Impact of electronic bedside meal ordering systems on dietary intake, patient satisfaction, plate waste and costs: A systematic literature review

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Abstract

Aims: Hospital foodservices provides an important opportunity to deliver valuable dietary support to patients, address hospital-acquired malnutrition risk and enhance patient satisfaction. Modifying the meal ordering process through the adoption of technology may actively engage patients in the process and provide an opportunity to influence patient and organisational outcomes. This systematic review was undertaken to evaluate the impact of electronic bedside meal ordering systems in hospitals on patient dietary intake, patient satisfaction, plate waste and costs.

Methods: A systematic search following PRISMA guidelines was conducted across MEDLINE, CINAHL, EMBASE and Web of Science for randomised controlled trials and observational studies comparing the effect of electronic bedside meal ordering systems with traditional menus on dietary intake, patient satisfaction, plate waste and cost. The quality of included studies was assessed using the Quality Criteria Checklist for Primary Research tool.

Results: Five studies involving 720 patients were included. Given the heterogeneity of the included studies, the results were narratively synthesized. Electronic bedside meal ordering systems positively impacted patient dietary intake, patient satisfaction, plate waste and costs compared with traditional menus.

Conclusion: Despite the increase in healthcare foodservices adopting digital health solutions, there is limited research specifically measuring the impact of electronic bedside meal ordering systems on patient and organisational outcomes. This study highlights

25 potential benefits of electronic bedside meal ordering systems for hospitals using
26 traditional paper menu systems, while also identifying the need for continued research to
27 generate evidence to understand the impact of this change and inform future successful
28 innovations.
29
30 **Key Words:** Patient satisfaction, Foodservices, Technology, Dietary intake, Systematic
31 Review

Introduction

There is an increasing focus within the hospital environment to provide quality care that enhances patient satisfaction and supports positive patient outcomes[1,2]. In the current consumer-focused environment, hospital services aim to meet increasing patient expectations while simultaneously managing budgetary constraints and/or increasing expenses[3,4]. With a duty of care to provide safe, effective and equitable care to patients, hospitals must achieve this while treating and preventing malnutrition[5]. Hospital foodservices provide a unique opportunity to influence dietary intake, address malnutrition risk and subsequent clinical outcomes across the hospital population. In addition, hospital foodservices are a key point of customer service and have the capacity to influence patients' perception of their entire hospital experience and enhance their satisfaction[3,6,7]. Innovative foodservice models that enhance patient experience and improve dietary intake while reducing waste and remaining cost-effective are therefore worthy of further investigation.

A potential tool to address these drivers is the utilisation of technology[8]. While the adoption of technology in healthcare has been slower than other industries, electronic foodservice management systems have been increasingly implemented over the last decade to support food procurement, food preparation, meal ordering and delivery, allergen management and to enable foodservice model transformations,- delivering positive patient and organisational outcomes[3,9,10]. Customer-focused technological innovations that can impact dietary intake and address malnutrition risk through enabling patients to be active participants in their meal ordering while in hospital, is the focus of this systematic review. Electronic bedside meal ordering systems (eBMOS) are

used by meal ordering staff at the patient bedside on wireless devices, or by patients using bedside televisions/computers or their own mobile phone, to place their meal orders[9,10]. Any meals (main or mid-meals) which the facility allows patients to have an advanced choice can be ordered via the eBMOS. This model is different to a traditional paper menu method of meal ordering (TM), as it enables real-time patient data, including diet and allergies, to be available at the time of ordering. It also allows closer to mealtime ordering due to the data being entered directly into an electronic system ready for meal tray preparation.

To date, no systematic reviews have specifically evaluated the impact of eBMOS on patient and hospital outcomes in comparison to TM. It is important to understand whether this innovation is successfully delivering the outcomes it was designed to achieve, independent to the food delivery model, to guide hospitals in determining the best method for patient meal-ordering. A recently published review assessing the impact of eBMOS had a broader inclusion criteria for the study design, did not require studies to include a comparator to the intervention and featured studies with concurrent changes in the foodservice system, such as a transformation to room service[11]. Room service is well recognised as a foodservice model that can deliver improvements in hospital and patient outcomes, and therefore any improvements cannot be directly attributed to the utilisation of eBMOS. A high-quality review which featured research published 5 years ago by Ottrey and Porter[3] was also broader in scope than the current review and explored the effect of different menus and meal ordering systems on outcomes including dietary intake, cost, satisfaction and meal tray accuracy.

79 The aim of this systematic review was to 1) evaluate current empirical evidence on the
80 impact of an eBMOS on key outcomes including patient dietary intake, patient
81 satisfaction, plate waste and cost in comparison to a TM; and 2) review the quality of
82 these studies using a validated tool. It is anticipated that this systematic review will
83 provide an evidence-base to uniquely inform future foodservice design relating to
84 patient meal ordering models to positively benefit patient and organisational outcomes,
85 as well as drive future research.
86
87 **Methods**
88 This systematic literature review was undertaken in line with recommendations of the
89 Cochrane Handbook for Systematic Reviews of Interventions[12] and reported according to
90 the Preferred Reporting Items for Systematic Reviews and Meta-Analysis: The PRISMA
91 statement[13]. The methodology for this review, including pre-specified eligibility criteria
92 and search strategies, was prospectively registered with the International Prospective
93 Register of Systematic Reviews (CRD 42017059111).
94
95 A literature search was conducted in the online bibliographic databases MEDLINE (Ovid
96 interface), CINAHL (EBSCO host interface), EMBASE (Elsevier interface) and Web of
97 Science (Web of Knowledge portal) from inception to December 2018, with no date or
98 language restrictions. Combinations of the terms "bedside menu ordering system,"
99 "menu," and "hospital food service" were searched for as medical subject headings and
100 key or free text words. The search strategy is presented as **Online Supplemental**
101 **Material**. Additional relevant studies were retrieved through additional hand-searching,

102 contacting field experts and searching of ClinicalTrials.gov - a central repository of
103 clinical trials - to identify ongoing studies.
104
105 Three authors (RN, DS KMS) screened articles in a blinded, standardised manner.
106 Search results were exported to Endnote (X8; Thompson Reuters) and de-duplicated
107 prior to screening using the online screening application Rayyan[14]. Following screening,
108 full-text manuscripts of potentially relevant studies were sought and reviewed. Studies
109 were included if the following criteria was met: 1) prospective or retrospective
110 observational study design, randomised controlled trial (RCT); 2) included adult
111 participants (≥ 18 years of age); 3) took place in an acute healthcare/hospital setting;
112 and 4) compared a new eBMOS with an existing TM. The term "eBMOS" was used by
113 this review to describe an electronic solution for collecting patient meal orders.
114
115 Abstracts and non-peer-reviewed manuscripts were excluded. Studies that implemented
116 and evaluated the use of room service or other broader foodservice model interventions
117 were excluded[15,16]. Interventions that included a simultaneous change in foodservice
118 models were excluded from the analysis as the outcomes could not be attributed to the
119 meal ordering system alone[15-19]. Two reviewers (RN and DS) independently extracted
120 data from included studies.
121
122 Review outcomes included the difference or change from the application of an eBMOS
123 when compared to a comparator/control on the following outcomes: 1) patient dietary
124 intake (defined as the amount of energy [kJ] and protein [g] consumed in a 24-hour period
125 and/or 48-hour period); 2) plate waste (percentage of served food that remains uneaten

126 by the patient[20]; 3) patient satisfaction (a subjective rating of hospital foodservices
127 quality[21]; or 4) cost (any cost associated with the food served, staff or overall system). A
128 meta-analysis was not considered appropriate due to the small number of eligible studies,
129 which measured different outcomes using a range of tools.
130
131 The quality of included studies was evaluated by two independent reviewers (RN and
132 DS) using the Quality Criteria Checklist for Primary Research tool from the Academy of
133 Nutrition and Dietetics[22]. To ascertain the presence or absence of threats to the validity
134 of research, the tool consists of 10 questions encompassing: clarity of the research
135 question; subject selection; comparability of study groups; handling of withdrawals;
136 blinding; descriptions of the intervention; validity of outcome measures; appropriateness
137 of data synthesis; conclusion support; and likelihood of funding bias[22]. Based on these
138 domains, overall quality ratings of either positive (most validity questions answered yes,
139 including the first four), neutral (one or more of the first four validity questions assessed
140 as 'no', but other criteria indicate strengths) or negative (six or more of the domains are
141 assessed as 'no') would be generated[22].
142
143 **Results**
144 A total of 3076 papers were retrieved from the data base search for inclusion across the
145 four online databases (Figure 1). Following the removal of duplicate papers (n = 805) and
146 screening abstracts (n = 2270), 40 papers were retained for full text screening. One study
147 was identified through hand-searching, resulting in a total yield of 5 articles included in
148 this review.
149

All studies compared an eBMOS to a TM (Table 1). Three studies evaluated the impact of a patient-directed eBMOS (terminology including BMOS/e-menu/TV menu)[10,23,24] and the other two studies reported on staff-deployed eBMOS[9,25]. One study was conducted using an observational point prevalence approach[23], with the remainder conducted using of pre- and post-test study designs [9,24-26] (Table 1). Sample sizes investigated across included studies ranged from 50 participants to 860 participants.

The effect of eBMOS on dietary intake was reported in three studies. Barrington et al.[23] found that a patient-directed eBMOS led to significantly higher mean daily energy intake 6457 ± 3069 kJ vs 4805 ± 2028 kJ ($p<0.001$) and protein intake 72.3± 36.7 g vs 57.7±26.9 g ($p<0.001$) compared with a TM. Similarly, two staff-deployed eBMOS models found a significantly higher mean daily energy intake compared with TMs 8273 ± 2043 kJ vs 6273 ± 1818 kJ ($p<0.001$) [9]; and 6232 ± 2523 kJ vs 5513 ± 2212 kJ ($p=0.04$)[25]. Likewise, these two studies also found mean daily protein intake was significantly higher with eBMOS compared with TMs 83 ± 24 g compared with 66 ± 25 g ($p=0.01$)[9]; and 78 ± 36 g compared with 53 ± 24 g ($p<0.001$)[25]. Further comparisons of energy and protein intake relative to the estimated requirements of patients (EER and EPR respectively) were undertaken by Maunder et al.[9] and McCray et al.[25]. In the study undertaken by Maunder et al., patients recieving eBMOS met, on average, 110% estimated energy requirements and 105% estimated protein requirements compared with 86% for both using the traditional TM ($p=0.01$ and $p=0.02$, respectively)[9]. Similarly, McCray et al found that significantly more patients receiving eBMOS met their estimated energy (73% vs 64%; $p=0.02$) and protein (98% vs 70%; $p<0.001$) requirements compared with TM[25].

Patient satisfaction for the overall hospital foodservice was assessed in three of the five papers[9,10,25] (Table 2). Two studies showed that staff-deployed eBMOS and TM reported high, stable scores in overall foodservice patient satisfaction using the Acute Care Hospital Foodservice Patient Satisfaction Questionnaire; which does not specifically explore satisfaction with the type of meal ordering system. Maunder et al.[9] reported patients rating their overall satisfaction as 'good' or 'very good' at 82% using eBMOS compared to 84% using the TM ($p>0.05$). McCray et al.[25] also reported patients rating their overall satisfaction as 'good' or 'very good' at 74% using eBMOS and 75% with TM ($p=1.0$). Hartwell et al.[10] evaluated satisfaction in a patient-directed eBMOS compared to a TM across several domains (including temperature, presentation and ease of use), and reported the only difference was an increased satisfaction with regard to having meal ingredient information provided in eBMOS ($p=0.01$).

Three studies assessed or asked specific additional questions related to patient satisfaction in regards to the new meal ordering system Jamison et al.[24] found that patients preferred the eBMOS over the TM on the basis of interest, curiosity, convenience, availability, satisfaction and motivation ($p<0.01$).When McCray et al.[25] and Maunder et al.[9] surveyed patients specifically about their menu ordering system preference, they found that significantly more preferred eBMOS to the TM in both studies; 84% versus 16% ($p<0.001$)[25] and 80% versus 15% with 6% not minding either way ($p<0.05$)[9]. Two studies evaluated the effect of eBMOS on plate waste[23,25]. A patient-directed model[23] found no significant difference in average daily plate waste between BMOS (34.3%) and TM

197 (35.4%) (p=0.75), while a staff-deployed model displayed a significant reduction in plate
198 waste using eBMOS (30%) compared with TM (26%) ($p<0.001$)[25].
199
200 Costs were evaluated in two studies[24,25]. McCray et al. reported a decrease in total
201 patient food cost of 19% for eBMOS compared with TM across a comparable 12-month
202 period[25]. Jamison et al. reported on the cost of effectiveness of implementation of the
203 eBMOS determined by means of the payback method (i.e. the time required to recoup
204 the initial investment of their project). Costs were based on labour, software and
205 printed menu costs for each model. They reported that operating the eBMOS instead of
206 the TM would result in monthly savings of $1197 ($615 per month compared with
207 $2093 per month) and an estimated payback period of 8.4 months[24]. They also
208 suggested additional possible savings could be achieved through a reduction in food
209 waste due to increased accuracy of forecasting and tallying using the eBMOS.
210
211 The overall quality of included studies was mostly neutral across the five included studies
212 (Figure 2). The research question was clearly stated by all included studies, as were
213 intervention descriptions, relevancy of study outcomes, specificity of inclusion criteria
214 and analyses performed. The characteristics and subsequent comparability of stratified
215 participant groups was adequately described in four studies[9,10,23,25], while only one study
216 discussed and response rates among participant groups[9]. Three of the five included studies
217 used validated methods to assess study outcomes[9,23,25]. Though the conclusions of each
218 study were supported by their results, limitations of the research were not considered in
219 two studies[10,24]. Blinding for outcome assessments was not discussed in any of the
220 included studies. Based on this risk of bias tool, the overall quality rating of included

studies was mostly neutral: only a single study was judged as "positive"[9] with the remainder assessed as "neutral"[23-26].

Discussion

Despite the paucity of literature, this systematic literature review identified studies to demonstrate that an eBMOS has the potential to improve patient dietary intake and satisfaction, as well as reduce plate waste and foodservice costs. As healthcare continues to transition to a digital health environment, technological solutions that support consumer engagement, as well as provide essential patient and organisational benefits, will become critical in the future.

Three studies featured within the systematic review demonstrated that changing to an eBMOS can increase patients' dietary intake[9,23,25], which may consequently contribute to addressing malnutrition risk and preventing hospital-acquired malnutrition[27,28]. This study refines the broader findings of complementary systematic reviews[3,7,11]. While very specific in scope; it enables the opportunity to narrow the impact of other interventions and support the role of implementing an eBMOS as a core component of contributing to these positive outcomes. In each of these studies there was a major change in patient meal order timing, shifting from up to 24 hours in advance to between 1 to 4 hours prior to meals. Therefore, a potential explanation is that using an eBMOS facilitates patients to make meal orders closer to the mealtime, when they are more likely to know what they feel like eating, resulting in increased dietary intake. eBMOS may also enable more patients to receive their personal selections compared to TM, which is harder to manage patient dietary and location changes during their admission, and therefore may result in

245 receiving standard default meals. While the calculations adopted for estimating dietary
246 requirements were different across two studies and could have contributed to the
247 differences in proportion of percentage of energy and protein requirements achieved[9,25],
248 there are other variables that can cause differences across sites, including the menu.
249 However, the studies used consistent measures in the pre- and post-data analysis within
250 each study and found a consequent statistically significant increase in both studies of
251 patients meeting their estimated energy and protein requirements when using eBMOS.
252
253 Patient satisfaction has long been a focus of achieving optimal foodservice models in
254 healthcare, and systems and processes that encourage increased patient interaction and
255 involvement with the meal order process have been suggested to improve satisfaction.
256 This review featured several studies, albeit with small sample sizes, that showed that
257 patient satisfaction was either maintained or improved after the implementation of
258 eBMOS. To inform current and future meal ordering system design and to provide
259 opportunities for research meta-analysis, it may be useful to ensure consistency in use of
260 a valid and reliable tool for measuring patient satisfaction with foodservices and
261 specifically measuring satisfaction with the meal ordering process. Validated tools that
262 measure patient satisfaction e.g. the Acute Care Hospital Foodservice Patient Satisfaction
263 Questionnaire by Capra et al[21] are excellent to assess overall satisfaction and are often
264 related to food quality and potentially dietary intake but do not contain specific questions
265 related to the meal ordering system or process. When surveys were conducted specifically
266 around the meal ordering process, two studies found that the eBMOS was preferred over
267 TM[9,25].
268

This ability of eBMOS to support closer to mealtime ordering may also have other positive effects; for example, it can decrease plate waste as evidenced in two studies within this review[23,25]. Other points of waste seen within a foodservice model such as duplicate trays produced for late meal orders due to poor and delayed communication of orders with a TM may be reduced using an eBMOS, as it enables real-time information on patient status and meal orders. Oyarazun et al cited ineffective diet-order communication as a major reason for late trays and accounting for 78% of extra meal trays required to be produced[29].

While it is accepted that costs are a critical control for hospital foodservices, in this review only two studies reported a cost figure associated with changing their meal ordering system[24,25]. Additionally, one of these reviews was undertaken in 1996, before significant technological advancements[24]. These two studies reported on different cost factors, one in relation to total patient food costs and the other on labour costs and time to take meal orders. Low costs reporting may be in part related to the fact that this information is sensitive or can be hard to measure and attribute impact to individual interventions. Nonetheless further information and clarity around cost measures will assist foodservice directors and managers to make informed decisions within budgetary constraints and be able to clearly demonstrate the financial impact of system and process changes[30]. Interventions that utilise technology to provide improved communication regarding the meal order may assist in reducing overall waste and therefore costs.

The main strength of this systematic review were its strict inclusion criteria ensuring that the intervention was predominantly related to a change to an eBMOS; and that studies

293 with concurrent changes in their distribution system or other major foodservice systems
294 were excluded. However, there were several limitations which should be considered when
295 interpreting the findings of this review. A paucity of high-quality studies of robust design
296 that specifically answered the research question were identified and therefore a narrative
297 synthesis of key findings was undertaken. Of the five studies that were included, one
298 study received a positive score[9] while four were assessed as neutral[23-26] using the Quality
299 Criteria Checklist[22]. A recent systematic review of foodservice interventions found that
300 only 9 of 33 included studies had sufficient methodologic quality to meet evidence-based
301 scientific standards[7]. Conducting foodservice research in an active hospital setting is
302 challenging, however investment in high quality, published foodservice research is
303 essential to demonstrate the potential impact of foodservice innovations in influencing
304 patient and organisational outcomes[7,9,27].
305
306 This review provides the many hospitals utilising a TM evidence that transitioning to an
307 eBMOS have the potential to improve dietary intake, patient satisfaction, plate waste and
308 foodservice costs. There are now a range of cost-effective technologies available to
309 facilitate this process. As hospitals increasingly investigate technological opportunities to
310 enhance their operation, communicating with facilities that have previously made similar
311 changes, and piloting solutions can help to inform the feasibility, and manage risk[7]. In
312 addition, encouraging a research culture within foodservice dietetics, implementing
313 system changes and innovations within a research framework, and collecting pre- and
314 post- implementation data using validated tools will continue to generate valuable
315 evidence to inform future foodservice system interventions.
316

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 PRISMA guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned.

Conflict of Interest

Kristen MacKenzie-Shalders: None to declare.

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Authorship contribution

K MacKenzie-Shalders: Study design and concept, study protocol, second reviewer search screening, manuscript completion and submission, revisions.
K Maunder: Study design and concept, study protocol, critical analysis and revision of manuscript.
D So: Systematic literature search and screening, data extraction, risk of bias, revision of methodology.
R Norris: Study protocol, systematic literature search and screening, data extraction, risk of bias, draft manuscript.
S McCray: Study design and concept, study protocol, critical analysis and revision of manuscript.
All authors approved final version.

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Search strategies
December 15th, 2018

MEDLINE via Ovid
(menu*.tw. OR eMenu*.tw. OR ((food OR meal*) and order*).tw. OR Meals/ OR catering service*.tw. OR hospital food service*.tw. OR meal ordering system*.tw.)
(BMOS.tw. OR bed?side.tw OR spoken.tw OR electronic.tw. OR informatics.tw. OR system.tw. OR wireless.tw. OR computer*.tw. OR monitor.tw. OR digital.tw. OR exp Food Service/ OR exp Hospitals/)
(acute.tw. OR hospital*.tw. OR hospital patient*.tw.)
Results: 853

Excerpta Medica Database (EMBASE) via Elsevier
(menu*:ti,ab OR eMenu*:ti,ab OR ((food OR meal*) AND order*):de OR 'meal'/exp OR 'catering service'/exp OR 'hospital food service'/exp OR 'meal ordering system'/exp)
(BMOS:ti,ab OR bedside:ti,ab OR 'bed side':ti,ab OR spoken:ti,ab OR electronic:ti,ab OR informatics:ti,ab OR system:ti,ab OR wireless:ti,ab OR computer*:ti,ab OR monitor:ti,ab OR digital:ti,ab)
(acute:ti,ab OR hospital*:ti,ab OR 'hospital patient*':ti,ab)
Results: 958

Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO host
(menu* OR eMenu* OR ((food OR meal*) AND order*) OR (MH "Meals") OR (MH "Menu Planning") OR (MH "Food Service Department") OR meal ordering system*
BMOS OR bedside OR "bed side" OR spoken OR electronic OR informatics OR system OR wireless OR computer* OR monitor OR digital
acute OR hospital* OR (MH "Inpatients") OR "hospital inpatient*"
Results: 270

Web of Science via Web of Knowledge
TI=((menu* OR eMenu* OR ((food OR meal*) AND order*) OR meal* OR catering service* OR hospital food service* OR meal ordering system*)) OR AB=((menu* OR eMenu* OR ((food OR meal*) AND order*) OR meal* OR catering service* OR hospital food service* OR meal ordering system*))
TI=((BMOS OR bedside OR bed side OR spoken OR electronic OR informatics OR system OR wireless OR computer* OR monitor OR digital)) OR AB=((BMOS OR bedside OR bed side OR spoken OR electronic OR informatics OR system OR wireless OR computer* OR monitor OR digital))
TI=((acute OR hospital* OR hospital inpatient*)) OR AB=((acute OR hospital* OR hospital inpatient*))
Results: 995

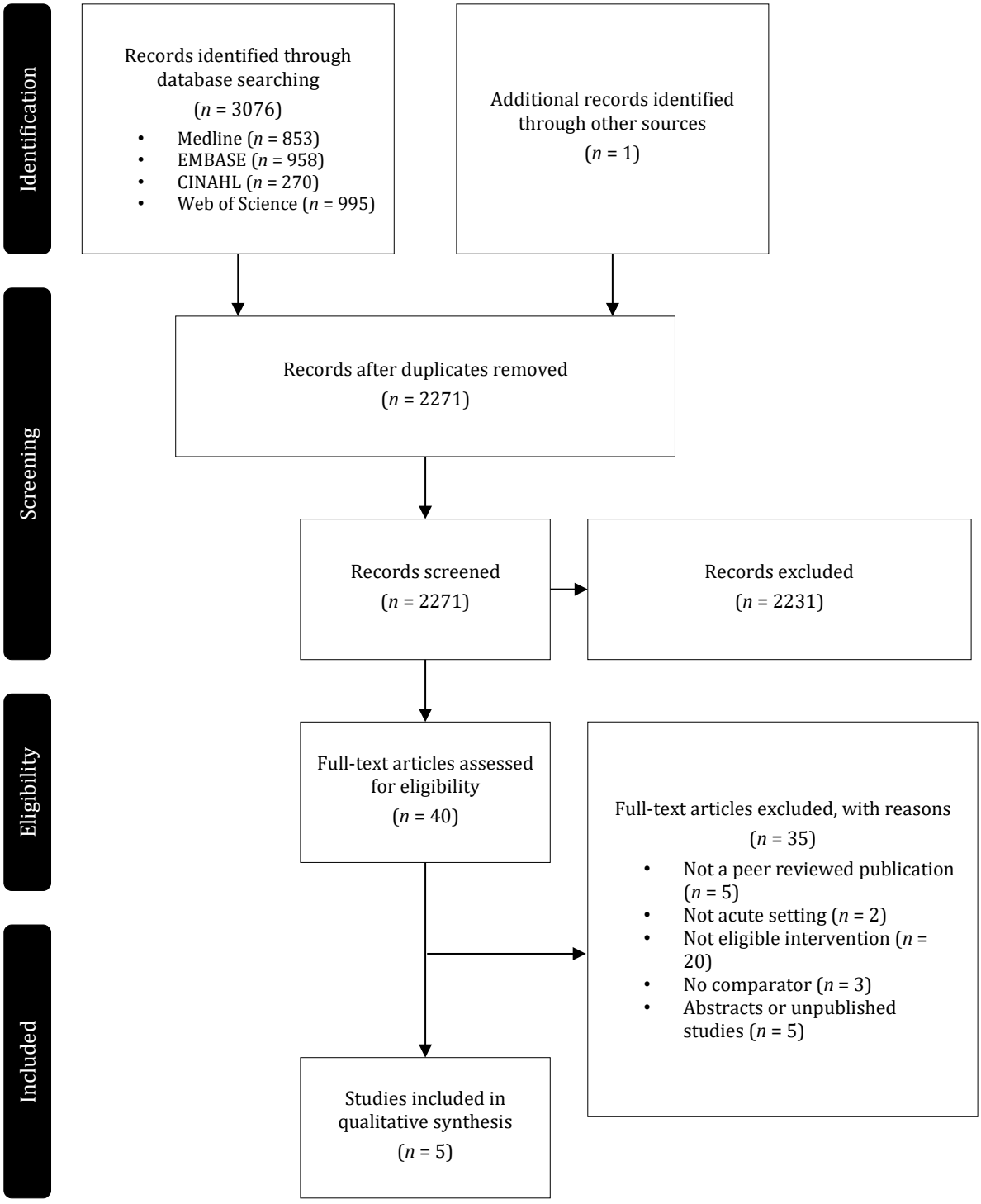
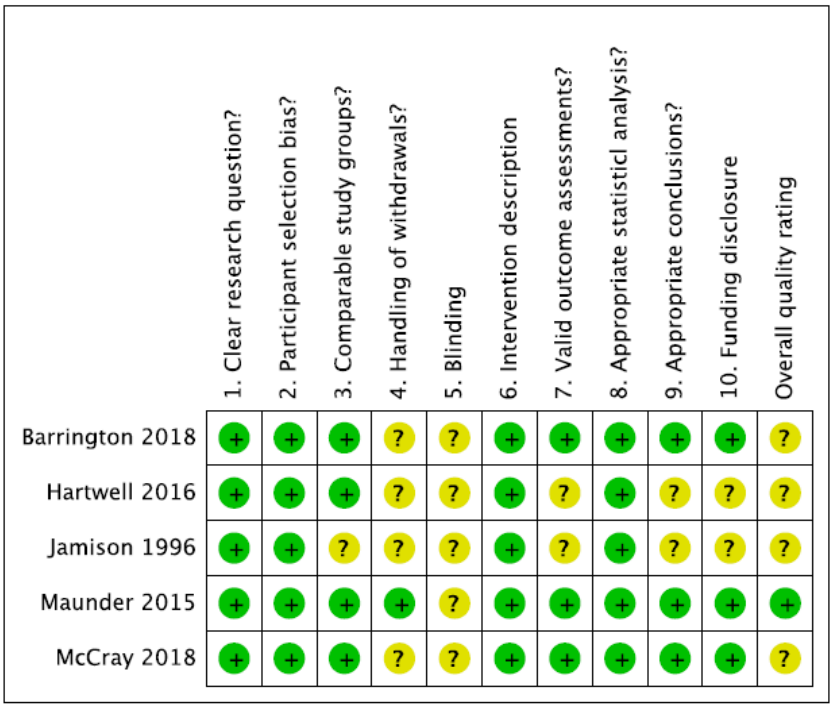


Figure 1. PRISMA Diagram: Flowchart of studies included in the systematic review



501

502 *Figure **2** – Quality Criteria Checklist and overall rating for each study included in this*

503 *systematic* review *(n = 5). Risk of bias judgments performed per Primary Research*

504 *Quality Criteria Checklist for Primary Research tool from the Academy of Nutrition*

505 *and Dietetics [22]. Plus/positive ratings presented as green/low; neutral ratings presented*

506 *as yellow/unclear, minus/negative ratings presented as red/high.*

Table 1 – Characteristics table of studies evaluating the impact of electronic bedside menu ordering systems on foodservice and patient outcomes with a comparator

Author (year)	Country	Duration[1]	Cohort age[2] (years)	*n*	Study design	Aim	Intervention; Delivery	Comparator	Reported Outcomes
Barrington et al. (2018)	Australia	NA	Intervention: 65 Comparator: 61	201	Observational point prevalence	To determine changes in patient dietary intake, plate waste and meal experience associated with the implementation of a patient directed BMOS compared to traditional paper menus.	BMOS; Patient-directed	Paper menu	Nutritional intake Plate waste Meal experience
Hartwell et al. (2016)	UK	NA	68	162	Pre-test post-test	To evaluate an initiative in which e-menus and touch screen technology were piloted in a large UK hospital.	E-menu; Patient-directed	Paper menu	Patient Satisfaction
Jamison et al. (1996)	USA	NA	7-78	50	Pre-test, post-test	To evaluate patient acceptability and cost-effectiveness of a computerised menu selection system compared with that of a printed menu system.	Computerised menu (TV screen); staff-deployed	Paper menu	Patient Satisfaction (acceptability) Cost effectiveness
Maunder et al. (2015)	Australia	4	65	119	Quasi-experimental pre-test post-test	To determine changes in the dietary intake and satisfaction of hospital patients, as well as the role of the NA, associated with the implementation of an electronic BMOS compared to a paper menu.	BMOS; staff-deployed	Paper menu	Nutritional Intake Patient Satisfaction
McCray et al. (2018)	Australia	NA	Intervention: 72 Comparator: 63	188	Observational point prevalence	To evaluate the impact of changing from a traditional paper menu ordering system to BMOS on key outcome measures of nutritional intake, plate waste, and the satisfaction of both patients and staff	BMOS; staff-deployed	Paper menu	Nutritional intake Patient satisfaction Plate waste Food costs

[1] Intervention duration in weeks; not applicable in study conducted using pre-test, post-test study designs. [2]Age expressed in mean years of each group; age range provided when means were not obtainable; age expressed as entire cohort where per group data was not available.

Abbreviations: BMOS, Bedside Menu Ordering System; E-menu, Electronic menu; N/A, Not applicable; TV, Television.

Table 2 – Summary of studies evaluating the effect of electronic bedside meal ordering systems on patient satisfaction.

Author (year)	Intervention	Patient Satisfaction Tool	Tool Validity	Satisfaction of intervention Group (%)	Satisfaction of Comparator Group (%)	Overall Satisfaction[1]
Barrington et al. (2018)	Patient-directed BMOS	KCFSQ	Y	46	54	NA[2]
Hartwell et al. (2016)	E-menu	10-question survey	N	NA-	NA	NA[2]
Jamison et al. (1996)	Computerised menu	Two-page survey	N	76	24	↑; P < 0.01
Maunder et al. (2015)	BMOS[5]	ACHFPSQ; Meal Selection Survey	Y; N	82	84	→; P > 0.05
McCray et al. (2018)	BMOS	ACHFPSQ; Meal Selection Survey	Y; N	65	35	→; P > 0.05

[1] Reported between group differences in patient satisfaction with overall hospital foodservice system. [2] Between group differences in patient satisfaction not assessed. Abbreviations: ACHFPSQ, Acute Care Hospital Foodservice Patient Satisfaction Questionnaire; BMOS, Bedside Menu Ordering System; E-menu, Electronic menu; KCFSQ, King's College Food Service Questionnaire; NA, Not applicable; N, No; Y, Yes.