceived barriers influencing these estimates include strict health regulations leading to foods in good condition to be thrown out, food service facilities run by outside food companies that may not have a goal to minimize food waste, and students buying an abundance of food that may not be realistic to eat due to accessibility to food markets. An approach to reduce the prevalence of food waste on college campuses, the Federal Good Samaritan Act was created. With the increase of communities not having accessibility to a sufficient amount of food, also called food-insecure communities, this act sought to allow foods from college campuses to be donated to low-income populations without any liability held on the colleges. Since this act was implemented, several organizations have been developed with the main goal of recovering uneaten food from campus dining halls and reallocating the foods to low income communities. These programs include organizations such as the *Campus Kitchens Project* and the *Food Recovery Network*.

Campus Kitchens Project

As previously mentioned, the progressive epidemic behind food waste especially in college campuses is concerning as this population are the next generation of leaders. Raising awareness of the concerning food waste increase among students and campus faculty can assist this generation by fostering the want to protect their environment as well as reduce college's food expenses and trash-hauling expenses. Higher education should be the first place where food recovery is the norm, not the exception (Bendici, 2016). An organization that practices food waste recovery and nutrition recovery in communities lacking nutritious foods is Campus Kitchens Project (CKP). The idea behind CKP is student powered hunger relief including a mission to recycle food, provide meals, educate and engage with the community, and provide leadership opportunities for students (Campus Kitchens Project, 2017). CKP is based on a four-component model, (refer to table 1 for this model). This program assists students with their personal development as well as raising awareness of the issues around them such as hunger. Alongside the student development, this program is geared towards the nutritional needs of the low-income communities in the U.S. By encouraging students to address the hunger epidemic in their communities, CKP is facilitating leadership in colleges while attacking the issues of food insecurity and food waste.

Table 1.

Campus Kitchens Project Model**Summary**

Regardless of the abundance of food resources Americans have, the epidemic of malnutrition continues to grow. According to the USDA, 85% of Americans run the risk of malnutrition because of insufficient consumption of the recommended vitamins and minerals. Research has been conducted over the years to determine the contributions of malnutrition. The most common causes include lack of food, limited knowledge about nutrition, loss of appetite due to illness or pain, age related malnutrition, non-prescribed drug use, eating disorders, and prescribed medication altering one's ability to absorb nutrients. Aside from these causes, a primary contribution that does not come as a surprise is the food waste in the U.S. An estimated 40% of food is thrown away and of this food wasted, roughly 25 million individuals could have been fed. Of the food waste statistics, an estimated 22 million pounds of uneaten food is discarded each year in college campuses equating to 142 pounds of food wasted by a single college student. Given the food waste prevalence in college campuses and its impact on malnutrition in the U.S, why haven't we done something to address this issue?

To address this deficit, I am conducting research aimed at the effectiveness of a student led hunger relief project towards food waste recovery and nutritional impact in low income communities. The purpose of this study is to evaluate to what extent Campus Kitchens Project (CKP) mitigates campus food waste and affects the diets of low income individuals visiting select local soup kitchens around Merrimack College. The proposed hypothesis behind CKP efforts is by having students of Merrimack College prepare, cook, and serve donated nutritious foods from the campus dining hall to local soup kitchen communities in Lawrence, the nutrition of the soup kitchen communities will improve and the food waste at Merrimack College will decrease. From a broader approach, this proposed research will contribute to the food waste statistics at college campuses along with its contributions to the malnutrition prevalence in the U.S.

Methods

Participants

Recruitment for participation was done through convenience sampling and the participants consisted of individuals utilizing the meal center services as well as the staff members at the meal center where Campus Kitchens Project (CKP) worked with. The soup kitchen Campus Kitchens Project volunteered at was Cor Unum Meal Center which is located in Lawrence, Ma and serves low income communities with a restaurant style experience.

The first group of participants included the staff members at the soup kitchen. The majority of the staff were volunteers who have been working with this community for years and so this allowed Campus Kitchens Project to gain insight on the perceived barriers of the Lawrence community's nutrition. This group primarily consisted of 15-20 females in ages

ranging from 35-55 years old. Recruitment was done with the help of the director of Cor Unum meal center. Arrangements were made with the director and volunteers on a day and time they were able to meet. The meeting began with a detailed explanation of the research being conducted and how their participation would apply to the research study. If any volunteers were interested, then consent forms were given and questions were encouraged. Written consent forms included detailed information of the purpose of the study and their role, confidentiality agreement, and general information pertaining to the individuals understanding of their consent and participation. Upon the completion of the consent forms, the questionnaires were administered and any further questions were answered. To participate in this study, the individuals were required to be a volunteer at Cor Unum meal center and at least 18 years of age.

The second group of participants included those utilizing the meal services at Cor Unum meal center. This group consisted of roughly 200-400 persons both females and males varying in ages from 18-70 years old. Generally, many were Spanish and English-speaking individuals who resided in Lawrence. Recruitment for these individuals were done in a similar fashion as the staff member recruitment however an announcement was given by one of the main volunteers at the soup kitchen due to their relationship with this community. Explanation of the research study was done by myself in great detail including clarification that this study did not ask for any identifiable information from the participants (ie. name, gender, age). After the explanation, written consent forms were handed out to those who were willing to participate and questions were encouraged. Upon the completion of the consent form, the questionnaires were administered and any questions were answered at that time. To participate, all subjects were required to be at least 18 years of age and utilizing the meal services at Cor Unum meal center.

Measures

The primary purpose of this study was evaluate to what extent Campus Kitchens Project mitigates campus food waste and affects the diets of low income individuals visiting select local soup kitchens around Merrimack College. This study focused on both qualitative and quantitative research where Campus Kitchens Project was measuring the overall nutritional impact (diet) and food waste recovery through needs assessments, key informant interviews, dietary questionnaires, and financial analyses’.

Data collection included an initial needs assessment reported by the soup kitchen staff members to determine what barriers to a healthy diet, if any, were present for individuals who visited these soup kitchens and to gain an understanding of the community’s nutrition through their experience. This assessment consisted of 7 open ended questions and were developed by myself as well as my fellowship supervisor and research assistants (Refer to Appendix 1. for specific questions asked). After the implementation of Campus Kitchens Project, a Likert scale questionnaire was given to the staff members to measure the nutritional impact CKP has provided (Refer to Appendix 3. for specific questions asked).

Key informant interviews were conducted with the Lawrence community utilizing the meal center services to measure the nutritional impact through their eyes. The data collected included Likert scale questionnaires and dietary assessments addressing their levels of satisfaction in their daily nutritional intake and whether this had changed with the help of CKP (Refer to Appendix 2. for specific questions asked). Foods being served by these soup kitchens before CKP were recorded to help with determining dietary impact.

While providing food to these communities, we measured the food recovered with the efforts of CKP. This was done by measuring the food the campus dining hall was able to save (weight/volume) and reallocate to these shelters. A financial cost analysis was also conducted to see how much money was saved during this time. Cost analysis was done with the assistance of the Sodexo foodservice director, who provided the costs on a per pound or per volume basis. The dietary impact analysis (Refer to table 2.) included the collection of foods CKP had served over the course of the 2017-2018 year as well as the food served by the soup kitchens prior.

Table 2.

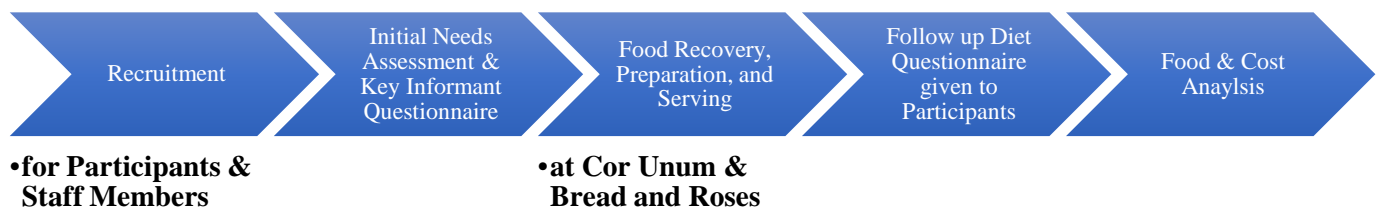
Dietary Impact Analysis Example

Food Item	10/23/17	10/30/17	11/6/17	11/13/17
<i>Brown Rice</i>		4.21	4.56	
<i>Zucchini</i>	4.29	4.96		5.5
<i>Summer Squash</i>	4.51	4.96		5.5
<i>Roasted Turkey</i>			4.36	
<i>Baked Ham</i>		2.2		
<i>Chicken Breast</i>	2.27			
<i>Sweet Potatoes with Cinnamon</i>				8.16
<i>Roasted Carrots</i>		4.96	8.51	
<i>Pork Butt with Chipotle Cinnamon</i>				6.22
Total Waste Recovery (in lbs)	75.17			

Procedures

Table 3.

Recruitment and Research Process



- Recruitment for participants began in January. Recruitment for participants was done through convenience sampling with staff members and the soup kitchen community at Cor Unum meal center.
- An initial needs assessment was given to the staff member participants to help us understand the barriers and how CKP could help. A key informant questionnaire was given to the soup kitchen community to help us understand their diets prior to CKP involvement. Regardless of participant recruitment, the Lawrence soup kitchen community continued to receive nutritious meals consisting of a whole grain, protein, and vegetable.
- The Community Nutrition student volunteers, and any other student volunteers recruited, assisted in preparation of the food for delivery, transportation of the food to the soup kitchens, and serving this food to the community. Students were organized in shifts (food prep, delivery, service) and were supervised by two undergraduate research assistants under my supervision. This process began in October and ended the first week of May.
- After 2-3 months of volunteering with the soup kitchens, a diet questionnaire was given to the participants to report any nutritional impact obtained through CKP efforts. A satisfaction survey was administered to the soup kitchen staff to report any impact obtained through CKP and to see if the staff observed a change in the soup kitchen community's diets during this study.
- A food waste analysis and cost analysis was done to show the food CKP was able to recover and the amount of money saved while reallocating this food.

Data Analysis

All data was entered into an excel spreadsheet. For the needs assessment and key informant interviews, common responses were recorded into this spreadsheet as well. Food waste and cost analysis data was quantified and expressed in pounds and dollars respectively. The effect of Campus Kitchen Project foods on diet was determined by the Likert Scale surveys given to the Cor Unum community and staff members. Descriptive statistics were included to view if there is a correlation between the Campus Kitchen Project efforts in food recovery and the nutritional impact of the Lawrence low income community.

Results

Introduction

Recruitment took place over a three week period where two groups of participants were recruited for this study from Cor Unum Meal Center in Lawrence, Massachusetts. A total of sixty-six participants out of roughly two hundred individuals were recruited from the Lawrence population utilizing the meal center. The other group consisted of the volunteers and staff members at Cor Unum Meal Center whom Campus Kitchens worked with on Tuesday and Thursday evenings. Out of the twelve participants that were asked to partake in this study, nine participants agreed to be a part of the study.

Cor Unum Communities Results

Demographics of the sixty-six participants that utilize Cor Unum were not recorded however the volunteers at Cor Unum reported the population consisted of all ages varying from 11-70+ with mixed ethnic backgrounds mostly of Hispanic, Asian, and Caucasian descent (Table

5). Upon consent, a survey was administered to the Cor Unum community utilizing the meal center to measure the impact that Merrimack College CKP had on their nutrition (Refer to Appendix 2. for the specific questions asked).

Analysis of Cor Unum communities perception on the impact CKP was able to assist with is reported in Table 4. Results indicate that the majority (60%) of these individuals consume home-cooked meals when they are not eating at Cor Unum meal center. In terms of the amount of consumption, the largest report on fruits and vegetable consumption (39%) is a moderate amount, 39% reported consuming a moderate amount of protein, such as chicken, beef, and eggs, and 29% reported consuming a moderate amount of dairy, such as milk, yogurt, and cheese. Participants were also asked whether they would like Merrimack College CKP to continue delivering meals to Cor Unum meal center, of which 86% responded yes, 1% responded no, and the remaining 13% (n=8) did not leave a response.

Table 4.

Cor Unum Community Questionnaire on CKP Impact

Cor Unum Community Questionnaire Results					
Weekly Meal Types Consumed	Microwaved Meals	Home-cooked	Fast Foods/Takeout	Restaurants	
	39%	60%	24%	9%	
Level of Consumption	A Great Deal	A Lot	A Moderate Amount	A Little	None At All
Fruits and Vegetables	20%	18%	39%	24%	2%
Protein (ie. Chicken, Beef, Eggs)	29	26	39	9	0
Dairy (ie. Milk, Yogurt, Cheese)	26	24	29	20	0
CKP Meal Nutritional Impact	A Great Deal	A Lot	A Moderate Amount	A Little	None At All
	46%	30%	13%	5%	6%
CKP Meal Satisfaction	Extremely Sat.	Very Sat.	Moderately Sat.	Slightly Sat.	Not Sat.
	55%	32%	8%	3%	2%

Diet Analysis

Analysis of the communities' daily consumption of fruits and vegetables, protein, and dairy are reported in Table 4 above. 38% of participants reported their fruit and vegetable intake to be between a great deal and a lot, 39% reported a moderate amount, and 26% reported between a little to no intake at all. 55% of participants reported their protein intake (ie. chicken, beef, eggs) to be between a great deal and a lot, 39% reported consuming a moderate amount, and 9% reported very little amount of protein. 50% of participants reported their dairy consumption (ie. milk, yogurt, and cheese) to be between a great deal and a lot, 29% reported a moderate consumption, and 20% reported very little dairy consumption. The participants were also asked what types of foods they typically eat during the week with the options consisting of microwaveable meals, home-cooked meals, fast food and take-out meals, and restaurants. 39% of the participants reported consuming microwaveable meals, 60% reported home-cooked meals, 24% reported fast foods and take-out, and 9% reported restaurants. Please note that some participants chose more than one option for this question. Lastly, the participants were asked to mention the food groups they would like to see served at Cor Unum in the future (n=46). The most common responses recorded were fresh fruits and vegetables, red meat, and more of a variety. Some participants (n=13) reported that they enjoy the foods served at Cor Unum Meal Center.

Cor Unum Meal Center Volunteer Results

A total of nine participants were recruited whom were either volunteers or staff members at Cor Unum Meal Center. Upon consent, these participants were first asked to complete a needs assessment to gain an understanding of the community utilizing this meal center (refer to Table 5

for common responses). The nine volunteers varied between one month to eleven years of experience with the Cor Unum community. The participants reported the individuals utilizing the meal center to have poor to average health outcomes with the local soup kitchens contributing the most to their health and wellness. It was reported that this community's poor nutrition is mostly due to the lack of resources including money, food markets, nutritious meal options, and shelters. The volunteers reported Cor Unum's offerings consisting of a wide selection of foods to the Lawrence community such as various meats, vegetables, soups, and desserts and it was recommended having a larger selection of fresh fruits, vegetables, meats, and fish to help improve this community's nutrition. The participants also suggested improving the accessibility of food markets in the area and increasing the amount of healthy food options to contribute to the community's nutrition.

Table 5.

Cor Unum Volunteers Needs Assessment Common Responses

Cor Unum Volunteers Needs Assessment Common Responses	
Discussion Topic	Common Responses
<i>Volunteer Experience</i>	1 month - 11 years
<i>Soup Kitchen Community Demographics</i>	All ages (11-70+) with mixed ethnic backgrounds - Spanish, Caucasian, Asian
<i>Soup Kitchen Community Health</i>	Poor to average
<i>Good Nutrition Aspects</i>	The meal centers available to the community
<i>Bad Nutrition Aspects</i>	Lack of resources (money, food markets, shelters)
<i>Food Offered at Cor Unum</i>	Wide variety - meat, vegetables, soup, and desserts
<i>Three Nutrition Suggestions</i>	Accessibility to food markets & healthy food options

Merrimack College Campus Kitchens Project Impact

Upon completion of the needs assessment, a Likert scale survey was administered to evaluate the impact that Merrimack College CKP had on the communities nutrition through the

volunteers perspective (Refer to Table 6 for the results of the survey). When asked *How much of an impact do you feel CKP has made on the nutrition of the Cor Unum Meal Center community?*, 78% of participants reported between a great deal and a lot. 56% of the participants reported feeling extremely satisfied with CKP meal donations in terms of nutritional value (protein, vegetables, and whole grains). 67% reported feeling a great deal of the Cor Unum community enjoyed the CKP meals and 100% reported believing the community felt between a great deal and a lot of enjoyment towards the Merrimack students help. Participants were also asked whether they desire Merrimack College CKP to continue delivering meals in the future, of which 100% of the participants responded yes. Lastly, the volunteers were asked to report the future foods desired which consisted of fresh fruits and vegetables, seafood, and red meat (ie. steak).

Table 6.

Cor Unum Volunteer Survey on CKP Impact

Cor Unum Volunteer Survey Results					
Topic of Discussion	A Great Deal	A Lot	Moderate Amount	A Little	None At All
CKP Nutritional Impact on Cor Unum Community	22%	56%	22%	0%	0%
Soup Kitchen Community Meal Enjoyment	67	33	0	0	0
Soup Kitchen Community Enjoyment in Student Volunteers	44	56	0	0	0
	Extremely Sat.	Very Sat.	Moderate Sat.	Slightly Sat.	Not Sat.
Nutritional Satisfaction in Meal Donations	56	44	0	0	0

Note. For the topic of discussion: Nutritional Satisfaction in Meal Donations, satisfaction was abbreviated as “Sat.”.

Food Waste Recovery Analysis

Analysis of food waste recovery and financial data are reported in Table 7. Starting in October, every food item CKP recovered from Merrimack College dining hall was recorded in

pounds (lbs.). To date, CKP has recovered a total of 1,533.69 lbs. of food from Merrimack College. A financial analysis was performed to determine the amount of money saved in lbs. per volume and the total amount CKP was able to save was \$3,598.07. The most common vegetables recovered were Zucchini (152.12 lbs. recovered saving \$272.29) and Summer Squash (140.34 lbs. recovered saving \$251.21). The most common proteins recovered were Roasted Turkey (197.33 lbs. recovered saving \$605.80) and Pork (154.70 lbs. recovered saving \$341.16). Lastly, the whole grain used was Brown Rice (141.3 lbs. recovered saving \$117.28).

Table 7.

Food Waste Recovery Analysis

Food Groups	Food Recovery (in lbs.)	Savings (in US dollars)
Vegetables	713.02	\$1,200.74
Meat	557.39	\$1,695.91
Whole Grains	141.3	\$117.28
Fish	9	\$25.65
Pre-packaged Items	112.98	\$558.49
Total	1533.69	\$3,598.07

Note. The pre-packaged items included pre-made fruit salad, fruit and cheese boxes, assorted sandwiches, and hot dogs buns.

Discussion

Campus Kitchens Project Contributions

Among the 66 individuals consuming meals at Cor Unum Meal Center Tuesday and Thursday evenings, a strong majority (76%) agreed that they observed a nutritional impact on their diets with the CKP meals and eighty five percent were very satisfied with the meals in terms of the nutritional value. The participants were also asked to report the frequency of consumption of dairy, vegetables, and protein as well as the types of food they normally

consume outside of Cor Unum (ie. home-cooked meals, fast food meals). The data collected demonstrated that sixty percent of the Cor Unum community ate home-cooked meals when they were not eating at the soup kitchen and most ate a moderate amount of fruits and vegetables, protein, and dairy. The responses of the future desired foods were consistent with food groups consumed at home such as fresh fruits and vegetables, red meats, and fish.

Important lessons were observed by evaluating Campus Kitchens Project's (CKP) nutritional contributions on the Cor Unum community. Previous studies conducted found contributing factors of malnutrition in low income communities to be related to the lack of accessibility of nutritious food donations provided to food assistance programs such as local soup kitchens and food pantry's (Mandal, 2017). To combat the malnutrition, organizations such as the USDA and EPA plan to partner with charitable organizations, faith organizations, private sectors, and local, state and tribal governments. We observed a strong nutritional impact provided by CKP suggesting further research of the added benefits of nutrition interventions in soup kitchens where healthy food options are often hard to obtain.

Opportunities for Malnutrition Improvements in Meal Centers

Additionally, we found that the community dining at Cor Unum had poor to average health outcomes. The perceived poor health was mainly caused by the lack of resources, money, food markets, and shelters. A previous study conducted determined out of the 700,000 homeless individuals in the US, sixty five percent received assistance from shelters (Koh et al., 2016). Also, we found that organizations such as Cor Unum assist to the best of their abilities with this issue. Open 365 days per year, Cor Unum serves breakfast and dinner - The common foods observed at Cor Unum during dinnertime consist of breads, meats, vegetables, soups, and

desserts. Due to these organizations operating solely on donations, the foods offered consist of a wide variety of food groups but are not always nutritious.

Our findings that implementation of CKP was associated with perceived improved nutrition and enjoyment of the meals provided is consistent with other studies. Also consistent with the literature is our finding that individuals at soup kitchens typically do not have the best nutrition. One study performed in the Greater Boston area found that shelters can improve the food quality under a constricted budget (Koh et al., 2015). By improving food quality, education, and policies in shelters and soup kitchens, we can help provide homeless individuals the dignity of opportunity to restore their health and quality of life (Koh et al., 2016). Implementation of programs such as CKP at local soup kitchens can not only assist with the community's nutrition but such programs can also raise awareness of the various barriers pertaining to the soup kitchen community's malnutrition.

Food Waste Recovery

Food waste recovery measuring the food items per pound (lb.) demonstrated that CKP was able to recover 1533.55 lbs. of food from Merrimack College from October, 2017 to May, 2018. The nutritious foods recovered were able to help feed the Cor Unum community on Tuesday and Thursday evenings. Previous studies indicated college campuses to be an area of concern for food waste, equating to an estimated 22 million pounds of uneaten food each year counting for an average of 142 pounds of food wasted by a single college student (Bendici, 2006). The Federal Good Samaritan Act was created to reduce the food waste on college campuses by allowing the foods on campus to be donated without holding any colleges liable. Consistent with our hypothesis, programs such as CKP provide opportunities to reduce the food

waste in the U.S. and specifically on college campuses where an abundance of food goes to waste.

Implications

The results from the current study support colleges in the U.S. adopting programs such as CKP to reduce food waste on campus. In having students prepare, cook, and serve donated nutritious meals to local communities in need, programs such as CKP can raise awareness of the food waste and malnutrition epidemic in our country. Additionally, this project contributed to existing knowledge that malnutrition is a major area of concern in food assistance programs and student led hunger relief programs may be efficacious in decreasing this malnutrition in surrounding low income communities.

Limitations

This current study has several limitations. Although the participants recruited represented both individuals utilizing the soup kitchen and staff members in the soup kitchen, this sample group only consisted of one soup kitchen in Lawrence limiting us to a smaller sample size. In addition, the nutritional impact contributed by CKP were obtained by self-report. Because of the socio-economic status of some of the participants, this may undermine the validity of the provided nutritional impact due to the communities appreciation of any food items given to them. Additionally, the limited time allotted for this research may have limited the results of both the communities nutritional impact and the food waste recovery at Merrimack College. Lastly, because of the limited number of nutrition interventions previously done in soup kitchens, it was difficult to compare this study to others.

Future Direction

Further implementation and evaluation of student led hunger relief programs in college campuses similar to CKP, coupled with food waste recovery and nutritional impact measurements, could help in reducing the prevalence of malnutrition and the food waste in the U.S. Future studies should focus on further understanding the malnutrition in food assistance programs and the main contributing barriers. Furthermore, a nutritional analysis should be done comparing the meals served at soup kitchens with meals served by programs such as CKP. In focusing on these elements, prospective studies could further identify causal relationships.

Conclusion

Implementation of Campus Kitchens Project at Cor Unum meal center in Lawrence, Ma was associated with an improved nutritional impact observed in the soup kitchen community and reduced food waste at Merrimack College in North Andover, Ma. CKP was able to recover 1533.55 lbs. of nutritious food from October, 2017 to May, 2018, of which fed the Cor Unum meal center community Tuesday and Thursday evenings. With the impact observed from CKP, this shows the many possibilities other colleges have in being a part of reducing the malnutrition and food waste in the U.S. as well as the opportunities such programs provide for raising awareness of the health concerns in our country.

Appendices

Appendix 1. Initial Needs Assessment

Instructions:

The purpose of this questionnaire is to gain a general understanding of the nutrition of Cor Unum meal center community. All answers will remain anonymous. Please answer the questions as honestly as possible.

1. How long have you volunteered at Cor Unum meal center?
2. What are the demographics of this community? (ie. age, gender, ethnic background?)
3. How would you describe the health of the community at Cor Unum meal center?
4. What do you think affects Lawrence community's nutrition?

The good aspects are:

The bad aspects are:

5. What kinds of foods are available at Cor Unum meal center for the Lawrence community?
6. Which three things would you suggest to improve these individual's nutrition and why?

Appendix 2. Key Informant Interview

Instructions:

The purpose of this questionnaire is to measure the impact that Merrimack College CKP has on the Cor Unum meal center community. All answers will remain anonymous. Please answer the questions as honestly as possible.

1. What types of foods do you and your family typically eat during the week?

Heat and serve meals

Home-cooked meals

Fast foods/Take-out

Restaurants

2. How often do you eat these food groups?

- Fruits and Vegetables

A great deal

A lot

A moderate amount

A little

None at all

- Protein (ie. chicken, beef, eggs)

- A great deal
- A lot
- A moderate amount
- A little
- None at all

- Dairy (ie. milk, yogurt, cheese)

- A great deal
- A lot
- A moderate amount
- A little
- None at all

3. How satisfied are you with the meals donated by Campus Kitchens Project?

- Extremely satisfied
- Very satisfied
- Moderately satisfied
- Slightly satisfied
- Not at all satisfied

4. How much of an impact do you feel our meal makes on your nutrition?

- A great deal
- A lot
- A moderate amount
- A little
- None at all

5. Would you like the Merrimack College CKP to continue delivering meals to Cor Unum meal center?

- Yes
- No

6. What foods would you like to see in the future at Cor Unum meal center?

Appendix 3. Campus Kitchens Project Questionnaire for Meal Center Staff Members

Instructions:

The purpose of this questionnaire is to evaluate the impact that Merrimack College Campus Kitchens Project has on the Cor Unum meal center community. All answers will remain anonymous. Please answer the questions as honestly as possible.

1. How much of an impact do you feel CKP has made on the nutrition of Cor Unum meal center community?

- A great deal
- A lot
- A moderate amount
- A little

None at all

2. How satisfactory are the meals being donated in terms of nutrition (ie. protein, vegetables, whole grains)?

- Extremely satisfied
- Very satisfied
- Moderately satisfied
- Slightly satisfied
- Not at all satisfied

3. Do you feel Cor Unum meal center community enjoys the meals CKP is serving them?

- A great deal
- A lot
- A moderate amount
- A little
- Not at all

4. If you answered “A little” or “Not at all”, can you explain why you think this and what CKP could do to improve this?

5. How much do you think Cor Unum meal center community enjoys the Merrimack students helping serve the nutritious meals?

- A great deal
- A lot
- A moderate amount
- A little
- Not at all

6. Would you like the Merrimack College CKP to continue delivering meals to Cor Unum meal center?

- Yes
- No

7. What foods would you like to see in the future at Cor Unum meal center?

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