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Room Service Food Delivery Models for Hospital In-Patients: Perspectives and Experiences

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Context and Policy Issues

Hospital food services play a critical role in the management of all hospitalized patients. Optimal nutritional intake is considered crucial for both patient health and patient satisfaction with hospital experience.[1,2] Inadequate food intake throughout the course of admission may result in nutritional status deterioration,[3] which is associated with prolonged length of stay, decreased quality of life, and increased morbidity and mortality.[4-6] The prevalence of malnutrition in Canadian hospitals has been estimated to be as high as 45%,[7] an issue which is the source of significant financial burden to health systems.[8] In addition to the economic considerations, there is increasing focus on the importance of patient-centred and value-based health care within the Canadian system,[9] approaches in which food service models will be central factors.

Numerous strategies have been implemented to source, purchase, prepare, and deliver food within hospital settings both nationally and internationally, with no truly standardized approaches established. Some examples of these strategies include: restaurant style menus, on demand dining, paper menus, meals served at a buffet service, communal dining halls, spoken menus or other electronic ordering systems, meal cart delivery service, cook-chill systems, high frequency meals, and traditional meal service models that typically consist of three meals per day served at the patient bedside.[10] Understanding the differences between these service models and their possible benefit compared to each other is potentially valuable information for decision-makers who are responsible for the planning of food service models within their hospital facility or jurisdiction.

The purpose of the current report is to explore patients', families' and health care providers' experiences and perspectives regarding alternative room service food delivery models for hospital in-patients. The findings of this review are supplemented by a rapid review of the clinical effectiveness, cost-effectiveness, and evidence-based guidelines on the same topic, separately conducted by CADTH.[11]

Research Questions

1. What are in-patients' and their families' expectations of hospital food and its delivery?
2. How do in-patients and their families experience and perceive hospital food and its delivery?
3. What are health care providers' expectations of hospital food delivery models and how do they engage with them?
4. How do health care providers experience and perceive hospital food delivery models, and what challenges or benefits do they experience when engaging with them?

Key Findings

In total, 19 studies were included in this review that explored patients' satisfaction with hospital food and its delivery, and patients', and hospital staff's experiences and perspectives regarding alternative room service food delivery models for in-patients.

In general, results from patient satisfaction studies suggest that alternative food delivery models have the potential to increase patient satisfaction when compared to traditional meal delivery service. However, the models under investigation were very heterogeneous, making it difficult to pinpoint which aspects of the alternative models improved patient satisfaction, and in which ways. Despite heterogeneity, common elements of alternative food delivery models that were seen to be related to increased satisfaction, as compared to traditional food delivery, included: food taste, texture, smell, presentation, and quality; and,

availability of choice in terms of food selection, portion size, and time of service. It appears that patient satisfaction with food delivery is influenced not just by the quality of the food but also by the way food is presented and delivered.

Patients and their health care providers appreciated delivery models that added both choice and flexibility to menu options. Having the ability to choose from various menu options allows patients to select meals that are more in line with their preferences, personalized eating habits and culinary practices, and may offer a sense of control amidst an otherwise institutionalized and regimented experience. For hospital personnel, not having the ability to individualize meals for patients, or offer snacks between meals, is perceived as a barrier to meeting patients' nutritional needs, and which led them to express frustration and feelings of "powerlessness". Hospital staff raised concerns about the food budget and outsourcing of food as reasons for the lack of variety in meal options, suggesting that attention to budget and not nutritional content results in unintended negative consequences including decreased satisfaction, patient choice and food quality.

Flexibility in meal delivery times enables patients to match their meals with their appetites, which may change in the gap between traditional food ordering and delivery and result in uneaten or partially eaten meals. On-demand, cart delivery systems or flexible mealtimes that allow patients to choose their meal at the time of consumption are particularly important for people undergoing certain types of treatment, such as chemotherapy, which alters the senses of taste and smell. Both patients and health care providers commented that inconvenient or inappropriate delivery times were concerning due to missed or uneaten meals, which adversely impacts nutritional care.

Methods

Literature Search Methods

A limited literature search was conducted by an information specialist on key resources including Ovid MEDLINE and CINAHL. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concept was hospital food service. Search filters were applied to limit retrieval to qualitative studies as well as surveys relevant to the perspectives and experiences of patients and their caregivers. The search was also limited to English language documents published between January 1, 2009 and May 10, 2019.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Inclusion Criteria

Setting	Hospitals
Population/Perspective	Adult and pediatric hospital in-patients and their caregivers; health care providers (i.e. nursing and support staff)
Intervention	Alternative room service food delivery models (i.e., restaurant style menu, on-demand dining, and room service) – and elements of alternative models including open ended menu and broader hours of food availability
Comparison	Traditional food service model (i.e., 1. cook-serve model (fresh cooking prior to food service three times a day); 2. cold plating and reheating, and 3. outsourcing food cooking and/or plating with on-site reheating only
Evaluation	Issues emerging from the literature that relate to the research questions, including but not limited to: staffs' perceptions and experiences with alternative models; challenges to adoption or implementation; patients' and families' experiences with alternative food service (e.g., satisfaction, influence on food consumption (hospital and non-hospital food), sense of health, well-being, views of food served (quality), views of hospital)

Exclusion Criteria

Articles were excluded if they did not meet the inclusion criteria outlined in Table 1, they were duplicate publications, or were published prior to 2009. Systematic reviews that had broader inclusion criteria than the present review were examined in detail to ascertain whether data could be extracted from a relevant subset of included studies, rather than excluding the systematic review entirely. If it was not possible to identify relevant primary studies upon detailed investigation, the systematic review was excluded. Given the nature of this review, which reports both quantitative data about patient satisfaction and qualitative data about patient, family and provider experiences drawn from the results of primary studies, studies that were also included in the systematic reviews were not excluded.

Articles were also excluded if they reported experiences of patients for whom the provision of food in the hospital served a therapeutic function or was connected to the administration of medicine (e.g. studies conducted in in-patient eating disorder units).

Critical Appraisal of Individual Studies

One reviewer assessed the quality of the included publications. The included systematic reviews were critically appraised using AMSTAR II as a guide.[12] Publications that used a questionnaire to examine patients' satisfaction with hospital food and its delivery were assessed using questions from the Critical Appraisal of a Survey checklist.[13] For qualitative studies that aimed to capture the experiences of patients, caregivers and providers, an assessment of credibility, trustworthiness and transferability of the studies was guided by the ten items from the Critical Appraisal Skills Programme (CASP) Qualitative Checklist.[14] Results of the critical appraisal were not used to exclude studies from this review; rather, they were used to understand the methodological and conceptual limitations of the included publications in specific relation to this review. In particular, the critical appraisal contributed to the analysis by identifying the limits of transferability of the results of included publications.

Data Analysis

Descriptive Analysis

A descriptive analysis was conducted to detail the study design and participant characteristics of each included study. Descriptive study data included author, publication year and country of publication, study objectives, study design, inclusion criteria, data collection strategies, outcomes of interest and descriptions of interventions and comparators. Participant characteristics included mean age or age range in years, proportion of males (%), and sample size.

Data Extraction and Analytic Approach

Results related to patient satisfaction and patients', families' and hospital personnel's expectations of and experiences with hospital food delivery models were extracted from all systematic reviews and primary studies. A convergent synthesis design was used, in which qualitative and quantitative data were collected in parallel and integrated during the interpretation of results.[15]

Quantitative or numerical patient satisfaction data from both systematic reviews and primary studies were tabulated and summarized narratively. Results from systematic reviews are presented first followed by the results for primary studies.

With respect to qualitative or textual data reported from interviews, focus groups, or open-ended questionnaire responses, one reviewer conducted all stages of the coding and analysis process, using NVivo11.[16] During initial coding, the reviewer coded line-by-line to develop a preliminary coding framework, with a particular focus on elements of choice, flexibility, and satisfaction. These codes reflected the most substantial components of analysis but also those that were identified as most relevant to the review objectives.

During focused coding, data were coded through several iterative cycles where analysis remained open to new ideas, codes, and themes. Findings from the included studies were compared and contrasted to develop a cohesive interpretation of the phenomenon of interest. Brief analytic memos were written throughout the analytic process to maintain reflexivity.

Summary of Evidence

Quantity of Research Available

A total of 407 citations were identified in the literature search. Following screening of titles and abstracts, 353 citations were excluded and 54 potentially relevant reports from the electronic search were retrieved for full-text review. An additional 11 potentially relevant publications were identified through hand searching of bibliographies and from the complementary CADTH review of clinical and cost-effectiveness on the same topic,[11] and were retrieved for full text review. Of these 65 potentially relevant articles, 46 publications were excluded for various reasons, and 19 publications met the inclusion criteria and were included in this report. Appendix 1 presents the PRISMA[17] flowchart of the study selection process.

Summary of Study Characteristics

Details regarding the characteristics of included publications and their participants are provided in Appendix 2.

Study Design and Data Collection

Of the nineteen publications, four were systematic reviews,[2,10,18,19] and 15 were primary studies.[20-34] The systematic reviews included relevant RCTs, cohort studies and cross-sectional studies. One primary study[35] was included in two separate systematic reviews, with no other overlap identified.[10,18] The overlap of studies across included systematic reviews is outlined in Appendix 5. The primary studies consisted of a mix of quantitative (i.e. cohort studies[20,21,27] and cross-sectional studies,[24,33]) , qualitative (i.e. grounded theory,[30] phenomenology,[25,29] and various unspecified designs using qualitative approaches[26,31,32,36]) and mixed methods[28] designs. One study was a formative evaluation of the experience of transitioning to a room service food delivery model.[34]

Four primary studies collected quantitative data relevant to patient satisfaction.[20,21,27,33] Tools and methods used varied across studies and included the hospital's patient satisfaction survey,[20] the Nutrition-Related Quality of Life (QoL) questionnaire,[27] closed-ended interview questions,[24] and Naithani et al.'s[37] an unnamed validated questionnaire.[21] Three studies used semi-structured interviews as the method of qualitative data collection,[24-26] two used focus groups,[29,31] two collected data using interviews, focus groups and observation,[30,32] one used semi-structured interviews and questionnaires,[28] and one publication used observation and interviews.[23]

Country of Origin

Two of the systematic reviews were conducted by authors in Australia.[18,19] One systematic review was conducted by authors in the Netherlands[10] and another by authors in Italy.[2]

Of the 15 primary studies, three were conducted in Canada[22,31,34] and three were conducted in Australia.[23,25,26] Two studies were conducted in the Netherlands.[21,27] One study was conducted in each of India,[20] Iran,[32] Italy,[24] Norway,[29] Slovenia,[28] the United Kingdom[33] and the United States.[30]

Participant Population

The included systematic reviews[2,10,18,19] incorporated 13 unique primary studies reporting patient satisfaction data, with a total of 3,152 hospital patients enrolled. Of these primary studies, two[38,39] were conducted in pediatric units and included a total of 281 pediatric patients.

The 15 relevant primary studies included an additional 503 patients and 339 providers and hospital personnel, which captured perspectives from nurses, nurse aides, dietitians, dietetic interns, diet technicians, menu clerks, and foodservice managers. Participants were recruited from a variety of hospital wards, such as geriatrics, neurology, cardiology, rehabilitation, oncology, and general and specialty surgery wards. Most patient participants were older adults, but one study included nurses working in pediatric oncology.[28]

Interventions (and Comparators)

The systematic reviews included studies that compared a wide variety of foodservice interventions. Dijxhoorn et al.[10] reported findings from patients who received meals through a "FoodforCare meal service" that comprised six small protein-rich menu items with snacks available after 7pm,[21] a la carte service where patients were able to order food and drinks throughout the day,[27,40] and a steamplicity system where patients ordered their meals two hours in advance from an extended choice menu. In one study, individual plated meals were transported to the ward, held chilled, and heated in the microwave prior to serving.[41]

Other interventions included an individual meal system that gave patients a choice of energy enriched meals from a menu cart,[42] foodservice where patients were given a choice of meal type and portion size from a food cart at mealtime,[35,38,43,44] a room service menu,[34,39,45] or a spoken menu with orders taken closer to mealtime compared to a traditional print menu.[46,47]

Similarly, the 15 primary studies described a variety of food service delivery models, including a la carte ordering throughout the day,[20,27,34] protein-rich menu items with the option to ask for additional snacks or drinks after 7pm,[21] spoken or visual menus.[26] Studies that included qualitative data regarding patient and hospital personnel experiences with hospital food in general were also included, which generally involved traditional food delivery models such as meals served three times per day and delivered on trays.[24,25,32]

Outcomes of Interest

The relevant outcome considered in the systematic reviews[2,10,18,19] was patient satisfaction.

The outcome of interest in the 15 primary studies was generally satisfaction, although some studies also reported broader patient, family and hospital personnel experiences with hospital food and its delivery.[22-25,28-32,34]

Quantitative data from outcomes related to nutritional intake, food intake or length of stay are discussed in a separate Review of Clinical Effectiveness, Cost-Effectiveness, and Guidelines.[11]

Summary of Critical Appraisal

Details regarding the quality of the included publications are provided in Appendix 3, Table 4.

In general, the systematic reviews were of good quality, although the particular food delivery models under investigation differed, and so the relevance to the current review was unclear. Similarly, the included qualitative studies were of high quality, although focused on broader topics than the current review, which again may limit transferability of results. Finally, the survey studies used a variety of tools and approaches to measure satisfaction; however, overall satisfaction improved across all included studies despite these differences indicating that alternative food service delivery models are likely to be preferred over traditional food delivery systems.

Summary of Findings

All four of the systematic reviews and four of the 15 included primary studies contributed results related to patient satisfaction. Details are provided in Appendix 4, Table 5 and Table 6.

Each of the included systematic reviews reported increased patient satisfaction in response to the alternative food delivery models across all of their included studies. While each of the included studies assessed satisfaction in a different way, common elements of alternative food delivery models that were related to increased satisfaction, as compared to traditional food delivery, included: food taste, texture, smell, presentation, and quality; and, availability of choice in terms of food selection, portion size, and time of service. However, all of the systematic review authors also noted the limited research available.[2,10,18,19] Dall'Oglio et al.[2] note that patients' satisfaction is influenced by the way food is presented and delivered, not just by the quality of the food.

Similarly, the results of the primary studies included in the current review indicate that alternative food delivery models improve patient satisfaction. One study[20] conducted in India compared a patient-centered service model to a traditional model; the authors found that patient satisfaction increased across all measures (i.e. quality of food, timeliness of delivery, flavour of food and explanations of special or restricted diets) with patient-centered service, and there was a statistically significant improvement in overall satisfaction among the oncology patients included in this study. Another study[27] investigated patient satisfaction with room service delivery using a restaurant style menu compared to traditional meal service offered three times per day. Patients scored the room service system higher in terms of supply, presentation, service, autonomy and overall satisfaction. However, scores for "quality" were consistent between the two cohorts. There was no difference in the overall score for quality of the food between the cohorts because it included an equal score for taste, a lower score for food temperature, and a higher score for freedom to order food. Higher satisfaction scores were reported from patients across all included hospital wards: cardiology, geriatrics, oncology, surgery, neurology and acute admission. Dijxhoorn et al.[10] compared an alternative meal service comprised of six small protein-rich menu items with snacks available after 7pm with traditional meal service. Patients' ratings of "meal service" and "food quality" were slightly higher, but not significantly, with the alternative meal service program. Finally, one study[24] reported patients' overall satisfaction with food quality in a hospital setting that offered ready-made trays delivered to patients from an internal kitchen. In this study, 57% of patients thought the food quality was "good", 22% believed it was "acceptable" and 21% thought it was "inadequate".

Taken together, the available quantitative data on patient satisfaction suggest that in general, patients prefer the alternative delivery models investigated as compared to traditional delivery three times per day. An examination of the qualitative data offers some insight into *why* these delivery models might receive higher satisfaction ratings. In what follows, the qualitative data are explored according to elements of choice and flexibility, which were identified as predominant themes in the review of perspectives and experiences.

Choice

Choice of meal options was a crucial component of satisfaction with food delivery models that was raised by both patients and hospital staff. [25,28,29,31-34,36]

For hospital personnel, not having the ability to individualize meals for patients or offer snacks between meals is perceived as a barrier to meeting their nutritional needs.[29,31] Hospital staff pointed to concerns about the food budget and outsourcing of food as reasons for the lack of variety in meal options; they suggested that "people making the decisions have very little clinical experience – very little bedside experience. And they're driven by the budget".[31](p. 196). Nurses expressed frustration and feelings of "powerlessness"[31] at not being able to offer more choice with meals when patients were dissatisfied with the food offered.

Beyond addressing nutritional needs and clinical outcomes, offering choice at mealtimes brings an element of hospitality to what can otherwise be a very institutionalized and regimented experience. Patients appreciate being given a sense of control over their food choices, particularly pediatric patients.[33,36] Foodservice managers acknowledged that meal options are an important strategy to improve overall patient satisfaction because food choice is one of the few aspects of hospital life over which patients can exert some

control.[22] A foodservice manager from a large hospital in Ontario reported that "when [they] switched to restaurant style service, patient satisfaction skyrocketed; patients can have comfort food when they want it and they have more choice"[22](p. 52)

Offering food choices also allows hospitals to be attentive to patients' differing preferences. Furman's[30] theory about the social processes that influence the eating behaviour of older adults draws on the concept of "foodways", that is, person's eating habits and culinary practices which in turn shape their preferences and expectations and can become more set with age. Dissatisfaction with hospital food can result when meals offered do not meet these expectations, for example, because the food is unfamiliar, not the right temperature, or lacks flavouring. Lack of food flavour is a common complaint among adults[30] and those accustomed to cooking with more spices and food flavouring.[11,32] Restaurant style menus can offer more culturally appropriate or simply appealing menu options.[34]

In the absence of food choices provided by the hospital, several study authors note that visitors bring food to patients that is more appetizing.[24,25,28,32,33] Others purchase snacks from the cafeteria or vending machines to supplement the hospital offerings.[28] One nurse in a pediatric oncology ward suggested that food provided by parents may represent life outside of hospital to children.[28]

Finally, nurses and patients in two studies[29,32] raised the issue of satisfaction with food choice and variety being linked to the patient's length of stay. Patients with longer stays or chronic conditions that led to frequent readmission became bored with limited menu choices.

Flexibility

Having the flexibility to select meal delivery times was a second commonly described component of patient satisfaction with food delivery models.[24,25,28-34] Lack of flexibility in meal ordering or delivery times can mean that meals go uneaten or partially eaten due to poor appetite at mealtime.[25,33,34]

A key issue with a traditional food delivery service (where menu selections are made in advance) identified by hospital staff and patients is that changes in appetite and food preference can occur in the gap between meal ordering and delivery.[25,34] This is particularly true for patients undergoing chemotherapy, which alters the senses of taste and smell.[28] But in general, patients commented that advance selection is challenging because they ''don't know what [their] appetite is going to be''.[33](p.183) On-demand or cart delivery systems that allow patients to choose their meal at the time of consumption can mitigate some of these issues.

In addition to the timing between ordering and delivery, flexible mealtimes were important to patients' satisfaction.[29] For some patients, timing of meal delivery was essential because treatments or medications could cause appetite changes or reductions in appetite.[25,28] One female patient lamented the rigid meal delivery times that conflicted with medication administration and appetite:

> Breakfast serving time is torture. They wake us for breakfast even if we have taken a high dosage of pain killer and after that we have a sense of sickness and headache all day long.[32](p. 531)

Inconvenient or inappropriate delivery times (e.g. while the patient was undergoing treatment)[29] concerned nurses because of missed meals and, in turn, inadequate nutritional

care.[29] They also believed that flexibility of meal times in response to nausea, vomiting or constipation were essential to having patients eat.[28] The opportunity to order between-meal snacks was desirable.[29,31]

Patients remarked that meal delivery times are sometimes incongruous with their home routines, and they felt that the rigid timing was constraining.[30,33] Part of patients' previously described "foodways" includes the timing of meals and the ability to perform traditional meal rituals.[30] A nurse with eleven years of experience in pediatric oncology noted that flexible mealtimes in the late afternoon or in the evening were ideal because children seemed to have better appetites then, and were able to eat with parents, which boosted their appetites.[28]

Implementation Considerations

Although hospital personnel (as well as patients) were generally supportive of increased choice and flexibility in menu options and food delivery, some implementation considerations are worth noting. A dietitian from an Ontario hospital that transitioned to a restaurant-style room service menu noted that there were language barriers because the new system had patients order their meals by phone. Diet-order changes also caused delays in ordering because approval was needed. Further, staff needed to monitor patients to ensure that the meals were being ordered and eaten by them and not shared with visitors.[34]

Finally, responses to open-ended questions across included studies revealed that foodservice managers' priorities were budget and staffing, not the nutritional content of and patient satisfaction with menus. Attention to funding led to strategies to control costs—for example outsourcing—and unintended negative consequences related to patient choice and food quality.[22] These concerns were echoed by nursing staff, who felt that decisions were perhaps being made by those with no bedside experience.[31]

Limitations

There was notable heterogeneity among the included studies with respect to food delivery models. The models under investigation were often inadequately described to gain a true understanding of how they differed from traditional models with meals selected in advance and served to patients in their rooms three times daily. However, even when clearly described, the models differed in various ways that may impact patient satisfaction.

Moreover, as the authors of the included systematic reviews noted, tools to measure patient satisfaction were not used consistently across studies, making comparisons across various models difficult.

The review of qualitative data attempted to capture a more nuanced understanding of the underlying factors contributing to patient satisfaction with hospital food and its delivery. However, the included studies were generally more broadly focused on nutritional care and undernourishment in hospitals as opposed to food delivery, and patient satisfaction with food and particularly its delivery was not explored in depth.

In addition, the review was limited to perspectives captured in the available literature. The included studies primarily recruited older adult (≥65 years) patient participants, which might limit the applicability of the findings to children and younger adults who have different expectations of and preferences for hospital food. It is noteworthy that some of the included primary studies excluded patient participants who had language barriers or cognitive

impairments. As a result, the increased satisfaction and positive experiences expressed in the results may not extend to patients who would struggle with novel meal ordering and delivery systems as a result of such challenges.

Family and caregiver perspectives were not reported in most of the included studies, despite reference to their important role (e.g. in bringing food to patients or assisting during mealtimes).

Finally, although the quantity of literature was limited, three studies were conducted in Canadian hospitals. In particular, one study described the experience of transitioning to a room service model within a pediatric hospital setting, and raised issues very relevant to the Canadian context.

Conclusions and Implications for Decision or Policy Making

This review used a convergent synthesis design to synthesize results of 19 included studies and to explore patients', families' and health care providers' experiences and perspectives regarding alternative room service food delivery models for hospital in-patients.

The results synthesized in this report suggest that alternative food delivery models have the potential to increase patient satisfaction when compared to traditional meal delivery service. However, the models under investigation were very heterogeneous, making it difficult to pinpoint which aspects of the alternative models improved patient satisfaction, and in which ways. Despite heterogeneity, it is apparent that patient satisfaction with food delivery is influenced not just by the quality of the food but also by the way food is presented and delivered. The qualitative data synthesized in this report provide some insight into the aspects of meal delivery that are important to patients. In particular, choice of meal options and flexibility in meal delivery times were crucial components of satisfaction raised by both patients and hospital personnel.

Offering a variety of food choices may increase food intake and nutritional status, with options available that are more in line individual patient's preferences, personalized eating habits and culinary practices. Further, choice offers patients some comfort and control in an otherwise institutionalized and regimented environment. For hospital personnel, not having the ability to individualize meals for patients, or offer snacks between meals, is perceived as a barrier to meeting patients' nutritional needs, and which led them to express frustration and feelings of "powerlessness". Hospital staff additionally raised concerns about the food budget and outsourcing of food as reasons for the lack of variety in food choices, suggesting that attention to budget and not nutritional content results in unintended negative consequences including decreased satisfaction, patient choice and food quality

Similarly, flexible meal times can have key clinical benefits for patients who would otherwise miss or skip meals, or not eat all of the food delivered to them. Flexibility in meal delivery times enables patients to match their meals with their appetites, which may change in the gap between traditional food ordering and delivery and result in uneaten or partially eaten meals. Allowing patients to choose their meal at the time of consumption may be particularly important for people undergoing certain types of treatment, such as chemotherapy, which alters the senses of taste and smell. Both patients and health care providers commented that inconvenient or inappropriate delivery times were concerning due to missed or uneaten meals, which adversely impacts nutritional care.

Challenges in implementing alternative food delivery models include concerns about increased costs and staffing demands. While alternative food delivery models were noted throughout the literature as a potential way of reducing food waste, experiences from one Canadian hospital that transitioned to a restaurant style on-demand ordering system note the need to monitor and potentially limit meals ordered to prevent family members from ordering meals for themselves. Language barriers would also need to be addressed where applicable.

Relatedly, several studies referred to challenges in offering alternative food delivery models for people with cognitive impairments and noted the inability of such patients to participate in related studies and programs. Alternative food delivery models might have unique staffing requirements to accommodate patients who require extra support to exercise their choice in meal selection.

Finally, several studies noted that family and other visitors often brought food to patients to supplement the meals offered by the hospital. A food delivery model that can be tailored to patients' needs and preferences may address some of the need for non-hospital-provided meals, and be of particular value to patients who do not have the option of accessing outside food sources.

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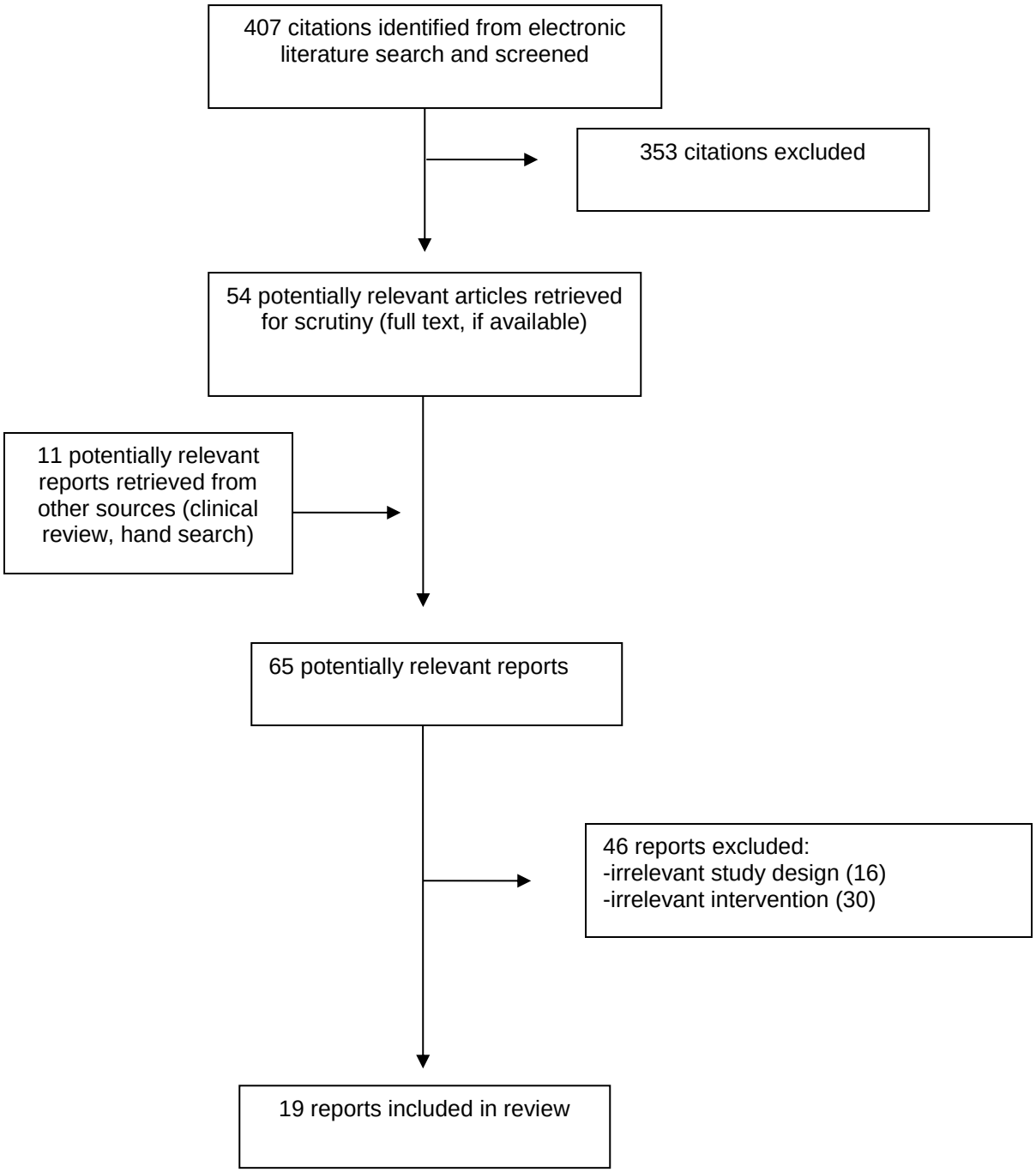
Appendix 1: Selection of Included Studies



Appendix 2: Characteristics of Included Publications

Table 2: Characteristics of Included Systematic Reviews

First Author, Publication Year, Country	Study Designs and Numbers of Primary Studies Included	Population Characteristics	Intervention and Comparator(s)	Relevant Outcomes
Dijxhoorn, 2019, Netherlands[10]	**Study design:** SR of relevant RCTs, cohort studies, and cross-sectional studies **Number of studies included**: In total, 33 studies were included, with eight relevant for this review **Objective:** To systematically describe the effects of published foodservice interventions on nutrition and clinical outcomes	Adult hospitalized patients Studies on patients who received parenteral and/or tube feeding or that took place in nonhospital facilities were excluded	**Interventions:** Various food service interventions, including: preparation and composition of meals, menu, meal delivery, mealtime assistance, or mealtime environment **Comparators:** Other or more traditional food service interventions	Patient satisfaction
Doyle, 2017, Australia[18]	**Study design:** SR of relevant RCTs, cohort and cross-sectional studies **Number of studies included**: In total, 12 studies were included, with one relevant for this review **Objective:** To determine the effect of foodservice interventions on nutritional outcomes and satisfaction of hospitalized and ambulatory adults with cancer	Hospitalized and ambulatory adult oncology patients	**Interventions:** Various food service interventions, including: oral nutritional supplements, mealtime assistance, and post-of-service meal selection from an electronic food cart **Comparators:** Various nutritional interventions The study relevant to the current review compared electronic food cart delivery (allowing patients to choose) to traditional tray service	Patient satisfaction
Dall'Oglio, 2015, Italy[2]	**Study design:** SR of relevant cohort and cross-sectional studies **Number of studies included**: In	Hospital in-patients, caregivers, and employees	**Interventions:** Various food service interventions, including: hotel room service and extended choice menus	Patient satisfaction

Table 2: Characteristics of Included Systematic Reviews

First Author, Publication Year, Country	Study Designs and Numbers of Primary Studies Included	Population Characteristics	Intervention and Comparator(s)	Relevant Outcomes
	total, 31 studies were included, with six relevant for this review **Objective:** To review the literature describing patient satisfaction with hospital foodservices		**Comparators:** Other or more traditional food service interventions The studies relevant to the current review compared room service models and trolley systems to traditional tray service	
Ottrey, 2016, Australia[19]	**Study design:** SR of relevant observational studies **Number of studies included**: In total, six studies were included, with two relevant for this review **Objective:** To determine which strategies that provide menu choices to patients are effective in improving clinical and non-clinical outcomes in hospital	Adult hospitalized patients	**Interventions:** Various food service interventions, including: menu design, meal ordering, mealtime assistance and kitchen redesign **Comparators:** Other or more traditional food service interventions The studies relevant to the current review compared printed menus with spoken menus collected closer to mealtime	Patient satisfaction

SR = systematic review

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Sathiaraj, 2019, India[20]	**Study design**: Cohort study **Data Collection Strategy:** Questionnaire **Objective**: To evaluate patient satisfaction and nutritional intake with a patient-centered foodservice model in a cancer hospital	**Inclusion criteria**: Adult hospitalized oncology patients who received food service **Number of patients:** 160 (100 in the patient-centered group; 60 in the traditional group) **Mean age, years (SD)**: 55.1 (17.4) in the patient-centered group; 55.1 (17.0) in the traditional group **Sex (% male)**: 48.9% in the patient-centered group; 48.3% in the traditional group	**Intervention**: Patient-centered food service model. This model gave patients and/or their family the option of ordering meals from an à la carte style menu throughout the day (including midnight snacks) **Comparator**: Traditional food service model. Patients were served meals off a seven-day cyclic menu at set timings during the day meals (breakfast: 8:00 am to 9:00 am; lunch: 11:45 am to 12:45 pm; dinner: 7:00 pm and 8:00 pm)	Patient Satisfaction

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Dijxhoorn, 2018, Netherlands[21]	**Study design**: Cohort study. The findings of the original study are summarized in the included systematic review[10] **Data Collection Strategy:** Questionnaire **Objective**: To investigate the differences in protein intake at each mealtime as the hospital transitioned from a traditional meal service to a "FoodforCare" meal service	**Inclusion criteria**: Dutch-speaking in-patients (≥ 18 years of age) who had oral intake for at least one full day **Number of participants:** 637 (311 in the "FoodforCare" group; 326 in the traditional service group) **Mean age, years (SD)**: 60 (16) in the "FoodforCare" group; 59 (17) in the traditional service group **Sex (% male):** 45 in the FoodforCare" group; 49 in the traditional service group	**Intervention**: "FoodforCare" meal service that included six meals per day (three main meals and three in-between meals). Nutritional assistants served the meals at patient bedside and provided advice on meal selection based on individual needs. Patients could ask for additional food and drinks after 7:00 pm. **Comparator**: Traditional meal service that consisted of three meals per day served by nutritional assistants. Small snacks were provided between meals. Patients had access to additional food and drinks after the schedule meal times	Patient Satisfaction

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Greig, 2018, Canada[22]	**Study Design:** Cross-sectional study **Data Collection Strategy:** Questionnaire **Objective:** To examine the current practices for assessing the nutritional adequacy and patient satisfaction with menus in hospitals and explore the perceptions of foodservice managers on related priority issues	**Inclusion criteria:** Foodservices leaders of large, small and academic hospitals and those affiliated with long-term care facilities **Number of participants:** 45 foodservice managers from academic and community hospitals and12 Foodservice managers working in hospitals governing long-term care facilities **Age range, years:** NR **Sex (% male):** NR	It was assumed, for the study purposes, that the same menu processes were used for multiple sites	Perceptions of priorities and challenges
Ottrey, 2018, Australia[23]	**Study Design:** Qualitative descriptive study (ethnographic approach) **Data Collection Strategy:** Observation and semi-structured interviews **Objective:** To explore and understand patterns of mealtime culture, environment and social practice from the perspective of staff, volunteers and visitors on the hospital ward	**Inclusion criteria:** Staff, volunteers and visitors present on the subacute care wards (geriatric or rehabilitation). Leaders from key professions in health care were also invited. Participation required spoken English and informed consent for interviews **Number of participants:** 61 interview participants **Age range, years:** 18 to 80+ **Sex (% male):** NS (“both genders represented”)	Foodservice staff delivered meals to patients in their rooms or the dining room if patients wished	Perspectives on hospital and mealtime role, things that help or hinder mealtime involvement

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Bonetti, 2017, Italy[24]	**Study Design:** Cross-sectional study **Data Collection Strategy:** Semi-structured interviews **Objective:** To determine and compare the prevalence of malnutrition in medical and surgical hospital units; to assess quality of nutritional care and patients' perception about quality of food and nutritional care	**Inclusion criteria:** Head nurses in medicine, geriatrics, neurology, cardiology, rehabilitation, nephrology, oncology, orthopaedics, general and specialist surgery wards. Patients age ≥65 years able to eat, and not confused **Number of participants:** 80 head nurses and 161 patients **Age range, years:** NR **Sex (% male):** NR	All hospitals used ready-made trays to deliver food to patients, and had an internal kitchen service	Perceptions about quality of food
Hope, 2017, Australia[25]	**Study Design:** Phenomenological study **Data Collection Strategy:** Semi-structured interviews **Objective:** To explore whether food and mealtime experiences contribute to inadequate dietary intake in older people during hospitalization	**Inclusion criteria:** Patients age ≥65 years Observed food intake of 50% or less of food provided at a lunch meal Length of stay ≥2 days at the time of meal observation Provision of informed verbal consent **Number of participants:** 25 patients **Age range, years:** 65 to 98 **Sex (% male):** 16	The hospital primarily uses a cook-chill plated delivery system with some items freshly prepared. Meals are served three times per day. Certain patients with dietary needs are served snacks in addition	Patient food and mealtime experiences

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Ottrey, 2017, Australia[26]	**Study Design:** Qualitative descriptive study (evaluative theoretical framework) **Data Collection Strategy:** Semi-structured interviews **Objective:** To explore patients' experiences of written, spoken and visual menus in the acute hospital setting	**Inclusion criteria:** English speaking patients over 18 years old and who had experienced at least two days of meal ordering via their allocated system **Number of participants:** 10 patients **Age mean, years:** 70 **Sex (% male):** 30	**Intervention:** Three hospital meal-ordering systems: 1) a written menu (menu cards delivered each morning), 2) a spoken menu (menu items read aloud), and 3) a visual menu (colour photographs of food and drink, also read aloud) **Comparator**: Written menus delivered daily with breakfast; Meal orders taken for dinner that evening and breakfast and lunch for the following day. Short order items (e.g. scrambled eggs, meat pies) available for patients with reduced appetites	Patients' experiences with various meal ordering systems

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Doorduijn, 2016, Netherlands[27]	**Study Design:** Cohort study **Data Collection Strategy:** Questionnaire **Objective:** To evaluate whether a meal service concept with a restaurant style menu card and room service improved patient satisfaction, nutritional status, and food intake compared to the traditional 3-meals per day service	**Inclusion criteria**: Patients age ≥ 18 years with an expected admission time of four days and a good understanding of the Dutch language **Number of participants:** 337 patients (169 in the At Your Request group; 168 in the Traditional Meal group) **Mean age, years (SD):** 66.1 (14.5) in the At Your Request group; 63.3 (15.4) in the Traditional Meal group **Sex (% male):** 46 in the At Your Request group; 52 in the Traditional Meal group	**Intervention:** At Your Request patients were able to order food and drinks through the day (between 7:00 am and 7:00 pm) using a telephone and printed menu. Food as delivered within 45 minutes of order **Comparator:** Traditional meal service consisted of three meals per day with drinks between meals. Patients selected their meals one day prior to receiving them	Patient satisfaction

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Klanjsek, 2016, Slovenia[28]	**Study Design:** Mixed methods **Data Collection Strategy:** Semi-structured interviews and a questionnaire **Objective:** To explore nurses' perceptions of different causes of inadequate food intake in children treated with chemotherapy and to determine how often nurses identify these causes	**Inclusion criteria**: For the interviews, participants were sought who had at least one year of professional experience, knowledge and professional reputation in pediatric oncology nursing. The focus groups involved nurses working at the pediatric oncology unit **Number of participants:** 6 nurses participated in the interview; 24 nurses completed the questionnaire **Mean age, years (SD):** 38.7 (8.9) **Sex (% male):** 0	Food delivery system was not described	Nurses' perceptions of children's mealtime experiences
Eide, 2015, Norway[29]	**Study Design:** Phenomenological study **Data Collection Strategy:** Focus groups **Objective:** To identify what nurses experiences as barriers to ensuring adequate nutritional care for undernourished hospitalized older people	**Inclusion criteria**: Nurses working bedside for the three months prior to the study in a 50% position or more on the same ward **Number of participants:** 16 nurses **Mean age, years:** 29.3 **Sex (% male):** 6	On the participating hospital wards, food service used a cold chain principle organized by way of several ward kitchens that receive food transported from a central kitchen for heating	Nurses' experiences

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Furman, 2014, United States[30]	**Study Design:** Grounded theory **Data Collection Strategy:** Observation, interviews, document review **Objective:** To develop substantive theory that describes the social process that influences the eating behavior of hospitalized older adults	**Inclusion criteria**: Consenting older adult in-patients who were 65 and older, English speaking, and had an oral diet order, and consented Health care providers who were English speaking and had direct interaction with older adults relative to eating behaviour **Number of participants:** 8 older adults and four health care providers (one dietician, two RNs, one nurse aide) **Mean age, years (SD):** NR **Sex (% male):** NR	The hospital used room service and non-select diet ordering options. Room service offers designated patients the option to order a meal from a menu at any time, allowing for varied mealtimes and choice. The non-select option involves standardized mealtimes and a prescribed menu. Assigned to these options is based on an assessment by a nurse, taking into account the patient's ability to order a meal independently	Patient and health care provider experiences

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Keller, 2014, Canada[31]	**Study Design:** Qualitative study (critical realist approach) **Data Collection Strategy:** Focus groups **Objective:** To understand how nutrition care currently occurs, to explore the perceived enablers and challenges to care; and to identify the activities, processes and resources needed to improve the quality of acute care services	**Inclusion criteria:** Staff identified by the site coordinator to have a primary role in nutrition care of patients **Number of participants:** 91 dietitians, dietetic interns, diet technicians and menu clerks **Mean age, years (SD):** NR **Sex (% male):** NR	Food delivery system was not described	Staff perspectives on the process of nutrition care
Jessri, 2011, Iran[32]	**Study Design:** NS (Analyzed using grounded theory principles) **Data Collection Strategy:** Focus group discussions which were used to develop an interview guide, and meal observations **Objective:** To investigate in-patients' satisfaction with meals	**Inclusion criteria:** Patients who had consumed more than four meals in the hospital, were over 18 years old, and had no psychological disorders **Number of participants:** 23 patients in focus groups 75 patients interviewed **Age range, years:** 19 to 84 **Sex (% male):** 51	Meals are served three times per day. They are prepared in hospital kitchens and delivered to wards on trolleys	Patient views and perspectives Patient satisfaction

Table 3: Characteristics of Included Primary Studies and their Participants

First Author, Publication Year, Country	Study Design, Research Objective and Data Collection Strategy	Population Characteristics	Food Delivery Model(s)	Relevant Outcome(s)
Johns, 2010, United Kingdom[33]	**Study Design:** Cross-sectional study **Data Collection Strategy:** Questionnaire **Objective:** To study hospital food service from the patient's viewpoint	**Inclusion criteria:** Post-operative patients who had undergone elective surgery or medical treatment, had recovered well and felt strong enough to provide information about hospital meals **Number of participants:** 41 patients **Age range, years:** 40 to 99 (ages were recorded within 10-year intervals) **Sex (% male):** 34.1	Food delivery system was not described	Patient satisfaction
Kuperberg, 2009, Canada[34]	**Study Design:** Formative evaluation **Data Collection Strategy:** Not applicable **Objective:** To describe the experience of transitioning to a room service food delivery model in a pediatric health care facility	Not applicable. The author reflects on the transition of meal delivery at The Hospital for Sick Children (SickKids)	Transition from a cold-plating rethermalization system where menu selections were made two days in advance to a room service delivery model with a redesigned menu	Facilitators to implementation of a room service model

NR = not reported; NS = not specified; SD = standard deviation

Appendix 3: Critical Appraisal of Included Publications

Table 4: Critical Appraisal of Included Publications

Systematic Reviews Assessed using AMSTAR 2[12] as a Guide													
First Author, Year	**Research question and inclusion criteria include components of PICO?**	**Explicit statement that the review methods were established prior to the conduct of the review?**	**Authors explain their selection of study designs?**	**Authors use a comprehensive literature search strategy?**	**Authors perform study selection in duplicate?**	**Authors perform data extraction in duplicate?**	**Authors provide a list of excluded studies?**	**Authors describe the included studies in adequate detail?**	**Authors use a satisfactory technique for assessing risk of bias?**	**Authors report on the sources of funding for the included studies**	**Authors account for risk of bias when interpreting results?**	**Authors provide a satisfactory explanation for heterogeneity observed?**	**Authors report any potential sources of conflict of interest**
Dijxhoorn, 2019[10]	+	-	+	-	+	+	-	+	+	-	+	+	+
Doyle, 2017[18]	+	+	+	+	+	+	-	+	+	-	+	+	+
Dall'Oglio, 2015[2]	+	-	+	-	+	-	-	+	+	-	+	+	+
Ottrey, 2016[19]	+	+	+	-	+	+	-	+	+	-	+	+	-

Surveys Assessed using Critical Appraisal of a Survey Study[13] as a Guide												
First Author, Year	**Address a clearly focused question?**	**Research method appropriate for answering the research question?**	**Method of selection of the subjects clearly described?**	**Could the way the sample was obtained introduce bias?**	**Sample representative with regard to the population to which the findings will be referred?**	**Sample size based on pre-study consider-ations of statistical power?**	**Satisfact-ory response rate achieved?**	**Questionn-aires likely to be valid and reliable?**	**Statistical signific-ance assessed?**	**Confidence intervals given for the main result?**	**Confound-ing factors that haven't been accounted for?**	**Can the results be applied to your review?**
Sathiaraj, 2019[20]	+	+	+	+	-	-	+	-	+	-	+	+
Dijxhoorn, 2018[21]	+	+	+	-	+	+	+	+	+	+	+	+
Greig, 2018[22]	+	+	+	-	+	-	+	-	-	-	+	-
Bonetti, 2017[24]	+	+	+	-	+	-	+	-	-	-	+	+
Doorduijn, 2016[27]	+	+	+	-	+	-	+	+	+	+	+	+
Johns, 2010[33]	+	+	-	+	+	-	-	-	-	-	+	+

Qualitative Studies Assessed Using CASP Qualitative Checklist[14]										
First Author, Year	**Clear statement of the aims of the research?**	**Qualitative methodology appropriate?**	**Research design appropriate to address the aims of the research?**	**Recruitment strategy appropriate to the aims of the research?**	**Data collected in a way that addressed the research issue?**	**Relationship between researcher and participants been adequately considered?**	**Ethical issues been taken into consider-ation?**	**Data analysis sufficiently rigorous?**	**Clear statement of findings?**	**Relevant to the current review?**
Ottrey, 2018[23]	+	+	+	+	+	+	+	+	+	-
Hope, 2017[25]	+	+	+	+	+	+	+	+	+	-
Ottrey, 2017[26]	+	+	+	+	+	+	+	+	+	+
Klanjsek, 2016[28]	+	+	+	+	+	+	+	+	+	-
Eide, 2015[29]	+	+	+	+	+	+	+	+	+	-
Furman, 2014[30]	+	+	+	+	+	+	+	+	+	-
Keller, 2014[31]	+	+	+	+	+	+	+	+	+	-
Jessri, 2011[32]	+	+	+	+	+	-	+	+	+	-

+ = yes; - = no

Appendix 4: Main Study Findings and Authors' Conclusions

Table 5: Summary of Results Related to Patient Satisfaction from the Systematic Reviews

<table>
<tr><th>Main Study Results</th><th>Authors' Conclusion</th></tr>
<tr><td colspan="2">Dijxhoorn, 2019[10]</td></tr>
<tr><td>Systematic review that investigated the effects of food service interventions on nutrition and clinical outcomes for in-patients.

Relevant primary studies: The systematic review included eight primary studies that evaluated patient satisfaction related to food service delivery models relevant to the current review.

<table>
<tr><th>Primary study citation</th><th>Summary of relevant findings</th></tr>
<tr><td>Dijxhoorn, 2017[21] (N = 637)</td><td>- Patients who received food through the "FoodforCare" meal service were more satisfied with appearance and smell of the meals than patients served using traditional meal services. Ratings were similar.</td></tr>
<tr><td>Doorduijn, 2015[27] (N = 337)</td><td>- As measured by a rating of the meal service on a scale from 1-10, patients in the à la carte cohort rated their satisfaction at 8.1 compared to those in the traditional meal service cohort who rated it 7.5</td></tr>
<tr><td>Edwards, 2006[41] (N = 52)</td><td>- The steamplicity system that allowed patients to order meals two hours before meal service from an extended choice menu was rated higher in 5 out of 15 questions of the questionnaire, namely in the subjects of food texture, food presentation, overall meal satisfaction, knowing the available meal options, and sufficiency of potion size.</td></tr>
<tr><td>Freil, 2006[42] (N = 969)</td><td>- Patients were fairly positive about both individualized meal systems compared to the traditional fixed menu. There was an increase in satisfaction regarding meal appearance, taste, and general satisfaction.</td></tr>
<tr><td>Goeminne, 2012[43] (N = 189)</td><td>- In-patients preferred the meals on wheels system (i.e. being asked at mealtime how much and what they wished to eat) in the subdomains choice, sensation of hunger and food quality, compared to those served with the standard system.</td></tr>
<tr><td>Hartwell, 2007[44] (N=180)</td><td>- Patients who chose meals from a trolley at point of consumption reported improvements in temperature, flavour, texture and overall satisfaction compared to those served with the standard system</td></tr>
<tr><td>McCray, 2017[40] (N = 128)</td><td>- In-patients in the à la carte room service cohort reported improvements in all seven domains regarding food quality and foodservice compared to those who were served with a traditional food service model</td></tr>
<tr><td>Pietersma, 2003[35] (N=27)</td><td>- Patients who were able to decide what and how much to eat from an electric cart at bedside rated all items (i.e. food appearance, portion</td></tr>
</table>
</td><td>"A concise overview of evidence-based hospital foodservice interventions was created. Based on nine available high-quality studies, we conclude that several types of interventions have the potential to improve outcome measures. These interventions include the use of volunteers to provide mealtime assistance, encouraging patients to choose protein-rich foods, adding protein-enriched items to the menu, replacing existing items with protein-enriched items, ordering food by telephone from a printed menu, or a combination of the above. Health care institutions that wish to improve their foodservice might consider
one or more of these interventions."[10] (p. 23)</td></tr>
</table>

Table 5: Summary of Results Related to Patient Satisfaction from the Systematic Reviews

Main Study Results	Authors' Conclusion
size, variety and time of service) higher, except for meal temperature, than patients who ordered 24 h in advance and were delivered meal on thermal trays.	
Doyle, 2017, Australia[18]	
Systematic review that investigated the effect of foodservice interventions on nutritional outcomes and satisfaction of hospitalized and ambulatory adults with cancer. **Relevant primary studies**: The systematic review included one primary study that evaluated patient satisfaction related to food service delivery models relevant to the current review. Primary study citation: Pietersma, 2003[35] (N=27) Summary of relevant findings: - Patient satisfaction improved when patients were able to decide what and how much to eat from an electric cart at bedside - 95% preferred food cart service compared to tradition tray delivery - 90% preferred to choose food portions themselves - 94% preferred to choose foods themselves	"In conclusion, this review found that limited foodservice research has been conducted on the adult oncology patient population. Significant findings were found in favour of the intervention across a range of nutritional outcomes, suggesting that foodservice interventions can improve clinical outcomes and satisfaction of oncology patients, both in in-patient and ambulatory settings."[18] (p. 127)
Ottrey, 2016, Australia[19]	
Systematic review that investigated which strategies that provide menu choices to patients are effective in improving clinical and non-clinical outcomes in hospital **Relevant primary studies**: The systematic review included two primary studies that evaluated patient satisfaction related to food service delivery models relevant to the current review. Primary study citation: Folio, 2002[46] (N = 298) Summary of relevant findings: - There was improvement in patients satisfaction for "taste of food" (p = 0.0015),"courtesy of the server (p = 0.0001), "receipt of food ordered" (p = 0.0002) and overall satisfaction (p = 0.0001) among patients whose meal orders were taken close to mealtime using a spoken menu system compared to patients offered traditional printed menu service. Primary study citation: Oyarzun, 2000[47] (N 250) Summary of relevant findings: - Use of a spoken menu with meal orders taken close to lunchtime improved patient satisfaction for "food and nutrition staff attention" (p < 0.05) compared to traditional print menu collected 24 hours in advance.	"The major finding from this review is that there are few studies exploring the effect of menu interventions on outcomes in hospitals. The effect of menu strategies on clinical and non-clinical outcomes is unknown. The studies included in this review generally lacked methodological strength and the small number of studies conducted on any one menu concept or intervention and the quality of the evidence has made it difficult to establish a solid evidence base around the provision of menu choices to patients." [19] (p. 71)

Table 5: Summary of Results Related to Patient Satisfaction from the Systematic Reviews

<table>
<tr><th>Main Study Results</th><th>Authors' Conclusion</th></tr>
<tr><td colspan="2">Dall'Oglio, 2015, Italy[2]</td></tr>
<tr><td>Systematic review that investigated patient satisfaction with hospital foodservices

Relevant primary studies: The systematic review included four primary studies that evaluated patient satisfaction related to food service delivery models relevant to the current review.

<table>
<tr><th>Primary study citation</th><th>Summary of relevant findings</th></tr>
<tr><td>Williams, 1998[39] (N = 187)</td><td>- Both patients and parents were much more satisfied with room service meal delivery than with traditional meal service
- Excellent ratings increased by 35%</td></tr>
<tr><td>Hartwell, 2001[38] (N = 180)</td><td>- Patient satisfaction increased when there was choice at the point of consumption (trolley system).
- Enhanced overall satisfaction with respect to temperature, flavour, portion size, texture</td></tr>
<tr><td>Wadden, 2006[45] (N = 40)</td><td>- There was a significant increase of satisfaction in overall satisfaction quality, temperature, and variety of food after the implementation of a room service menu versus a traditional menu.</td></tr>
<tr><td>Kuperberg, 2008,[34] (N = 54)</td><td>- Room service improved patients' satisfaction with food temperature, perception of food, meal-serving times, and the perception that the food met their needs.</td></tr>
</table>
</td><td>"Exploration of patient satisfaction with ad hoc tools is tailored to the context of each hospital but limits the comparability of their results so that few firm conclusions can be reached. However, it can be affirmed that patients' satisfaction hospital foodservice does not only depend on food quality, but also on the way it is presented and delivered."[2] (p. xx)</td></tr>
</table>

Table 6: Summary of Results Related to Patient Satisfaction from Included Primary Studies

<table>
<tr><th>Main Study Results</th><th>Authors' Conclusion</th></tr>
<tr><td colspan="2">Sathiaraj, 2019, India[20]</td></tr>
<tr><td>A cohort study assessing a patient-centered food service model versus a traditional food service model for hospitalized oncology patients.

Comparison of patient-centered service model (PC) versus traditional food service model (TF) with respect to several clinical outcomes
<table>
<tr><th rowspan="2">Patient satisfaction</th><th colspan="2">Intervention cohort</th><th rowspan="2">Statistical significance (P-value)</th></tr>
<tr><th>PC (N = 100)</th><th>TF (N = 160)</th></tr>
<tr><td>Quality of food</td><td>28.6%</td><td>35.2%</td><td>NR</td></tr>
<tr><td>Timeliness of delivery</td><td>32.6%</td><td>37.1%</td><td>NR</td></tr>
<tr><td>Flavour of food</td><td>21.9%</td><td>37.1%</td><td>NR</td></tr>
<tr><td>Special/restricted diet explained</td><td>41%</td><td>41.9%</td><td>NR</td></tr>
<tr><td>Overall satisfaction</td><td>36.2%</td><td>42.9%</td><td>0.0000</td></tr>
</table>
N = number of patients; PC = patient-centered service model; SD = standard deviation; NR = not reported TF = traditional food service model.</td><td>"Based on the findings of this study, the patient-centred foodservice model was shown to be effective in significantly increasing foodservice satisfaction among Indian oncology patients. This flexible approach requires the organization and availability of sufficient staff to be able to assist with ordering and serving including co-ordination among the nutritionists, foodservice representatives and chefs. With more informed patients and caregivers and better hospital food service, the incidence of malnutrition can be decreased, and the patients experience improved within the context of oncology hospitals." [20] (p. 422)</td></tr>
<tr><td colspan="2">Dijxhoorn, 2018, Netherlands[21]</td></tr>
<tr><td>A cohort study that investigated the differences in protein intake of in-patients at each mealtime as a hospital transitioned from a traditional meal service to a "FoodforCare" meal service. Results from the same patient population are described in an included systematic review.[10]

Comparison of "FoodforCare" meal service (FfC) versus traditional meal service (TMS) with respect to several clinical outcomes
<table>
<tr><th rowspan="2">Patient Satisfaction</th><th colspan="2">Intervention cohort</th><th rowspan="2">Statistical significance (P-value)</th></tr>
<tr><th>FfC (N = 180)</th><th>TMS (N = 177)</th></tr>
<tr><td>Meal service
Food quality</td><td>7.84 ± 1.28
7.86 ± 1.46</td><td>7.71 ± 1.13
7.42 ± 1.35</td><td>0.29
0.09</td></tr>
</table>
FcF = "FoodforCare" meal service; N = number of patients; TMS = traditional meal service.</td><td>"Based on our results, we conclude that FfC improves protein intake and energy intake, while maintaining, and to some extent improving, patients satisfaction, within a short period of hospital stay."[21] (p. 2244)</td></tr>
<tr><td colspan="2">Bonetti, 2017, Italy[24]</td></tr>
<tr><td>A cross-sectional study that assessed patients' perception about quality of food and nutritional care</td><td>"Patients were satisfied with</td></tr>
</table>

Table 6: Summary of Results Related to Patient Satisfaction from Included Primary Studies

<table>
<tr><th>Main Study Results</th><th>Authors' Conclusion</th></tr>
<tr><td>No comparator. All hospitals used ready-made trays to deliver food to patients, and had an internal kitchen service. 91 (56%) interviews were conducted in medical wards and 70 (44%) were in surgical units.

The overall satisfaction level with food quality was good:
-92 (57%) patients thought it was "good"
-35 (22%) thought it was "acceptable"
-34 (21%) thought it was "inadequate"</td><td>nutritional care, but suggested improving food presentation and quality, as well as having more caregivers during mealtimes."[24] (p. 5090)</td></tr>
<tr><td colspan="2">Doorduijn, 2016, Netherlands[27]</td></tr>
<tr><td>A cohort study that investigated whether a meal service concept with a restaurant style menu card and room service improved patient satisfaction, nutritional status, and food intake compared to the traditional 3-meals per day service. Results from the same patient population are described in an included systematic review.[10]

Comparison of At Your Request (AYR), room service with a restaurant style menu cared versus traditional meal service (TMS).

<table>
<tr><th></th><th colspan="2">Intervention cohort</th><th>Max Score</th></tr>
<tr><th></th><th>TMS (N = 168)</th><th>AYR (N = 169)</th><th></th></tr>
<tr><td>Overall (SD)</td><td>124.5 (14.1)</td><td>132.9 (9.5)</td><td>162</td></tr>
<tr><td colspan="4">Scores per ward</td></tr>
<tr><td>Cardiology (SD)</td><td>121.1 (12.7)</td><td>135.2 (9.7)</td><td>162</td></tr>
<tr><td>Geriatrics (SD)</td><td>125.2 (11.5)</td><td>137.0 (7.5)</td><td>162</td></tr>
<tr><td>Oncology (SD)</td><td>124.1 (16.1)</td><td>131.2 (11.9)</td><td>162</td></tr>
<tr><td>Surgery (SD)</td><td>126.9 (14.7)</td><td>135.3 (7.6)</td><td>162</td></tr>
<tr><td>Neurology</td><td>125.2 (14.7)</td><td>128.4 (8.8)</td><td>162</td></tr>
<tr><td>Acute admission</td><td>122.9 (14.1)</td><td>131.6 (9.5)</td><td>162</td></tr>
<tr><td colspan="4">Scores per cluster of the NR-QoL</td></tr>
<tr><td>General (SD)</td><td>13.0 (2.2)</td><td>13.7 (2.3)</td><td>18</td></tr>
<tr><td>Supply (SD)</td><td>36.8 (6.1)</td><td>39.7 (4.8)</td><td>48</td></tr>
<tr><td>Quality (SD)</td><td>14.3 (1.8)</td><td>14.3 (1.7)</td><td>18</td></tr>
<tr><td>Presentation (SD)</td><td>8.8 (1.7)</td><td>9.6 (1.2)</td><td>12</td></tr>
<tr><td>Service (SD)</td><td>24.5 (2.9)</td><td>26.1 (2.0)</td><td>30</td></tr>
<tr><td>Autonomy (SD)</td><td>27.1 (3.9)</td><td>29.5 (2.5)</td><td>36</td></tr>
</table>
AYR = At Your Request; NR-QoL = Nutrition-Related QoL Questionnaire; SD = standard deviation; TMS = traditional meal service.</td><td>"Patients were more satisfied with the meal service after introduction of the At Your Request meal service concept than with three meals that need to be chosen one day ahead. Moreover, the meal service concept is able to maintain nutritional status and food intake. Further fine-tuning to stimulate the intake of protein-rich foods appears feasible and should be evaluated in the future." [27] (p. 1179)</td></tr>
</table>

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Appendix 5: Overlap between Included Systematic Reviews

Table 7: Primary Study Overlap between Included Systematic Reviews

Primary Study Citation	Systematic Review Citation			
	Dijxhoorn, 2019[10]	Doyle, 2017[18]	Dall'Oglio, 2015, Italy[2]	Ottrey, 2016[19]
Dijxhoorn, 2017[21]	X			
Doorduijn, 2015[27]	X			
Edwards, 2006[41]	X			
Folio, 2002[46]				X
Freil, 2006[42]	X			
Goeminne, 2012[43]	X			
Hartwell, 2001[38]			X	
Hartwell, 2007[44]	X			
Kuperberg, 2008[34]			X	
McCray, 2017[40]	X			
Oyarzun, 2000[47]				X
Pietersma, 2003[35]	X	X		
Wadden, 2006[45]			X	
Williams, 1998[39]			X	