ORIGINAL RESEARCH

Balancing Patients' Eating Habits with Planetary Health—Pilot Study to Decrease Food Waste with Vegetarian Lunches using a Quality Improvement Approach

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ABSTRACT

Background

Patient health is greatly impacted by increased likelihood of malnutrition if food is not consumed. Food waste also contributes to greenhouse gas emissions and may be possibly reduced by offering vegetarian food options. Therefore, a Plan-Do-Study-Act intervention of "Vegetarian Week" was conducted in an urban geriatric rehabilitation unit.

Method

Food waste was measured using the Visual Estimation Method, and the proportion of waste before and after the intervention was compared using a two-tailed *z*-test. Surveys assessed patients' attitudes towards vegetarian meals.

Results

Study population was of 54 (2022) and 65 (2023) patients with the majority being male (62.5%), average age 74.5 years, average length of stay 33 days. Comparing pre- and post-intervention periods, overall food wastage increased at: breakfast (22% to 32%), lunch (22% to 32%), and dinner (20% to 25%) with p values <.001. Considering lunch entrées only, wastage increased from 17% to 38%, with vegetarian entrees wasted (46%) more than non-vegetarian ones (34%). Vegetarian patients wasted (37%) as much as non-vegetarians (39%). Survey response rate pre-PDSA was 45%, with most patients (76%) reporting eating an omnivorous diet, a prior awareness of personal and planetary health benefits of vegetarian diets (59%), and previously trying vegetarian dishes (62%). Post-PDSA survey response rate was lower (22%) with 57% not willing to try vegetarian dishes again.

Conclusion

Through evaluation of the patient food experience with Visual Estimation Method and surveys, the very complex issue of food satisfaction was explored in older adults. Although food waste was not decreased during this "Vegetarian Week" pilot, improving patient and planetary health requires ongoing efforts.

Key words: older adults, malnutrition, quality of life, food choice, vegetarian diet, geriatric rehabilitation, food consumption

INTRODUCTION

Planetary health related to the health-care system has jumped to the forefront with a recent simultaneous call by 200 health journals to "treat the climate and nature crisis as one indivisible global health emergency".[1] Materials and processes related to health care contribute up to 5% of greenhouse gas (GHG) emissions.[2,3] Food waste (FW) contributes to these emissions,[4] with animal-based foods producing almost twice as much as plant-based ones.[5] Reducing FW in institutions[4] and having more plant-based menu items[6] are potential solutions to reduce GHG emissions. Concurrently, increasing satisfaction with food could result in increased intake and improved outcomes because malnourished patients who consume 50% or less of food on their meal trays in hospitals have higher length of stay, risk of mortality,[7] and risk of rehospitalization.[8] Older adults may have co-morbidities like frailty, cachexia, and sarcopenia.[9] Plant-based foods could be part of low-carbon, high-quality care[10] and sustainability,[11] while addressing quality domains of effectiveness and efficiency[12] for patients.

Specific Aim

The project aim was to reduce food waste by 10% within six months after introducing the intervention of "Vegetarian Week" and assess patient receptiveness to vegetarian entrees.

METHODS

Context

Holy Family Hospital (HFH) is an inpatient and outpatient geriatric facility in Vancouver, Canada comprising of a Rehabilitation (Rehab) Unit with 60–75 beds and Long-Term Care (LTC) with 126 beds, totaling almost 200 patients.

On June 24, 2022, food production and food service staff were repatriated from a private food services provider back to public health care "in-house production." This change provided an opportunity to directly collaborate with Food Services to improve the patient food experience to reduce FW.

Measurements

Food waste was measured using the Visual Estimation Method (VEM).[13] Patients' attitudes and knowledge about vegetarian meals were assessed using voluntary surveys (see Appendix A).

At HFH, food consumption is measured at a micro-level with dietitian analysis of individual patient intakes through calorie counts, observational assessment, and nutritional data. At a macro-level, FW is measured by Food Services through bi-annual plate waste audits weighing amalgamated solid and liquid food discarded. As data are too granular with individual measurements and not granular enough with gross food weights to determine what amounts and types of food are being wasted by a population, this Quality Improvement (QI) project strived to obtain meso-level data. Other food consumption studies have used individual weight measurements of meal tray waste, but as this type of data collection is too labor-intensive for point-of-care use, the VEM is an alternative method already commonly used by health-care staff, which has been validated and reviewed as useful for group level measurements even with inter-rater variability.[14] In-service educational sessions were held with staff to reduce this variability.

Initial baseline of patient food consumption at HFH Rehab was completed by nurses in June 2022 (before Food Services repatriation) for three meals daily for one week using VEM. Each food item's consumption amount was recorded on the food tray menu slips using quartile percentages (0%, 1–25%, 26–50%, 51–75%, 76–100%). Data collected in categories of location (room number), meal (breakfast, lunch, dinner), food categories (entrees, entrees cold vegetables, entrees hot vegetables, condiments, cold beverages, hot beverages, dessert, fruit, oral nutritional supplements) were entered manually into a password-protected Excel spreadsheet by a student intern or volunteer. The health authority's data analytics team analyzed the data and designed data visualizations (Appendix B1). This data collection was repeated during the intervention of "Vegetarian Week" with a few additional food categories (entrees including and excluding soup, water) to determine whether more specific areas of FW could be identified. Patient demographics including age, gender, and length of stay (at time of assessment) were obtained from the Electronic Medical Record (EMR) for both study periods (June 18–24 2022 and May 29–June 4 2023).

Surveys (Appendix A) to capture patient feedback were revised from ones used in a previous QI project[15] which incorporated Office of the Seniors Advocate patient-validated survey questions,[16] and further validated by a Performance Improvement Consultant, a Dietitian, and a Patient Voice Partner. Survey participation was voluntary and available electronically via QR code, web link, or by paper. The pre-intervention survey conducted two weeks before "Vegetarian Week" assessed patients' baseline diet types, experience with vegetarian meals, and awareness of health benefits associated with vegetarian eating patterns. Surveys administered alongside the vegetarian meal of the day garnered immediate feedback about the dish. The post-intervention survey, done the week after, solicited opinions about the dishes including willingness to have them again.

Intervention

During the "Vegetarian Week" pilot intervention, the private food service's existing core menu was used. Out of 14 lunch choices, four vegetarian (non-animal protein) entrée substitutions were chosen from available existing options by the Food Services' manager in consultation with the dietitian. Breakfast and dinner were unchanged. Patients selected their menu choices as usual, though were given a vegetarian lunch meal option by default unless they chose a non-vegetarian option. Individual patient dietary preferences were upheld with dietitian supervision. Menu items are listed in Table 1.

TABLE 1
Lunch entrée choices

Day	*Lunch Menu Vegetarian Entree*	*Alternative Option*
Monday	Cheese, Lettuce, and Cucumber Sandwich	Fried Rice with Chicken
Tuesday	Egg Salad Sandwich	Black Bean Cod
Wednesday	BBQ Tofu	Salmon Salad Sandwich
Thursday	Vege Chili	Chicken Salad Sandwich
Friday	Vege Patty w/ Mushroom Sauce	Roast Beef Sandwich
Saturday	Macaroni & Cheese	Tuna Salad Sandwich
Sunday	Tofu Vermicelli	Turkey Salad Sandwich

Analysis

For the food audit, quartiles of 0–50% food consumption were amalgamated and categorized as "food wasted" (Appendix B2). Wastage was compared for "all food categories" and "entrees only" categorized by meal type (i.e., breakfast, lunch, dinner). "Entrées only" included subcategories of entrée including soup, entrée excluding soup, entrée cold vegetable, entrée hot vegetable. In some instances, multiple rows of duplicate subcategory entrée items were averaged, to get a single quartile value to avoid overcounting for one patient. Wastage was also compared for vegetarian entrees versus non-vegetarian entrees, and for patients following vegetarian diets versus patients not on a vegetarian diet. A two-tailed *z*-test was used to compare FW between baseline and intervention periods to determine any significant difference, with a confidence level of 95%.

Survey results (Appendix A) were analyzed in Qualtrics (https://www.qualtrics.com/) using percentages for responses. Qualitative themes were collated and highlighted.

Ethical Considerations

The ARECCI (A pRoject Ethics Community Consensus Initiative) evaluation was completed in June 2022 and reviewed by another physician, as well as the Privacy Officer at Providence Health Care. As the study fit within a QI framework, formal ethics application and approval process was not necessary. Patient EMR data were anonymized and aggregated.

RESULTS

Study Population

The patient populations surveyed (Table 2) with 54 patients in 2022 and 65 patients in 2023 were similar, with majority male (62.5%), overall average age 74.5 years, and overall average length of stay 33 days. There were seven to eight different diet types, ranging from therapeutic diet requirements to texture modification.

Food Audit

The collection rate of meal tickets for baseline data was 77.6% (880 tickets collected/1,134 meals served) and for intervention week was 66.2% (904/1,365). Comparing food wastage (defined as 0–50% food consumption) of all food categories, stratified by meals (Figure 1), results showed statistically significant increased breakfast and lunch wastage. Dinner wastage as a balance measure also showed increased wastage. Focusing on the food category of entrees only, stratified by meals (Figure 2), there was statistically significant increased wastage in all meals, particularly at lunch (17% to 38%). Vegetarian entrees were wasted more than non-vegetarian entrees (Figure 3) with rehab patients on vegetarian diets having similar lunch entrée food wastage as patients on non-vegetarian diets (Figure 3).

Patient Survey

The pre-PDSA survey had a 29/65 (45%) response rate. Diet types were mostly omnivorous (76%), with most patients (59%) reporting prior awareness of personal and planetary health benefits associated with vegetarian eating patterns and most (62%) having tried vegetarian meals before (Appendix A).

After "Vegetarian Week", the survey response rate was lower; only 15/65 (23%) Rehab patients responded. Interest in trying a vegetarian meal again for lunch (14 responses) was mixed with most (57%) responding "no", 14% "yes", and 29% "maybe". General comments ranged from: food was "not spicy enough", "bland and tasteless", "don't like tofu" to "I think it was a good tryout" and "I like the idea of incorporating more vegetarian proteins into hospital meals!" (Appendix A).

DISCUSSION

Our project aim to reduce food waste by 10% using the intervention of "Vegetarian Week" was not achieved but, rather, food waste increased at lunch with the vegetarian entrees.

Overall food wastage rates in this project of 25–32% are similar to other studies where median FW was 31% by

TABLE 2.
Study population demographics

Demographics	*Baseline (2022)*	*Vegetarian Week (2023)*	*Overall Average*
Gender	n = 34 (63%) M n = 20 (37%) F total=54	n = 40 (62%) M n = 25 (38%) F total = 65	M 62.5% F 37.5%
Age:- average by gender	74 years M 72 years F	73 years M 79 years F	M 73.5 years F 75.5 years Both 74.5 years
LOS : average by gender	39 days M 22 days F	35 days M 36 days F	M 37 days F 29 days Both 33 days
Diet Types	8	7	

M = male; F = female; LOS = length of stay.

weight.[17] Likewise, more wastage of vegetarian entrees than non-vegetarian in this project are similar findings to a study of children with plant-based lunch items.[18]

Factors that may have contributed to increased wastage during the intervention include lack of palatability or familiarity with the current Food Services vegetarian entrees offered. Although dinner consumption was a balancing measure because patients who ate less lunch would most likely eat more dinner, increased dinner wastage may have been due to greater availability of alternative food (typically brought in by visitors, families, or food delivery). During 2022 (baseline), COVID-19 restrictions prevented easy and regular access to outside meals, thus patients were more reliant on hospital-provided meals. Even though vegetarians are more familiar with vegetarian food than non-vegetarians, patients on vegetarian diets wasted just as much as non-vegetarians possibly because the entrees were not to their personal standard. Although breakfast entrees also showed increased FW, the percentage difference was less than at lunch, perhaps due to the long interval between this meal and the previous evening's dinner.

Survey participation decreased over the study period potentially due to survey fatigue. The smaller number of

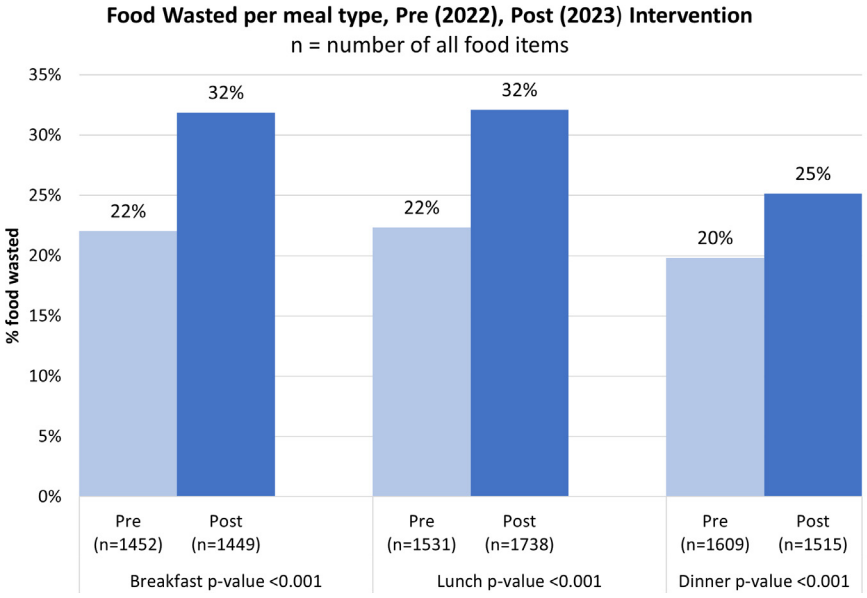

FIGURE 1. Food waste of all food categories, per meal

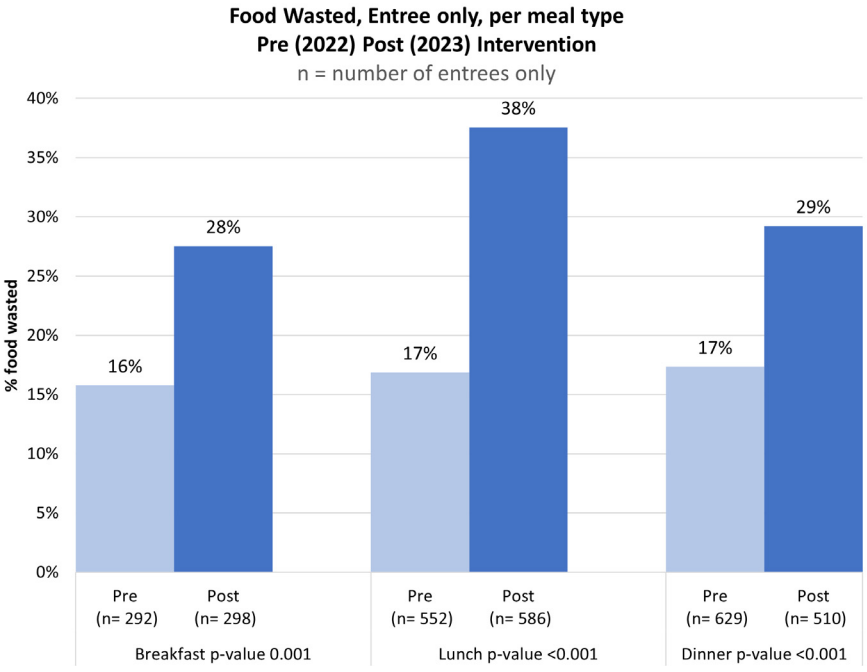

FIGURE 2. Food waste of entrée only, per meal

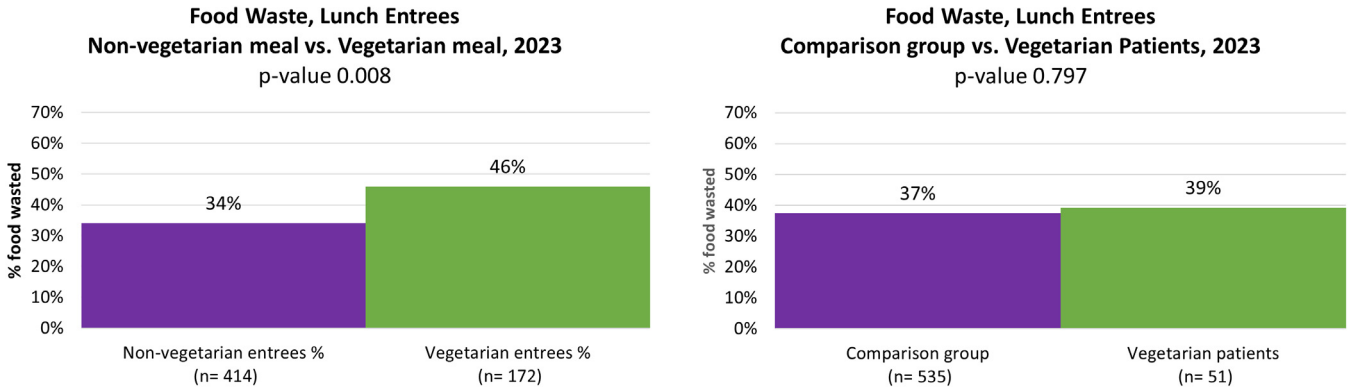

Figure 3. Food waste of lunch entrée only comparing non-vegetarian vs. vegetarian meal, patients

n = number of entrees.

post-PDSA responses made results difficult to interpret due to possible recall bias skewed towards negative feedback, not reflecting previous positive responses from the immediate feedback survey.

Strengths of the project included the use of two methods to gauge patient food experience through measuring food consumption with grouped patient meso-level data and different surveys. These two methods together could identify optimal intervention(s) and assess how receptive patients are to menu items, including plant-based ones, with the goal to improve food intake and guide future patient service initiatives. A detailed baseline of food consumption with variables of gender, location, food categories, and meals was established for future PDSA data comparisons. The possibilities of data collection/analysis to correlate with anonymized, generalized population EMR data were demonstrated. Efforts were made to understand a very complex system with varying group and individual food preferences using a QI framework.

The primary project limitation in using VEM was dependence on voluntary staff participation, with variable engagement contributing to incompletely collected data. Data quality can be affected by inter-observer variability in quantifying food consumption and recording, or data entry error/variability. Limitations of the survey data was low response rates dropping off later in the study and perhaps limiting the representativeness of the patient experience.

Other factors influencing the pilot included concurrent staff shortages, burnout from the ongoing pandemic, and intermittent COVID-19 outbreaks during the study period. The project was conducted during a period of large-scale transition from private food service provider to public in-house food production with operational constraints including menu choice and timing. Food acceptability by patients may have been affected by using existing recipes and menu items from the hospital food service provider. Although not surveyed in this study, ethnicity, cultural preferences, and personal food preferences would play a role in food selection. Other challenges included study population variations with patient admissions or discharges. Although survey information and suggestions by staff and patients are shared with Food Services, resource limitations or operational priorities remain barriers to implementing new recipes or meals.

Despite limitations, this simple but informative methodology was used previously pre-COVID-19 in LTC[15] and could be used in other care settings such as acute care, even with fluctuating populations. Data collection focusing on specific food categories and variables could acquaint and engage staff more quickly with VEM to facilitate more agile PDSAs and optimize sustainability. Comprehensive staff training on VEM can improve consistency.[14] Shorter focused surveys for immediate feedback on dishes might better capture the patient food experience. Establishing a detailed baseline enables better future data comparisons.

The future for measuring FW would be developing a standard FW audit methodology,[19] as well as one that is less labor intensive and time-consuming but timelier. In this project, entering the individual food items from paper meal tickets for all three meals from the study week into the data base required approximately two weeks of daily manual entry, but this could be streamlined for studies of one food category over a shorter time period. Using Artificial Intelligence (AI)-based electronic visual scanners[20,21] that are incorporated into food services workflow may achieve better data despite the initial barrier of equipment and training costs.

With the spotlight on Planetary Health, health authorities may endeavor to provide more plant-based foods for patients, but to implement and measure change, food quality improvement with metrics needs to be prioritized with sufficient financial and human resources, including knowledge users in future study designs to optimize feasibility. For more acceptable plant-rich menus, patients' robust input is essential to co-create vegetarian dishes because they are the end-users. However, addressing malnutrition is the foremost goal by improving patient intake with more palatable food choices, whether plant-rich or not. Because food is a quality-of-life issue for many, balancing patient eating habits and planetary health is delicate as personal food preferences often supersede institutional or health-care provider goals. Personal food choices can impact planetary health.[22]

CONCLUSION

This QI project aimed to reduce food wastage by 10% with a PDSA intervention of "Vegetarian Week" but we observed an increase in wastage. The very complex issue of food satisfaction was explored in older adults and showed changes, such as introducing vegetarian menu items, may not always be readily accepted by patients. The possibilities of using aggregated anonymized EMR patient data to correlate with population food consumption were also demonstrated. As food provides an important source of pleasure and comfort, reducing food waste while balancing patient eating habits with planetary health is a challenge to be met.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood the *Canadian Geriatrics Journal*'s policy on conflicts of interest disclosure and have no conflicts of interest to declare.

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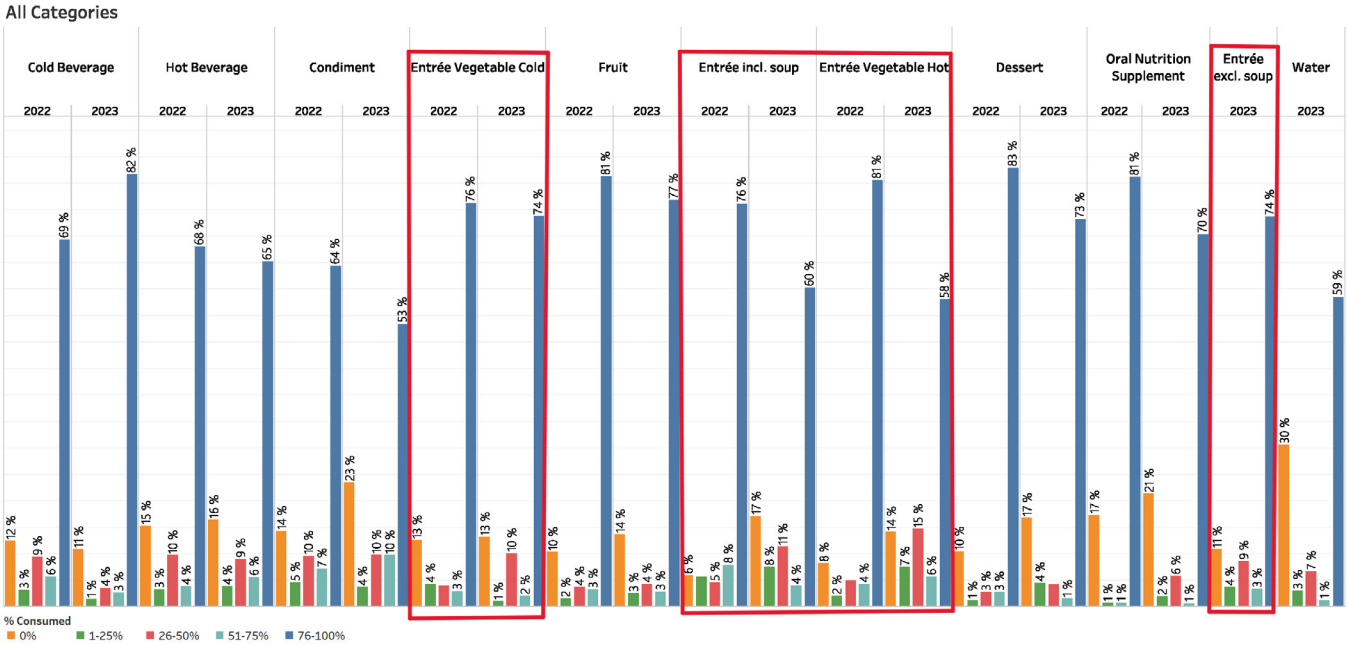
APPENDIX A. Sample survey questions and responses

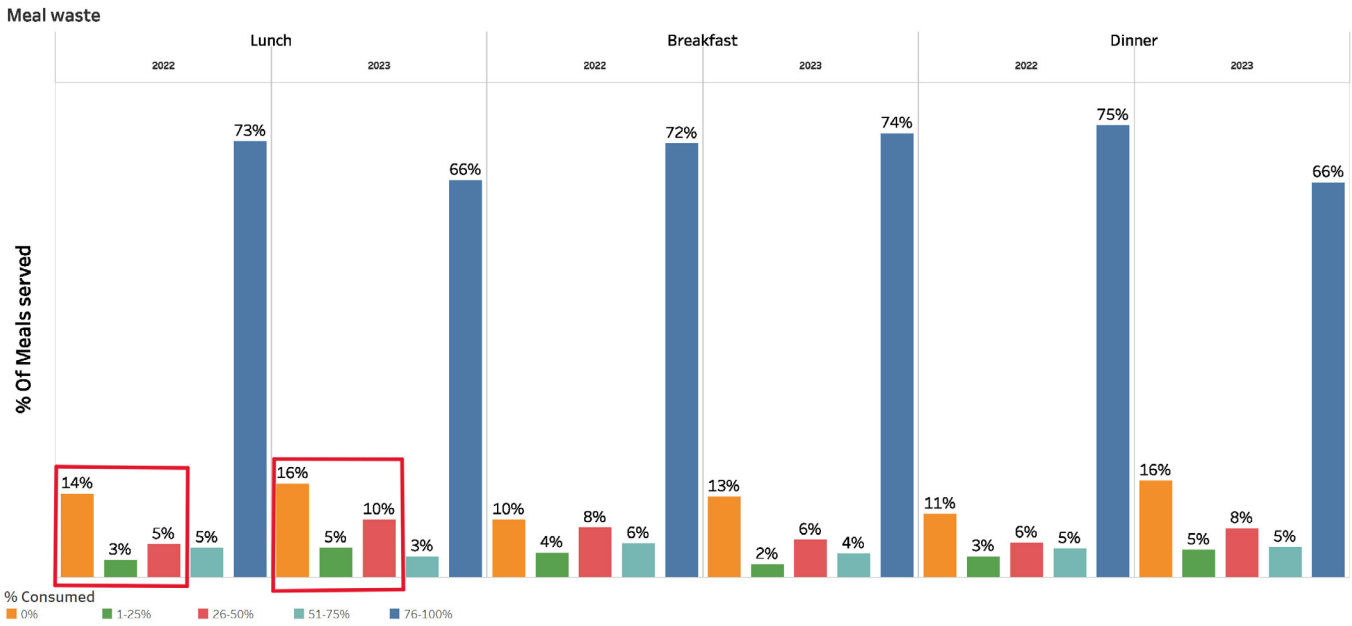
Pre-PDSA Survey n = 29 (29/65 = 45% overall response rate)					
How would you describe your current diet?	Vegan (Only plant-based, no animal products) n = 1 (3%)	Vegetarian (No meat, but dairy and eggs are ok) n = 1 (3%)	Omnivore (Eats all foods, including animal products) n = 22 (76%)	Pescatarian (No meat, but fish, dairy and eggs are ok) n = 3 (10%)	Other n = 2 (7%)
Have you tried a vegetarian meal before?	Yes n = 18 (62%)	No n = 9 (31%)	Don't know n = 2 (7%)		
Have you heard of any benefits of a vegetarian diet?	Yes n = 17 (59%)	No n = 5 (17%)	Maybe n = 4 (14%)	Don't know n = 0	No response n = 3 (10%)
A vegetarian diet is often promoted as having great benefits. Have you heard of any of these? – Physical health – Planetary health (environmental impact)	Yes n = 17 (59%)	No n = 3 (10%)	Maybe n = 5 (17%)	Don't know n = 2 (7%)	No response n = 2 (7%)
Post-PDSA Survey n = 14 (14/65 = 22% overall response rate)					
Are you interested in trying a vegetarian dish again for lunch?	Yes n = 8 (57%)	No n = 4 (29%)	Maybe n = 2 (14%)		

Post-PDSA Comments: What did you like or dislike about Vegetarian Week?
Not spicy enough
Would have liked the choice to have it or not
The food was bland, tasteless
Nothing
Not many choices
Not interested
Luke warm meal
It was not flavorful
I think it was a good tryout
I like the idea of incorporating more vegetarian proteins into hospital meals!
I don't like tofu

APPENDIX B. Raw data visualizations



APPENDIX B1. All Food Categories (food consumption in quartile percentages)



APPENDIX B2. Entrees only (food waste = 0-50% consumption quartiles)