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Room service in a public hospital improves nutritional intake and increases patient satisfaction while decreasing food waste and cost

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Abstract

Background: Room service (RS) is a hospital foodservice model that is traditionally unique to the private sector. It allows patients to order meals compliant to their nutritional requirements from a single integrated menu at a time that suits them. Meals are prepared and delivered within 45 min of order. Following implementation in a private adult facility in 2013, Mater Group implemented the first RS in a public adult facility in Australia in 2016. In a pre–post study comparing RS with a traditional foodservice model (TM), key outcomes were measured and analysed.
Methods: A retrospective analysis of quality assurance data audits in a pre–post study design was undertaken to assess patient nutritional intake, plate waste, satisfaction and meal costs before and after RS implementation.
Results: Comparison of nutritional intake between TM (n = 84) and RS (n = 103) showed statistically significant increases with RS in both energy (5513 kJ day^{-1} versus 6379 kJ day^{-1}, P = 0.020) and protein (53 g day^{-1} versus 74 g day^{-1}, P < 0.001) intake, as well as energy and protein intake as a percentage of requirements (64% versus 78%, P = 0.002 and 70% versus 99%, P < 0.001, respectively). Total average plate waste decreased from 30% to 17% (P < 0.001). Patient satisfaction indicated an improvement with RS, with 98% of patients scoring the service good to very good, compared to 75% for TM (P < 0.04). Patient food costs decreased by 28% per annum with RS.
Conclusions: This research provides insight into the benefits achievable with RS in the public hospital setting, confirming that a patient-centred food service model can cost-effectively improve clinical outcomes.

Introduction

Room service (RS) is a foodservice model that has been adopted within the private acute care setting over the past 15 years, driven by a focus on improving patient satisfaction and reducing food waste (1–3). Hospital food service provision is increasingly being scrutinised in the cost-constrained and patient-centred healthcare environment to reduce costs, as well as to reduce the environmental impact of foodservice waste (4–6). Patient-centred foodservice models that enable patient engagement and a personalised service can contribute to improvements in overall patient satisfaction (7–9). Patient experience is also linked to the delivery of high-quality care (10).

Malnutrition is a well-documented clinical issue associated with negative clinical outcomes and healthcare costs (11–14) and poor nutritional intake is also recognised as a risk factor for poor patient outcomes and hospital mortality (13,15). Meeting patients' nutritional requirements in an acute care setting is difficult with several extenuating factors, including patients' appetite and clinical symptoms, food access and availability, menu quality, food choice and individual patient preferences [16]. Therefore, there is a focus on hospital foodservices to potentially increase patients' nutritional intake. To date, menu strategies aiming to improve intake have included use of oral nutrition supplements [17,18], fortification of menu items in terms of protein and energy and use of protein and energy-dense snacks between main meal service [19]. Although these have been shown to be clinically effective [17,20], the potential for increase in costs and poor compliance is seen as a barrier to their use [17]. Other strategies have focussed on the meal environment, presentation [21,22] and patients' access to meals such as protected meal times [16,23] to allow patients adequate and uninterrupted time to consume their meals. Further strategies have addressed food ordering and delivery processes in an attempt to ensure that patients have adequate choice and are able to make their choice close to meal times. These include bulk trolley service models [8], electronic bedside ordering [24,25] and e-menus [26].

Following the implementation of room service in Australia in their private adult facility in 2013, the Mater Group demonstrated improvements in key outcome measures nutritional intake, plate waste, patient satisfaction and patient meal costs with the RS model [27]. The present study aimed to repeat the measurement of these key outcomes in a public setting, following the implementation of RS in their public adult facility in 2016.

Materials and methods

Mater Hospital Brisbane (MHB) is a 126-bed public acute care adult hospital with a case mix of patients, designated into general medical, surgical and oncology wards. The organisation's annual malnutrition point prevalence audit data show malnutrition prevalence rates for MHB at 32% in 2014 and 33% for 2017. In 2016, MHB transitioned from a Traditional Model (TM) to RS, using the CBORD® Food and Nutrition Solutions (FNS) and Room Service Choice™ (version 10.12.100) [28] software. In TM, patients ordered their meals by completing a paper menu (cook fresh, 14-day cycle menu) up to 24 h prior to meals, which were then collected at a set time by Nutrition Assistant staff. Meals were delivered at set meal times during the day: breakfast between 06.30 h and 07.30 h; lunch between 11.45 h and 12.45 h; and dinner between 17.00 h and 18.00 h. In RS, patients order meals from a single integrated a la carte style menu anytime between 06.30 h and 19.00 h by phoning RS representatives in a central call centre. Meals are prepared on demand and aim to be delivered within 45 min of receiving the order. Menus for both RS and TM were analysed in FNS for nutritional quality and to ensure compliance with therapeutic diets according to the New South Wales (NSW) Agency for Clinical Innovation Nutrition Standards for Adult Inpatients and the Queensland Health Nutrition Standards for Meals and Menus [29,30].

A retrospective analysis of routinely collected quality assurance data in a pre–post study design measured nutritional intake, plate waste, patient satisfaction and overall patient meal costs at MHB to enable a comparison of TM (pre-implementation) in August 2014 and RS (post-implementation) in March 2017. Data collection process and tools utilised were the same for both TM and RS cohorts.

The Mater Health Human Research Ethics Committee assessed this project as being exempt from requiring ethical approval. As a retrospective analysis of deidentified routine audit data, it did not meet the definition of research in accordance with the [Australian] National Statement on Ethical Conduct in Human Research [31].

Nutritional intake and plate waste

Nutritional intake and plate waste data were collected by University nutrition and dietetics students during their food service internship placements. 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 1 day of training in the data collection methodology and use of the tool by the senior clinical educator and were also assessed in the use of the tool to ensure accuracy and uniformity of data collection between auditors. During these audits, patient demographic data including age, sex, weight and height were obtained via hospital records. Standardised food portions are served to the patient, managed through the use of FNS standardised recipes and serving sizes, and are audited monthly. A meal intake observation tool using a five-point visual scale (0, ¼, ½, ¾, all) was used to record the volume of each meal consumed by the patient [32]. FNS contains the menu items, weights of the standardised portion sizes and their nutritional composition per patient order and therefore can automatically calculate the nutritional composition of menu items recorded as eaten. All of the edible components of items ordered were evaluated, excluding bottled water as a result of its nil contribution to energy and protein intake. Audits were undertaken over a 4-day period in August 2014 for TM and March 2017 for RS. Patients were excluded if they were classified as NBM (nil by mouth), restricted to fluids only, on enteral or parenteral nutrition, less than 18 years old, critically ill or palliative, did not have a weight recorded or had less than 24 h of consecutive intake data.

Total nutritional intake including all meals and snacks was recorded across a minimum 24-h consecutive period to determine energy (kJ) and protein (g) intake for individual patients per day. Nutritional analysis was performed using CBORD® FNS version 10.12.100 [33,34], which contains the AusNut Special Edition nutrient database (1999) [35]. The patient's weight was used to estimate their energy and protein requirements by subgroup: medical [126kJ/ kg (30 kcal kg^{-1}); 1.0 g kg^{-1} protein], surgical [126kJ/ kg (30 kcal kg^{-1}); 1.2 g kg^{-1} protein] and oncology [135kJ/ kg (32 kcal kg^{-1}); 1.35 g kg^{-1} protein]. Where body mass index > 30 kg m^{-2}, adjusted ideal body weight was used to calculate these requirements to reflect current clinical practice on the wards [36–42]. A comparison was then made to assess percentage of protein and energy consumed against estimated energy requirements (EER) and estimated protein requirements (EPR).

Plate waste was recorded across a minimum 24-h consecutive period including all meals and snacks by evaluating each of the individual food items remaining on the plate and calculating overall plate waste.

Patient satisfaction

Patient satisfaction was measured using the Acute Hospital Foodservice Patient Satisfaction Questionnaire (AHFPSQ) [43]. Patients were excluded if they were asleep at the time of data collection, refused the survey or were requested by nursing staff to not be included. Data for both surveys were collected in a 1-day snapshot in August 2014 for TM and March 2017 for RS.

Patient meal costs

Total patient food costs were obtained from the foodservice department end of month finance expense reports. TM data were analysed for the 12-month period from January to December 2014 and RS data for the 12-month period from January to December 2017. Patient meal costs were calculated and compared as patient food cost per patient occupied bed day (OBD). OBDs were calculated for each 12-month period. Australian annual average inflation rate for food for the period 2014–2017 was 1.4% per annum and was considered when evaluating overall patient meal cost data for this period [44].

Statistical analysis

Statistical analysis of data was completed using SPSS software [45]. Normality checks were completed using histograms and Q-Q box plots with the Shapiro–Wilk test used as required. Independent *t*-tests were used to analyse pre- and post-data for age, weight, body mass index, estimated energy and protein requirements (EER and EPR), estimated energy and protein intakes (EEI and EPI) and plate waste. A Pearson chi-squared method was used to analyse pre- and post-data on sex, cohort split (medical, oncology and surgical) for nutritional intake versus requirements and patient satisfaction. $P < 0.05$ was considered statistically significant.

Results

Nutritional intake and plate waste

Nutritional intake and plate waste data were collected for 84 patients for TM and 103 patients for RS. There were significant differences between the TM and RS participant demographics with respect to age, weight and medical classification. There were no significant differences between TM and RS cohort with respect to sex. Despite some differences in participant demographics, no significant differences in the estimated energy or protein requirements were calculated between the patient cohorts (Table 1). After the introduction of RS, average energy intake, protein intake, % EER and % EPR all increased significantly from TM values ($P = 0.020$, $P < 0.001$, $P = 0.002$ and $P < 0.001$, respectively) (Table 2). When analysed by subgroups medical, surgical and oncology, there was a significant increase in average energy intake and % EER in the surgical group. All subgroups showed a significant increase in average protein intake and oncology and surgical subgroups showing a significant increase in % EPR (Table 3).

Plate waste data included a total of 4141 individual food items served to 84 patients in TM in comparison with 2332 individual food items served to 103 patients in RS. Overall, the average plate waste significantly decreased from 30% to 17% ($P < 0.001$).

Patient satisfaction

A total of 20 patients completed the AHFPSQ [43] for TM and 42 patients completed it for RS. There was no significant difference between groups in age, sex or medical classification. Overall, the percentage of patients rating their overall satisfaction with the foodservice as 'very good' or 'good' increased from 75% for TM participants to 98% for RS participants ($P = 0.040$).

Patient meal costs

Compared to the 12-month period for TM, total patient meal costs were decreased by 28% for an equivalent 12-month period for RS. Total staffing (full-time equivalent levels) required for TM and RS remained the same.

Table 1 A comparison of patient demographics between a group of adult inpatients receiving a Traditional Foodservice Model (TM) in August 2014 and a group of adult inpatients receiving Room Service (RS) in March 2017 at the Mater Hospital Brisbane (Australia)

Patient demographic	Traditional Foodservice Model (n = 84), mean (SD)	Room Service (n = 103), mean (SD)	P value
Age (years)	63.4 (19.1)	70.4 (15.0)	0.007*
Weight (kg)	80.3 (24.7)	72.7 (24.5)	0.036*
Medical classification			
Medical	38 (45%)	49 (48%)	
Oncology	10 (12%)	26 (25%)	0.022*
Surgical	36 (43%)	28 (27%)	
Sex, n (%)			
Female	48 (57%)	54 (52%)	0.519†
Male	36 (43%)	49 (48%)	
EER (kJ day^{-1})	8954 (1728)	8537 (2025)	0.137*
EPR (g day^{-1})	80.2 (18.4)	79.3 (21.1)	0.742*

*Independent samples t-test (two-tailed).
†Chi-squared.
EER, estimated energy requirement; EPR, estimated protein requirement.

Discussion

Research supporting positive outcomes from the implementation of RS to date has been conducted in private hospital settings and it is often seen as an option in the private healthcare sector only. The present study demonstrated improvements across key outcome measures in the public hospital setting, thus demonstrating that this model has value across both public and private environments.

RS is designed to allow patients to order food that they desire (within therapeutic diet compliance limits) when they desire, leading to the expectation that they will eat a greater proportion of what they order, waste less and have greater satisfaction with their hospital foodservice experience. Similar to recent findings in the private hospital setting [27], the present study found statistically significant increases in both total energy and protein intake, as well as intake in energy and protein, as a percentage of requirements with the implementation of RS compared to TM. This finding is important as hospitals continue to investigate strategies to assist patients to maximise their intake, with poor food intake being recognised as a risk factor for negative and costly clinical and hospital outcomes [13,15–17]. These strategies usually focus on individual points in the foodservice process such as menu quality and supplementation [17–19], menu choice [22], meal environment [16,21,23], and ordering and delivery processes [8,24,26]. RS delivers on all of these strategies, providing a wide range of high nutritional quality menu items at flexible times throughout the day via an engaging patient-centric ordering process. The British Dietetic Association supports a 'food first' approach recommending the improvement of nutritional status via ordinary food as a first step in providing nutritional support [17] and the RS cook on-demand model allows flexibility for meals to be tailor-made to a patient's individual needs in an aim to achieve this. A single integrated a la carte style menu available throughout the day allows items that may traditionally only be available at certain meal times (such as scrambled eggs at breakfast) to be ordered anytime according to patient preferences, taste and appetite. The 'build your own' concept applied to items such as sandwiches, pizzas and omelettes allows greater menu personalisation. Oncology patients often experience poor appetite, feelings of nausea and regular taste changes as a result of disease and treatments. Therefore, being able to order food items that suit their immediate appetite and preferences may assist in both their nutritional intake, as well as improve their overall experience of foodservice [3,46,47]. Many medical and surgical patients miss set meal times as a result of tests and procedures, surgery schedules and fasting protocols. Having the ability to order food at times that suit their appetite and clinical schedule may improve both intake and satisfaction with the meal service [16,17]. The provision of regular hospital snacks also comprises a strategy used for patients who prefer to eat little and often [48] and a lack of hospital snack provision has been identified as an inhibitory factor of optimal nutrition [17]. The order on-demand nature of RS allows

Table 2 A comparison of energy and protein intake (absolute and percentage of requirements) between a group of adult inpatients receiving a Traditional Foodservice Model (TM) in August 2014 and a group of adult inpatients receiving Room Service (RS) in March 2017 at the Mater Hospital Brisbane (Australia)

Variable	Traditional Foodservice Model (n = 84), mean (SD)	Room Service (n = 103), mean (SD)	P value
Average energy intake (kJ day^{-1})	5513 (2112)	6379 (2797)	0.020*
Average protein intake (g day^{-1})	52.9 (23.5)	73.9 (32.9)	<0.001*
Proportion of EER met (%)	63.5% (26.1%)	78.0% (36.7%)	0.002*
Proportion of EPR met (%)	69.7% (35.7%)	99.0% (51.0%)	<0.001*

*Independent samples t-test (two-tailed).
EER, estimated energy requirement; EPR, estimated protein requirement.

Table 3 A comparison of energy and protein intake (absolute and percentage of requirements) between a group of adult inpatients receiving a Traditional Foodservice Model (TM) in August 2014 and a group of adult inpatients receiving Room Service (RS) in March 2017 at the Mater Hospital Brisbane (Australia) by group

Variable	Traditional Foodservice Model, mean (SD)*	Room Service, mean (SD)†	Mean ± SE difference	*P* value
Energy intake (kJ day^{-1})				
Medical	5579 (2124)	6348 (3026)	−769 (577)	0.186‡
Oncology	5390 (1985)	6056 (2742)	−665 (954)	0.490‡
Surgical	5478 (2188)	6733 (2467)	−1254 (583)	0.035‡
Protein intake (g day^{-1})				
Medical	55.2 (22.0)	72.7 (35.9)	−17.4 (6.3)	0.007‡
Oncology	45.8 (22.1)	68.4 (29.8)	−22.6 (10.4)	0.037‡
Surgical	52.3 (25.6)	81.2 (29.6)	−28.9 (6.9)	<0.001‡
Proportion (%) of EER met				
Medical	68.2% (27.5%)	80.2% (39.9%)	−11.9 (7.5)	0.119‡
Oncology	58.9% (24.6%)	67.0% (29.0%)	−7.9 (10.4)	0.447‡
Surgical	59.8% (24.8%)	84.6% (36.3%)	−24.8 (7.6)	0.003‡
Proportion (%) of EPR met				
Medical	84.9% (30.0%)	95.0% (48.8%)	−10.1 (9.6)	0.297‡
Oncology	49.5% (25.0%)	75.9% (34.7%)	−26.5 (12.0)	0.035‡
Surgical	59.3% (29.2%)	127.5% (55.5%)	−68.2 (10.8)	<0.001‡

*Medical, *n* = 38; oncology, *n* = 10; surgical, *n* = 36.
†Medical, *n* = 49; oncology, *n* = 26; surgical, *n* = 28.
‡Independent Samples T-test (2-tailed).
EER, estimated energy requirement; EPR, estimated protein requirement.

for this, with no limit on number of times that patients can order throughout the day.

Plate waste is reported between 20% and 40% in traditional preplated meal models [4]. The present study saw an overall reduction in plate waste with RS to 17%, similar to a previous RS study that reported average plate waste of 12% [27]. Bulk service systems, including buffet trolleys allowing patients to choose what they feel like at set meal times, have reported leftover waste of up to 50% [4,49]. The cook on-demand model is expected to reduce production waste because only items that are ordered are produced compared to bulk cook in advance models, which rely on a degree of forecasting. Production waste was not measured in the present study, although total food costs were significantly less, and a proportion of this is likely a result of reductions in total food production. Future research should include measures of production waste when comparing models.

Food provision may be considered as an important aspect in mitigating anxiety, stress and the suffering of a patient in a hospital environment [2]. Improved patient satisfaction has been consistently reported in the literature as a major benefit of RS in the private setting [1,2,27] and this was also seen in the present study in the public setting. Although patient satisfaction could be considered high in TM, this increased to 98% of patients reporting the food service as being good to very good for RS. The improvement in patient satisfaction with RS may be a result of the flexibility for patients being able to order what and when they feel like eating and in amounts and combinations that they feel like, enabling greater control in meal choices plus increased interaction and engagement in the meal order process compared to TM. A key point of difference in RS compared to the TM model is the elimination of structured meal times, focusing the hospital's meal service around the patient's clinical treatment schedule, rather than being driven by the organisation's operational meal production schedule.

Ordering via the call centre or meal order staff at the bedside facilitated increased patient–staff interactions and greater patient engagement compared to the traditional paper menu ordering model in the present study. Increased patient engagement in the meal order process has been demonstrated in other foodservice interventions such as an electronic bedside menu ordering system [24] and bulk trolley service models where patients have significant interaction with meal staff to assist them to choose items best suited to their preferences and requirements [8]. It has been suggested that patients benefit from support with respect to making the most appropriate choices and that healthcare professionals have the responsibility to facilitate this [17,50]. Enabling ordering closer to meal times is also likely to better meet patients' immediate preferences and contribute to increased satisfaction. The RS model by mater group in the present study facilitates meal delivery within 45 min of ordering.

A reduction in food costs has been reported as a major benefit of the RS model [27,51,52]. This study reported a 28% reduction in overall food costs with RS compared to TM in the public setting. This is important because health care is increasingly delivered within a cost-constrained environment and there is a focus on foodservice models to be cost-efficient. This reduction in food costs is expected to be a result of reductions in production waste through the removal of meal forecasting and bulk cooking in advance, a reduction in nonselect meals (where a patient is sent a meal that is suitable to their requirements but is not of their choosing) and the elimination of replacement meals as a result of missed, inappropriate or rejected meals. The transition to RS also facilitated a removal of standard snacks ordered for patients on therapeutic diets, including a reduction in oral nutrition supplements, leading to overall reductions in food costs. The integrated menu design allows for higher quality items to be offered to restrictive diets and decreases the need for nutritionally fortified foods, a strategy that is often used to increase nutritional intake in traditional foodservice models [19].

The principal limitation of the present study was the retrospective analysis of quality audit data over a 2.5-year period. A randomised controlled trial was not a feasible option in the operative hospital environment, although a strategic pre–post approach within a shorter defined timeframe would be recommended for future RS implementation research. Although the two study cohorts were different in terms of age, weight and medical classification, they were closely matched in sex and nutritional requirements.

Collecting meal intake data in the operative hospital environment is difficult and can be a limitation of studies focusing on this outcome measure. Weighing individual meal items before and after patient meals is considered to be the most accurate measure of intake [53]; however, this is difficult at a large scale and was not considered feasible for the present study. A meal intake observation tool was used to evaluate nutritional intake and plate waste, recording items as a percentage rather than weight, and all individual items were assessed in an effort to obtain nutritional intake data that were as accurate as possible. This tool has also been used in other large studies to measure intake [15,54].

Data collection for nutritional intake and plate waste was collected over a short period of time (4 days per group) and, as a result of differences in ward occupancy rates between 2014 (66%) compared to 2017 (87%), as well as exclusion criteria and the requirement for a minimum of 24 hours of consecutive order data, a relatively small number of patients was included per subgroup. Future studies should aim to include greater patient numbers to allow sufficient statistical power to analyse effects in subgroups. Patient satisfaction was captured in a 1-day snapshot of data collection. Although there is value in this real-time data as opposed to other survey tools that measure satisfaction post-discharge, measuring patient satisfaction over a longer time period when they are in hospital may provide information more reflective of their total hospital stay.

Conclusions

The redesign of hospital foodservice models is increasingly a focus with respect to not only driving improved patient satisfaction and cost savings, but also influencing clinical outcomes associated with nutritional intake. Systematically measuring key outcomes associated with improvements in foodservice models allows for a balanced, evidence-based approach to foodservice model evaluation and redesign. This is the first time that a comprehensive measurement of key outcomes has been reported for RS in a public hospital setting. The positive outcomes reported suggest that the RS model offers both clinical and cost benefits important to both patient and organisational outcomes, irrespective of public or private settings.

Transparency declaration

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The reporting of this work is compliant with STROBE guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

Conflict of interests, source of funding and authorship

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SM determined the study design, was involved in the collection and collation of study results, as well as in the statistical analysis, and drafted the manuscript. KM assisted and determined the study design, and was also involved in the collation of study results and in the review of the manuscript. LB assisted with the study design, the collection and collation of study results, the statistical analysis and the review of the manuscript. KM-L assisted and determined the study design, the collation of study results and the review of the manuscript. All authors approved the final version of the manuscript submitted for publication.

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