

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

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

4 **Abstract**

5 **Background**

6 Room service (RS) is a hospital foodservice model that is traditionally unique to the private sector.
7 It allows patients to order meals compliant to their nutritional requirements from a single integrated
8 menu at a time that suits them. Meals are prepared and delivered within 45 minutes of order.
9 Following implementation in a private adult facility in 2013, Mater Group implemented the first RS
10 in a public adult facility in Australia in 2016. In a pre-post study comparing RS with a traditional
11 foodservice model (TM), key outcomes were measured and analysed.

12 **Methods**

13 A retrospective analysis of quality assurance data audits in a pre– post study design was undertaken
14 to assess patient nutritional intake, plate waste, satisfaction, and meal costs before and after RS
15 implementation.

16 **Results**

17 Comparison of nutritional intake between TM (n=84) and RS (n=103) showed statistically
18 significant increases with RS in both energy (5513 kJ/day vs. 6379 kJ/day, p=0.020) and protein
19 (53g/day vs. 74g/day, p<0.001) intake, as well as energy and protein intake as a percentage of
20 requirements (64% vs.78%, p=0.002 and 70% vs. 99%, p<0.001 respectively). Total average plate
21 waste decreased from 30% to 17% (p<.001). Patient satisfaction indicated an improvement with RS,
22 with 98% of patients scoring the service good to very good, compared with 75% for TM (p<0.04).
23 Patient food costs decreased by 28% per annum with RS.

24 **Conclusions**

25 This research provides insight into the benefits achievable with RS in the public hospital setting,
26 confirming that a patient-centered food service model can cost-effectively improve clinical
27 outcomes.

28 **Introduction**

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

36
37 Malnutrition is a well-documented clinical issue associated with negative clinical outcomes and
38 healthcare costs⁽¹¹⁻¹⁴⁾, and poor nutritional intake is also recognised as a risk factor for poor patient
39 outcomes and hospital mortality^(13,15). Meeting patients' nutritional requirements in an acute care
40 setting is difficult with several extenuating factors including patients' appetite and clinical
41 symptoms, food access and availability, menu quality, food choice and individual patient
42 preferences⁽¹⁶⁾. Therefore, there is a focus on hospital foodservices to potentially increase patients'
43 nutritional intake. To date, menu strategies to improve intake have included use of oral nutrition
44 supplements^(17,18), fortification of menu items in terms of protein and energy and use of protein and
45 energy dense snacks between main meal service⁽¹⁹⁾. Whilst these have been shown to be clinically
46 effective^(17,20), the potential for increase in costs and poor compliance are seen as barriers to their
47 use⁽¹⁷⁾. Other strategies have focussed on the meal environment, presentation^(21,22) and patients'
48 access to meals such as protected meal times^(16,23) to allow patients adequate and uninterrupted time
49 to consume their meals. Further strategies have addressed food ordering and delivery processes in
50 an attempt to ensure that patients have adequate choice and are able to make their choice close to
51 meal times. These include bulk trolley service models⁽⁸⁾, electronic bedside ordering^(24,25) and e-
52 menus⁽²⁶⁾.

53
54 Following the implementation of room service in Australia in their private adult facility in 2013, the
55 Mater Group demonstrated improvements in key outcome measures nutritional intake, plate waste,
56 patient satisfaction and patient meal costs with the RS model⁽²⁷⁾. This study aimed to repeat the
57 measurement of these key outcomes in a public setting, following the implementation of RS in their
58 public adult facility in 2016.

59 **Methods**

60 Mater Hospital Brisbane (MHB) is a 126 bed public acute care adult hospital with a case mix of
61 patients, designated into general medical, surgical and oncology wards. The organisation's annual
62

63 malnutrition point prevalence audit data shows malnutrition prevalence rates for MHB at 32% in
64 2014 and 33% for 2017. In 2016 MHB transitioned from a Traditional Model (TM) to RS, using the
65 CBORD® Food and Nutrition Solutions (FNS), and Room Service Choice™ (v10.12.100)⁽²⁸⁾
66 software. In TM, patients ordered their meals by completing a paper menu (cook fresh, 14 day
67 cycle menu) up to 24 hours prior to meals which were then collected at a set time by Nutrition
68 Assistant staff. Meals were delivered at set meal times during the day: breakfast between 0630-0730
69 hours; lunch between 1145-1245 hours; and dinner between 1700-1800 hours. In RS, patients order
70 meals from a single integrated a la carte style menu anytime between 0630-1900 hours by phoning
71 RS representatives in a central call centre. Meals are prepared on demand and aim to be delivered
72 within 45 minutes of receiving the order. Menus for both RS and TM were analysed in FNS for
73 nutritional quality and to ensure compliance to therapeutic diets according to the New South Wales
74 (NSW) Agency for Clinical Innovation Nutrition Standards for Adult Inpatients and the Queensland
75 Health Nutrition Standards for Meals and Menus^(29,30).

76

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

82

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

87

88 *Nutritional Intake and Plate Waste*

89 Nutritional intake and plate waste data was collected by University nutrition and dietetics students
90 during their food service internship placements. Data collection was supervised by the nutrition and
91 dietetics department's senior clinical educator, senior foodservices dietitian and director of nutrition
92 and dietetics as part of the quality assurance process. Students were provided one day of training in
93 the data collection methodology and use of the tool by the senior clinical educator and were
94 assessed in the use of the tool to ensure accuracy and uniformity of data collection between
95 auditors. During these audits, patient demographic data including age, sex, weight and height was
96 obtained via hospital records. Standardised food portions are served to the patient, managed through
97 the use of FNS standardised recipes and serving sizes, and are audited monthly. A meal intake

98 observation tool using a 5 point visual scale (0, ¼, ½, ¾, all) was used to record the volume of each
99 meal consumed by the patient⁽³²⁾. FNS contains the menu items, weights of the standardised portion
100 sizes and their nutritional composition per patient order and therefore can automatically calculate
101 the nutritional composition of menu items recorded as eaten. All of the edible components of items
102 ordered were evaluated, excluding bottled water due to its nil contribution to energy and protein
103 intake. Audits were undertaken over a four day period in August 2014 for TM and March 2017 for
104 RS. Patients were excluded if they were classified as NBM (nil by mouth), restricted to fluids only,
105 on enteral or parenteral nutrition, less than 18 years old, critically ill or palliative, did not have a
106 weight recorded or had less than 24 hr consecutive intake data.

107
108 Total nutritional intake including all meals and snacks was recorded across a minimum 24 hour
109 consecutive period to determine energy (in kilojoules) and protein (in grams) intake for individual
110 patients per day. Nutritional analysis was performed using CBORD® FNS version v10.12.100^(33,34)
111 which contains the AusNut Special Edition nutrient database (1999)⁽³⁵⁾. The patient's weight was
112 used to estimate their energy and protein requirements by subgroup: medical (30 kcal/kg; 1.0g/kg
113 protein), surgical (30 kcal/kg; 1.2g/kg protein) and oncology (32 kcal/kg; 1.35g/kg protein). Where
114 BMI > 30kg/m², Adjusted Ideal Body Weight was used to calculate these requirements to reflect
115 current clinical practice on the wards⁽³⁶⁻⁴²⁾. A comparison was then made to assess percentage of
116 protein and energy consumed against estimated energy requirements (EER) and estimated protein
117 requirements (EPR).

118
119 Plate waste was recorded across a minimum 24 hour consecutive period including all meals and
120 snacks by evaluating each of the individual food items remaining on the plate and calculating
121 overall plate waste.

122

123 *Patient Satisfaction*

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

128

129 *Patient Meal Costs*

130 Total patient food costs were obtained from the foodservice department end of month finance
131 expense reports. TM data was analysed for the 12-month period from January to December 2014
132 and RS data for the 12-month period from January to December 2017. Patient meal costs were

133 calculated and compared as patient food cost per patient occupied bed day (OBD). OBD's were
134 calculated for each 12 month period. Australian annual average inflation rate for food for the period
135 2014-2017 was 1.4% per annum and was considered when evaluating overall patient meal cost data
136 for this period⁽⁴⁴⁾.

137

138 *Data Analysis*

139 Statistical analysis of data was completed using SPSS software⁽⁴⁵⁾. Normality checks were
140 completed using histograms and Q-Q box plots with the Shapiro-Wilk test used as required.
141 Independent t-tests were used to analyse pre and post data for age, weight, BMI, estimated energy
142 and protein requirements (EER and EPR), estimated energy and protein intakes (EEI and EPI) and
143 plate waste. A Pearson chi-square method was used to analyse pre and post data on gender, cohort
144 split (medical, oncology and surgical) for nutritional intake versus requirements and patient
145 satisfaction. Significance was assessed at $p < 0.05$.

146

147 **Results**

148 *Nutritional Intake and Plate Waste*

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

160

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

164

165 *Patient Satisfaction*

166 A total of 20 patients completed the ACHFPSQ⁽⁴³⁾ for TM and 42 patients completed for RS. There
167 was no significant difference between groups in age, gender or medical classification. Overall the

168 percentage of patients rating their overall satisfaction with the foodservice as ‘very good’ or ‘good’
169 increased from 75% for TM participants to 98% for RS participants (p=0.040).

170

171 *Patient Meal Costs*

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

175

176 **Discussion**

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

181

182 RS is designed to allow patients to order food that they desire (within therapeutic diet compliance
183 limits) when they desire, leading to the expectation that they will eat a greater proportion of what
184 they order, waste less and have greater satisfaction with their hospital foodservice experience.

185 Similar to recent findings in the private hospital setting⁽²⁷⁾, this study found statistically significant
186 increases in both total energy and protein intake as well as intake in energy and protein as a
187 percentage of requirements were seen with the implementation of RS as compared with TM. This
188 finding is important as hospitals continue to investigate strategies to assist patients to maximise
189 their intake with poor food intake recognised as a risk factor for negative and costly clinical and
190 hospital outcomes^(13,15-17). These strategies usually focus on individual points in the foodservice
191 process such as menu quality and supplementation⁽¹⁷⁻¹⁹⁾, menu choice⁽²²⁾, meal environment^(16,21,23)
192 and ordering and delivery processes^(8,24,26). RS delivers on all of these strategies providing a wide
193 range of high nutritional quality menu items at flexible times throughout the day via an engaging
194 patient-centric ordering process. The British Dietetic Association supports a ‘food first’ approach
195 recommending the improvement of nutritional status via ordinary food as a first step in providing
196 nutritional support⁽¹⁷⁾ and the RS cook on demand model allows flexibility for meals to be tailor-
197 made to a patient’s individual needs in an aim to achieve this. A single integrated a la carte style
198 menu available throughout the day allows items that may traditionally only be available at certain
199 meal times (such as scrambled eggs at breakfast), to be ordered anytime according to patient
200 preferences, taste and appetite. The “build your own” concept applied to items such as sandwiches,
201 pizzas and omelettes allows greater menu personalisation. Oncology patients often experience poor
202 appetite, feelings of nausea and regular taste changes due to disease and treatments and therefore

203 being able to order food items that suit their immediate appetite and preferences may assist in both
204 their nutritional intake as well as improve their overall experience of foodservice⁽⁴⁶⁻⁴⁸⁾. Many
205 medical and surgical patients miss set meal times due to tests and procedures, surgery schedules and
206 fasting protocols. Having the ability to order food at times that suit their appetite and clinical
207 schedule may improve both intake and satisfaction with the meal service^(16,17). The provision of
208 regular hospital snacks is also a strategy used for patients who prefer to eat little and often⁽⁴⁹⁾ and a
209 lack of hospital snack provision has been identified as an inhibitory factor of optimal nutrition⁽¹⁷⁾.
210 The order on demand nature of RS allows for this with no limit on number of times that patients can
211 order throughout the day.

212
213 Plate waste is reported between 20-40% in traditional pre-plated meal models⁽⁴⁾. This study saw an
214 overall reduction in plate waste with RS to 17%, similar to a previous RS study which reported
215 average plate waste of 12%⁽²⁷⁾. Bulk service systems including buffet trolleys whereby patients
216 choose what they feel like at set meal times have reported left over waste of up to 50%^(4,50). The
217 cook on demand model is expected to reduce production waste as only items that are ordered are
218 produced compared to bulk cook in advance models which rely on a degree of forecasting.
219 Production waste was not measured in this study but total food costs were significantly less, and a
220 proportion of this is likely due to reductions in total food production. Future research should
221 include measures of production waste when comparing models.

222
223 Food provision may be considered an important aspect in mitigating anxiety, stress and suffering of
224 a patient in a hospital environment⁽²⁾. Improved patient satisfaction has been consistently reported in
225 the literature as a major benefit of RS in the private setting^(1,2,27) and this was also seen in this study
226 in the public setting. While patient satisfaction could be considered high in TM, this increased to
227 98% of patients reporting the food service as good to very good for RS. The improvement in patient
228 satisfaction with RS may be due to the flexibility for patients to order what and when they feel like
229 eating and in amounts and combinations that they feel like, enabling greater control in meal choices
230 plus increased interaction and engagement in the meal order process when compared to TM. A key
231 point of difference in RS compared to the TM model is the elimination of structured meal times,
232 focusing the hospital's meal service around the patient's clinical treatment schedule, rather than
233 being driven by the organization's operational meal production schedule.

234
235 Ordering via the call centre or meal order staff at the bedside facilitated increased patient-staff
236 interactions and greater patient engagement, as compared to the traditional paper menu ordering
237 model in this study. Increased patient engagement in the meal order process has been demonstrated

238 in other foodservice interventions such as an electronic bedside menu ordering system⁽²⁴⁾ and bulk
239 trolley service models whereby patients have significant interaction with meal staff to assist them to
240 choose items best suited to their preferences and requirements⁽⁸⁾. It has been suggested that patients
241 benefit from support with respect to making the most appropriate choices and that healthcare
242 professionals have the responsibility to facilitate this^(17,51). Enabling ordering closer to meal times
243 is also likely to better meet patients' immediate preferences and contribute to increased satisfaction.
244 The RS model by mater group in this study facilitates meal delivery within 45 minutes of ordering.
245

246 A reduction in food costs has been reported as a major benefit of the RS model^(27,52,53). This study
247 reported a 28% reduction in overall food costs with RS compared to TM in the public setting. This
248 is important as healthcare is increasingly delivered within a cost constrained environment and there
249 is a focus on foodservice models to be cost efficient. This reduction in food costs is expected to be
250 due to reductions in production waste through the removal of meal forecasting and bulk cooking in
251 advance, a reduction in non-select meals (whereby a patient is sent a meal that is suitable to their
252 requirements but is not of their choosing) and elimination of replacement meals due to missed,
253 inappropriate or rejected meals. The transition to RS also facilitated a removal of standard snacks
254 ordered for patients on therapeutic diets, including a reduction in oral nutrition supplements, leading
255 to overall reductions in food costs. The integrated menu design allows for higher quality items to be
256 offered to restrictive diets and decreases the need for nutritionally fortified foods, a strategy that is
257 often used to increase nutritional intake in traditional foodservice models⁽¹⁹⁾.
258

259 The principal limitation of this study was the retrospective analysis of quality audit data over a 2.5
260 year period. A randomised controlled trial was not a feasible option in the operative hospital
261 environment, though a strategic pre-post approach within a shorter defined timeframe would be
262 recommended for future RS implementation research. While the two study cohorts were different in
263 terms of age, weight and medical classification, they were closely matched in gender and nutritional
264 requirements.
265

266 Collecting meal intake data in the operative hospital environment is difficult and can be a limitation
267 of studies focusing on this outcome measure. Weighing individual meal items before and after
268 patient meals is considered the most accurate measure of intake⁽⁵⁴⁾ however this is difficult on a
269 large scale and was not considered feasible for this study. A meal intake observation tool was used
270 to evaluate nutritional intake and plate waste, recording items as a percentage rather than weight
271 and all individual items were assessed in an effort to obtain as accurate nutritional intake data as
272 possible. This tool has also been used in other large studies to measure intake^(15,55).

273

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

283

284 **Conclusion**

285 The redesign of hospital foodservice models is increasingly a focus to drive improved patient
286 satisfaction and cost savings, but also to influence clinical outcomes associated with nutritional
287 intake. Systematically measuring key outcomes associated with improvements in foodservice
288 models allows for a balanced, evidence-based approach to foodservice model evaluation and
289 redesign. This is the first time that the comprehensive measurement of key outcomes has been
290 reported for RS in a public hospital setting. The positive outcomes reported suggest that the RS
291 model offers both clinical and cost benefits important to patient and organisational outcomes,
292 irrespective of public or private settings.

293

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