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Original article

Bedside Menu Ordering System increases energy and protein intake while decreasing plate waste and food costs in hospital patients

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Introduction

Malnutrition in the acute hospital setting is associated with adverse clinical outcomes, increased mortality and morbidity, increased hospital length of stay and increased costs [1–5]. Poor nutritional intake is now recognized as an independent risk factor for hospital mortality [4–6]. Meeting patients' nutritional requirements in the healthcare setting can be difficult due to a range of barriers including appetite, physical barriers, organizational barriers, food choice and quality [6–11]. With one in three hospital patients malnourished [3,4], it is imperative that hospitals continue to explore strategies to improve nutritional intake [2] and encourage patients to meet their nutritional requirements [1,10].

High food wastage in hospitals is associated with reduced nutritional intakes [6,12,13] and can be influenced by a number of factors including the foodservice model design and its flexibility [12]. Although this wastage can occur in all points of the foodservice process, the largest losses are often at the point of consumption, referred to as plate waste [12]. Reasons for plate waste can relate to various issues within the categories of clinical, food/menu, service and environment [12]. Reasons within the food/menu and service categories include menu choice (limited, lack of selective menu) and ordering problems (insufficient information, ordering in advance) [10,12]. High plate wastage also contributes to the cost of foodservice models [12]. Foodservice models which can address these issues and sources of waste have become a focus of foodservice management [12,14].

Increasing focus on patient-centered care and consumer engagement has resulted in patient satisfaction becoming a driver of high quality care [15] and foodservice quality has been linked to patient satisfaction [16]. Quality and safety standards now require processes whereby consumers are partners in healthcare provision and are engaged in the planning and evaluation as well as the delivery of their care [17,18]. Foodservice models which increase consumer engagement may in turn increase patient satisfaction with foodservice [19].

The use of a 'spoken menu' has reported improvements in patient satisfaction [19–21], plate waste [21] and increased time spent with patients by staff [6]. More recently the electronic bedside spoken meal ordering system (BMOS) has shown increases in nutritional intake via increased engagement between the meal order staff (Nutrition Assistants – NAs) and patients and increased patient participation with the service [19]. This model has shown improved nutritional intake both as a measure of total energy and protein intake as well as intake as a percentage of requirements. This study aimed to evaluate the impact of changing from a traditional paper menu ordering system (TM) to a BMOS on the key outcome measures of nutritional intake, plate waste, patient and staff satisfaction and patient food costs.

Methods

Mater Hospital Brisbane (MHB) is a 126 bed public acute care adult hospital within the Mater Health group at South Brisbane, Queensland, Australia. It has a case mix of patients, designated by subgroup in general medical, surgical and oncology wards. In 2015, this facility changed from TM to BMOS. In TM, NAs deliver and collect paper menus from patients for dinner the same day and

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breakfast and lunch the following day, manually process this information and deliver to the kitchen for production. In BMOS model, NAs discuss the meal options compliant to the individual patient's diet at their bedside and enter orders into a hand-held wireless mobile device (Apple iPad). Utilizing the CBORD® Food and Nutrition Solutions (FNS) (version 10.12.100) software [22], NAs are able to provide meal suggestions that align with patients' therapeutic dietary requirements and personal meal preferences, and the orders are sent directly to the kitchen for production.

In TM, the facility had a 14 day cycle cook fresh menu. In January 2015, prior to implementing BMOS, the facility underwent a menu review and changed to a 7 day cycle menu, which remained cook fresh, but introduced a number of more contemporary menu items. Menus for both TM and BMOS were entered into FNS [23,24] and analyzed for nutritional quality and to ensure compliance to therapeutic diets and the New South Wales (NSW) Agency for Clinical innovation Standards for Adult Inpatient and Queensland Health Nutrition Standards for Meals and Menu [25,26].

The organization's annual malnutrition point prevalence audit data shows malnutrition prevalence rates for this facility at 28% for 2014 and 27% for 2016. Hospital average length of stay data for eligible wards was 4.35 in 2014 and 4.61 in 2016. A retrospective analysis of quality assurance data collected at MHB in August 2014 for TM and in July 2016 for BMOS was conducted. Data collection process and tools utilized were the same for both TM (pre-implementation) and BMOS (post-implementation) cohorts, modeled on the BMOS study by Maunder et al. [19].

The Mater Health Human Research Ethics Committee and Bond University's Human Research Ethics Committee assessed this project as exempt from requiring ethical approval. As a retrospective analysis of de-identified routine audit data, it did not meet the definition of research in accordance with the [Australian] National Statement on Ethical Conduct in Human Research [27].

Nutritional intake and plate waste

Nutritional intake and plate waste data was collected by University nutrition and dietetics students during their food service placement. Data collection was supervised by the Nutrition and Dietetics department's Senior Clinical Educator, Senior Foodservices Dietitian and Director of Nutrition and Dietetics as part of the quality assurance process. Students were provided with one day of training in the data collection methodology, and knowledge of serving sizes and were assessed in the use and scoring of the tool to ensure accuracy and uniformity of data collection between auditors. During these audits, patient demographic data including age, sex, weight, and diet classification was obtained via hospital records. A meal intake observation tool using a 5 point visual scale (0, ¼, ½, ¾, all) was used to record the volume of each meal consumed by the patient [6,7,28,29]. Patients were excluded if they were classified as nil by mouth, restricted to fluids only, on enteral or parenteral nutrition, less than 18 years old, critically ill or palliative, requested not to participate by patient or nursing staff, did not have a weight recorded or had less than 24 h of consecutive nutritional intake data. The recorded percentage of each individual menu item consumed was assessed separately and used to calculate energy (in kilojoules) and protein (in grams) for individual patient meals across a 24 h period including all meals and snacks to determine energy and protein intake per day.

Nutritional analysis was performed using FNS [23,24] which contains the AusNut nutrient database (Special Edition 1999) [30]. The patient's weight was used to estimate their energy and protein requirements by subgroup: medical (125 kJ/kg; 1.0 g/kg protein), surgical (125 kJ/kg; 1.2 g/kg protein) and oncology (135 kJ/kg; 1.35 g/kg protein) [31–35]. Where BMI > 30 kg/m^2, Adjusted Ideal Body Weight (AIBW) was used to calculate these requirements to reflect current clinical practice on the wards [31,36]. Plate waste was assessed via each of the individual food items remaining on the plate and from that the overall plate waste was calculated. Nutritional intake and plate waste audits were undertaken over a four day period in August 2014 for TM and July 2016 for BMOS.

Patient satisfaction

Patient satisfaction was measured using the Acute Care Hospital Foodservice Patient Satisfaction Questionnaire (ACPHFSQ) [37]. Patients were excluded if they were asleep at the time of data collection, refused the survey or were requested not to include by nursing staff. Similar to Maunder et al. [19], the Meal Selection Survey was also used during the patient satisfaction data collection period to assess patient satisfaction specific to the meal ordering service and their interaction with the NAs. Data for both surveys was collected in a one day snapshot in August 2014 for TM and July 2016 for BMOS.

Nutrition assistant role and satisfaction

Consistent with Maunder et al. [19], all NAs were provided with a survey pre (TM) and post (BMOS) implementation to determine their preferred service model and to assess if there were changes in the utilization of their nutrition knowledge, their perceptions of awareness of their role and the level of menu selection assistance provided to patients. The survey tool was developed, piloted and utilized by Maunder et al. [19]. Three multiple choice questions were added for this study to the post implementation (BMOS) survey to determine the NA perceptions on whether the service had increased the amount of time that they spent with patients, improved their work productivity or improved their job satisfaction. NA work schedules were analyzed for TM and BMOS to compare the time spent with patients at the bedside.

Patient food costs

Total patient food costs were obtained from the foodservice department end of month finance expense reports and were compared between TM and BMOS. TM data was analyzed for the 12-month period from January to December 2014 and BMOS data for the 12-month period from January to December 2016. Comparable twelve month data sets were used to avoid seasonal fluctuations in food costs and use. Australian annual average inflation rate for food for the period 2014–2016 was 1.4% per annum [38].

Data analysis

Statistical analysis was performed using IBM SPSS Statistics software (Version 24.0) [39]. For continuous demographic data and dietary intake, descriptive statistics (mean, standard deviation, count and percentage) were calculated. Checks for normality of data were conducted through visual observation using histograms and Q–Q box plots, and utilizing Skewness and Kurtosis values where <-1 and >1 considered not normally distributed. Independent samples t-test and Pearson $\chi 2$ analyses were conducted between TM (pre) and BMOS (post) data for continuous and categorical data respectively. The level of significance was set at $p < 0.05$.

Results

Nutritional intake

Data was collected for 84 patients for TM and 104 patients for BMOS. There were significant differences between the TM and

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