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Plate waste in hospitals and strategies for change

Abstract

Plate waste in hospitals refers to the served food that remains uneaten by patients. High levels of plate waste contribute to malnutrition-related complications in hospital, and there are also financial and environmental costs. Plate waste is typically measured by weighing food or by visual estimation of the amount of food remaining on the plate, with results presented as the percentage by weight of the served food, or by calculating the protein, energy or monetary value of the waste. Results from 32 studies in hospitals show a median plate waste of 30% by weight (range: 6-65%), much higher than in other foodservice settings. Levels are lower in hospitals using a bulk food delivery system compared to plated meal delivery. Reasons for these high levels can relate to the clinical condition of patients, food and menu issues (such as poor food quality, inappropriate portion sizes, and limited menu choice), service issues (including difficulty accessing food and complex ordering systems), and environmental factors (such as inappropriate meal times, interruptions, and unpleasant ward surroundings). Strategies to minimize waste include reduced portion sizes with food fortification, bulk meal delivery system, feeding assistance, provision of dining rooms, and protected meal times.

Keywords

food service, hospital, waste

Disciplines

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ABSTRACT

Plate waste in hospitals refers to the served food that remains uneaten by patients. High levels of plate waste contribute to malnutrition-related complications in hospital, and there are also financial and environmental costs. Plate waste is typically measured by weighing food or by visual estimation of the amount of food remaining on the plate, with results presented as the percentage by weight of the served food, or by calculating the protein, energy or monetary value of the waste. Results from 32 studies in hospitals show a median plate waste of 30% by weight (range: 6-65%), much higher than in other foodservice settings. Levels are lower in hospitals using a bulk food delivery system compared to plated meal delivery. Reasons for these high levels can relate to the clinical condition of patients, food and menu issues (such as poor food quality, inappropriate portion sizes, and limited menu choice), service issues (including difficulty accessing food and complex ordering systems), and environmental factors (such as inappropriate meal times, interruptions, and unpleasant ward surroundings). Strategies to minimize waste include reduced portion sizes with food fortification, bulk meal delivery system, feeding assistance, provision of dining rooms, and protected meal times.

INTRODUCTION

Undernutrition of hospital inpatients has been a problem recognised for nearly 40 years¹ and many studies find from 25-40% of acute hospital patients are malnourished.² It is therefore now acknowledged that provision of meals should be regarded as an essential part of treatment of patients and not just a hotel service.³ However simply planning and providing adequate nutritious food is ineffective if it is not eaten and serving larger portions is not a valid strategy to improve energy intake.^{4, 5} High food wastage is associated with reduced energy and protein intakes and has an impact on malnutrition-related complications.⁶ There is a two-fold increase in the risk a patients dying during a hospital admission if they eat only one-quarter of the food provided.⁷ Unfortunately there is still a disappointing lack of evidence to support interventions to improve this problem.⁸

In hospitals, food can make up to 50% of the total waste generated in a ward environment^{9, 10}, and in addition to the nutritional implications of this waste, there are financial and environmental concerns as well. It has been estimated that in 2000 the food wasted in British hospitals was worth £28 million¹¹ Virtually all food waste in hospitals today is thrown away, with very little composting or recycling¹² and the resultant organic is both expensive to dispose of¹³ and in landfill produces methane – a potent greenhouse gas.¹⁴ Furthermore, patient satisfaction can be affected, since patients report being upset by the amount of food being wasted.^{15, 16} For all these reasons, reducing food waste has become a priority in hospital foodservice management.¹⁷⁻¹⁹

Although food waste can occur at all steps in the foodservice system, including storage, ingredient preparation, cooking and service, the largest losses are at the last step, at the point of consumption.²⁰ Measures of plate waste – that is food that is served but not eaten – have been used to provide feedback on food acceptability to help plan menu changes²¹ and to monitor the adequacy of food intakes.²² They also provide one measure of the efficiency of the meal provision. Plate waste in hospitals has always been much higher than other foodservice sectors. Restaurants, cafes, schools and workplace canteens usually have levels of plate waste of less than 15%²³⁻²⁸; in hospitals, plate waste can be two or three times higher.²⁹

The aim of this narrative review is to summarise the literature on the extent of plate waste in hospital inpatient populations and methods for its measurement, and to examine the likely causes and possible strategies to reduce plate waste. To identify relevant articles a search of the literature for original studies and reviews was carried out in the following databases: Scopus; Pubmed, Medline and Cinahl over all dates to March 2011, using combinations of the search terms: “hospital”, “food”, “waste” and “plate waste”. Studies were limited to those published in English. The references in retrieved papers were examined individually to supplement the electronic search.

For the purposes of this review, articles were primarily chosen which reported results for plate waste with inpatients in hospital settings. Results from some other healthcare settings such as nursing homes were included for comparison purposes only. A total of 274 articles were identified from the initial search and

their abstracts reviewed. Of these only 60 were directly relevant to the topic. Hand searching of bibliographies added a further 29 primary references.

METHODS TO ASSESS PLATE WASTE

Plate waste refers to the volume or percentage of the served food that is discarded. There are two main measurement methods that have been used: weighing or visual estimation. Weighing involves collecting all food waste and recording either the total bulk amount for a population (eg, all meals from one ward), or the total food remaining on each individual tray, or the weights of each food component on each plate. The latter system is necessary if the data is to be analysed for its nutrient content – either by calculation or analysis. The weighed method is the most accurate, but requires significant resources and time to complete and can therefore be difficult to implement without disrupting or delaying normal foodservice operations. However it has been used successfully in many studies.³⁰⁻³³

Visual estimation uses a scale to measure approximately what proportion of food is left. A number of different scales have been used. The most extensive are a 7-point scale (all, one mouthful eaten, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, one mouthful left, none)³⁴ and the Comstock 6-point scale³⁵ (all, one bite eaten, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$, none). Other scales that have been used are the 5-point scale (all, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$ or less, none or almost none)³⁶, a 4-point scale (all, $\frac{1}{2}$, $\frac{1}{4}$, none)⁷ and a 3-point scale (all, $\geq 50\%$, $< 50\%$).³⁷

Visual estimation methods introduce problems of subjectivity into the assessment, and inter-observer reliability can be a problem, but they have been validated against weighed waste and found to give reasonably good approximations.^{34, 36, 38} However there are some inaccuracies with this method that can reduce the statistical significance of results.³⁹⁻⁴¹ A recent innovation has been to use digital photography to record the food waste, which can minimise disruptions and allow unhurried estimates of portion sizes at a later time.⁴²

Results of plate waste estimates are most commonly presented as the percentage by weight of the served food remaining uneaten. However, in some studies the results are presented in terms of the energy value of the meal or the protein content³², or even the monetary value of the waste.^{6, 43} Clearly, to calculate these values requires information on each different food type wasted. If percentage food weight is the only measure, then methods where all waste is combined together before weighting can be used to simplify measurement. This aggregate method has been used extensively in studies of school children⁴⁴ but relatively rarely in hospital studies, where most researchers have wanted to calculate the energy and protein value of wasted food, which requires measurement of individual food components.⁴⁵

EXTENT OF PLATE WASTE IN HOSPITALS

Some previous articles have reported on studies of food waste in hospitals, but they have only presented a few selected results. In 2003 Edwards and Hartwell summarised four studies in the UK²⁹ and Williams et al reported the results from

six hospital and three nursing home studies.⁴⁶ Table 1 summarises the results of 32 studies, carried out in 29 countries over the past 50 years.

The range of the results is wide (from 6-65%), but the median reported waste was 30% of the plated food weight, 27% of the energy content served and 26% of the protein provided. Furthermore, there does not seem to have been any general trend to lower levels of waste over time. There was no significant difference in the mean reported waste (percent by weight) comparing studies before and after 2000 (29.4 ± 12.3 vs 29.8 ± 15.0 ; $p=0.943$). These levels are higher than those found in other healthcare settings. In nursing homes, where patients more typically eat in dining room settings, plate waste has been reported between 7% and 27%.^{34, 47-52}

In six of the hospital studies, plate waste was compared between a plated meal service and a bulk service (where meals were plated and served in the ward). All six studies found significantly less plate waste with the bulk system – typically around 50% less – but often there was considerable unserved bulk waste in the food trolleys.^{31, 32, 53-56}

The median level of waste of energy and protein was usually somewhat lower than the food weight, suggesting that the foods not eaten were those that are less nutrient dense.

Sources of waste

The amount of food wasted varies by meal and by food type. Most studies have found that there is less plate waste at breakfast compared to other main meals^{31, 43, 49, 57-60}, although this is not a universal finding.⁶¹ Only a few studies have reported the actual foods wasted, but there seems to be more waste of vegetables compared to main meat dishes. Frakes et al found over 40% of served vegetables remained uneaten compared to only 18% of entrées³⁰, and others have found a similar pattern.^{47, 62} This may reflect a generally lower liking for vegetables by inpatients⁶³, or it might be a result of poor cooking practices.

REASONS FOR PLATE WASTE

There are many reasons why plate waste in hospitals is higher than in other settings – some related to the nature of the patient population, and some to the foodservice systems.¹⁸ Table 2 summarises the variety of reasons identified in the literature under four broad categories: clinical, food, service and environmental issues.

Several studies have used patient interviews or observational methods to understand the issues affecting food consumption in hospital. In one UK study, low appetite accounted for 40% of all patients' reasons for leaving food, meal quality issues made up 27%, and 19% stated it was because portion sizes were too large.⁵⁷ Loss of appetite was also the most common reason in a US study which found that this, along with taste loss, made up 28% of the reasons patients consumed less than half of the main entrée.⁶⁴ In a Swiss study, half of the

patients declared they had less appetite than at home.⁶⁵ This is not unexpected, since illness can often affect appetite and the senses of taste or smell. Reduced activity while in hospital, and drugs causing anorexia, nausea or gastrointestinal symptoms, can also interfere with the normal desire to eat. Many diet prescriptions, such as texture modification or low salt, reduce the sensory appeal of food, and it has been estimated that being on a special diet doubles the risk of insufficient energy intake.⁶⁶ Furthermore, physical constraints such as eating in bed, having immobilised limbs, or age-related declines in functional ability and dental problems, can all significantly affect food consumption.⁵⁰

There is probably only limited opportunity to overcome these clinical barriers to consumption, but the issues related to food quality, service and the ward environment should be more amenable to improvement. Overly large portion sizes are reported as a problem in several studies, particularly for older patients, but there may be difficulties reducing meal sizes while still meeting nutritional requirements. Lack of ability to select foods, and inappropriate or limited choice options, especially for long stay patients who experience menu fatigue, all increase waste. The odds of plate waste increased by 14% for every additional day a patient was admitted in one study.³⁷ With a plated meal service, patients normally have to order meals a long way in advance of meal service time. This may explain the greater waste with this system, since fickle appetites may change by the time the food arrives. Accessing food in portion control packaging is also emerging as a significant problem for many patients in recent studies.^{16, 67}

A Dutch study that looked at correlations of plate waste with a range of patient and environmental variables concluded that, aside from appetite, the movement of others in and out of patient rooms was the most significant predictor of increased plate waste.⁶⁸ This suggests that organisational changes to reduce meal interruptions could be an important way to support greater meal consumption, and has been one of the reasons for the introduction of protected meal times in many UK hospitals.⁶⁹

STRATEGIES TO REDUCE WASTE

Almost 100 years ago, staff were looking for ways to reduce waste of food in military hospitals, focussing on portion control and food quality.⁷⁰ Today it is recommended that food wastage and food intake should be monitored and audited regularly, with modification of policies as necessary.⁴ The Council of Europe document on prevention of undernutrition in hospitals recommends that this should be part of the quality management system of every hospital, with the formal involvement of administrative, medical, nursing, dietetic and catering staff, taking into account the costs of medical complications and prolonged hospital stays.⁷¹

There are many approaches that have been recommended to increase patient meal consumption and reduce waste. The British guidelines for managing food waste in the NHS include checklists with over 60 measures that aim to minimize waste.¹⁸ Table 3 summarises those strategies that have been trialled and evaluated in the literature. The most common measures have been those that

have tried changing portion sizes, increasing food choice, greater feeding assistance for patients, and changes to the meal delivery system.

Simply increasing meal frequency with smaller meals does not increase food intakes in elderly patients.⁷² Several studies where portion sizes were reduced have led to reductions in plate waste, but nutrient intakes did not seem to improve unless this was combined with efforts to increase the nutrient density of the food.⁷³⁻⁷⁷ Increasing the ability of patients to choose their food (with selective menus and greater ranges of choice) also seems successful in reducing waste. Similarly, a bulk food service (or buffet) system, where patients choose their foods at the time of service, has consistently been shown to reduce plate waste. This method of service is still common in UK hospitals, and has recently been introduced into a Danish hospital in an attempt to increase patient food intake, although an evaluation study found that more than half of the patients at nutritional risk still had less than 75% of their energy requirements covered by the food.⁷⁸ However, such systems have been largely replaced by pre-plated meals in many other countries, with moves to centralised cook-chill food production systems.^{79, 80}

Bulk service has the advantage of allowing portion sizes to be individualised according to patient demand. An alternative (but more expensive option) is the introduction of room service ordering and delivery of meals. These approaches appear to reduce waste and improve patient satisfaction, probably because patients are choosing their food close to the time of consumption, and also because it overcomes the problem of fixed meal times, which may not coincide

with when patients feel like eating. However, in both these systems there is the possibility that undernourished patients might choose meals that are inappropriate in terms of energy density, nutritional content or portion size, and there needs to be careful planning of patient education, menu information, and monitoring of intake by nursing and dietetic staff.⁸¹

The few studies providing feeding assistance to patients have produced some inconsistent results. One British study reported non-significant trends to increased food intake in patients⁸², but other studies have shown reductions in plate waste when patients are assisted to open food packaging and encouraged to eat.^{83, 84} Part of the success of this strategy probably comes from the increased social interaction at mealtimes, and this may explain the value of providing patient meals in dining room settings, rather than at the bed, where this is possible.⁸⁵ Protected meal times, which ensure that the service and consumption of meals is not interrupted by ward rounds or patient procedures, are likely to address some of the environmental problems leading to wasted meals. They were a national initiative launched in 2004, as part of the Better Hospital Food Programme in the UK, and appear to have reduced food waste in several evaluation reports.⁸⁶⁻⁸⁸

Some of these potential strategies (such as protected meal times) can be relatively simple to implement without great expense, while others (such as provision of dining rooms) would require greater investment in new facilities and possible additional staffing. Combining the considerations of effectiveness and feasibility, the following hierarchy of interventions (from easiest and

cheapest to most complex and costly) could be suggested to hospital administrators to address the problems of excessive hospital plate waste, with its adverse effects on patient food intake:

- 1) Improve the quality and presentation of food, to increase its appeal and acceptability to patients
- 2) Offer flexibility of meal portion sizes, to match patients' appetites
- 3) Increase the range of food choices offered to patients
- 4) Introduce Protected Meal Times, to minimise meal interruptions
- 5) Use nutrition assistants to help and encourage patients to make appropriate menu choices
- 6) Provide greater feeding assistance to patients at meal times, especially targeting those at greatest nutritional risk
- 7) If using a pre-plated system, change to a bulk meal delivery system
- 8) Provide communal dining rooms for mobile patients to eat meals.

No single change alone is likely to be sufficient to solve the intractable problem of excessive plate waste in hospitals, but a sequential trial and evaluation of these potentially effective approaches could provide a structured approach to a quality improvement process in a cost-effective manner.

Furthermore, there are other possible intervention strategies, related to the reasons for waste listed in Table 2, that have yet to be formally evaluated for effectiveness. These could include:

- Training of nursing and foodservice delivery staff to ensure they avoid any negative comments about the food, and actively encourage patients to eat
- Improvements in menu ordering systems, to reduce the time between ordering and receipt of meals
- Improvements in food packaging, to allow easier opening by patients with limited manual dexterity or strength
- Changes to delivery schedules to more normal mealtimes, especially to ensure the evening meal is not served too early.

CONCLUSIONS

Is there such a thing as a reasonable or acceptable level of plate waste in hospital foodservices? The very high levels recorded in many of the studies reviewed here suggest that more needs to be done to support adequate patient food intakes and improve operational efficiency. However zero wastage should not be target: when dealing with a sick population, many of the complex reasons for waste are not going to be changed. Some attempts have been made to develop targets for acceptable plate waste levels, ranging from 10-30%^{18, 29, 46}, but ultimately it is important for each institution to monitor their own performance and strive to find effective ways to improve the nutritional intakes of their vulnerable patients.

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Table 1. Summary of 32 studies in hospitals showing percentage plate waste by food weight, or energy or protein content

Study	Hospitals	Patients and/or meals	Service System	Method	Weight	% waste mean \pm SD (range)	
						Energy	Protein
Platt et al 1963 ⁴⁵	UK 152 hospitals	M & F 1 ward in each hospital	Bulk	Weighed	10 \pm 0.4		
Hirsch et al 1979 ⁵⁸	USA 1 University hospital	369 M & F	Not stated	5-point visual estimation	-	9.1 (selective menu) 16.7 (non-selective menu)	
Banks & Collison 1981 ²⁴	UK 3 hospitals	Not stated	Not stated	Weighed		15.1	
Frakes 1986 ³⁰	USA 1 University hospital	611 meals	Plated	Weighed	21.3		
Deutekom et al 1991 ⁶⁸	The Netherlands 1 teaching hospital	342 meals	Not stated	Weighed	42.7		
Al-shoshan 1992 ⁴³	Saudi Arabia 18 hospitals	554 M & F	Plated	Weighed	28.9		
Fenton et al 1995 ⁵⁹	UK 1 large psychiatric hospital	Elderly females 189 meals	Bulk	Weighed		21 \pm 23.7 (0-41)	
Hong & Kirk 1995 ⁵⁷	UK 11 hospitals	M & F 6469 meals	Not stated	Weighed	13.9 \pm 18.3 (8.0-16.5)		

Stephen et al 1997 ⁸⁹	UK 1 general hospital	M & F 600 meals	Not stated	Weighed	31 (surgical) 34 (medical) 35 (orthopaedic) 42 (elderly)		
Edwards and Nash 1999 ³¹	UK 4 hospitals – medical and surgical	623 M & F	Plated and bulk	Weighed	35.3 (plated) 27.8 (bulk) (17.0-51.6)		
Kelly 1999 ⁵³	UK 1 rehabilitation hospital	37 M & F (lunch and evening meals only)	Plated and bulk	Weighed	49.0 (plated) (37.0-56.7) 11.8 (bulk) (8.3-18.0)		
Barton et al 2000 ⁶	UK 1 University hospital	M & F 2529 patient days	Plated	Weighed	35		
Barton et al 2000 ⁷⁴	UK 1 University Rehabilitation ward	35 M & F 980 patient days	Plated	Weighed	32 (27-42)		
Allison et al 2000 ⁷³	UK 1 University hospital	1 ward of elderly patients 28 days	Plated	Weighed	42		
Wilson et al 2000 & 2001 ^{32, 90}	UK 1 general hospital	M & F 108 meals	Plated vs bulk	Weighed	33.5 (plated) 14.5 (bulk)	36.0 (plated) 13.4 (bulk)	26.4 (plated) 23.8 (bulk)
Kowanko et al 2001 ⁶¹	Australia 1 teaching hospital	M & F 585 meals	Plated	Visual estimation		42.9	30.1
Yang et al 2001 ⁹¹	Korea 1 general hospital	M & F 102 patients	Not stated	Weighed	30.3±7.3 (normal diet) 49.6±22.4 (soft diet)		

Hamilton et al 2002 ⁹²	UK 7 community hospitals	Elderly M & F 647 meals	Not stated	5-point visual estimation	18		
Marson et al 2003 ⁵⁶	UK 1 general hospital	M & F Renal ward 75 lunch meals only	Plated vs bulk	Weighed	65±3.8 (plated) 17±5.9 (bulk)		
Dilly & Shanklin 2003 ³³	USA 2 military hospitals	Not stated	Not stated	Weighed	42.3-45.5		
Hartwell & Edwards 2003	UK 1 general hospital	M & F 31 patients	Plated vs bulk	Weighed	11.6±3.0 (plated) 5.9±1.9 (bulk)		
Almdal et al 2003 ⁹³	Denmark 1 general hospital	Not stated 1 month study	Bulk	Weighed		27.9	29.4
Dupertuis et al 2003 ⁵	Switzerland 1 University hospital	M & F 1416 patients	Plated	4-point visual estimation		23.4	26.4
Freil et al 2006 ⁵⁴	Denmark 1 University hospital	M & F 641 patients	Plated vs bulk	Weighed	48 (plated) 21 (bulk)		
Nonino-Borges et al 2006 ⁹⁴	Brazil 1 University hospital	M & F 650 meals	Not stated	Weighed	22		
Walton et al 2007 ⁹⁵	Australia 3 general hospitals	M & F 30 patients in rehabilitation wards	Plated	Weighed		30.4	29.5

Sohn & Yeom 2008 ⁹⁶	Korea 1 general hospital	39 patients on diabetic diets	Not stated	Weighed	23.2			
Iff et al 2008 ⁴	Switzerland 1 University hospital	Not stated	Plated	Not stated	22-30			
Hiesmayr et al 2009 ⁷	25 European countries 256 hospitals	16, 290 patients One lunch meal only	Not stated	4-point visual estimation	18			
Thibault et al 2010 ⁶⁶	Switzerland 1 University hospital	M & F 1291 patients over one day	Plated	4-point visual estimation		27.2	25.3	
Mudge et al 2011 ⁹⁷	Australia 1 large teaching hospital	M & F ≥65y 134 patients for one day	Plated	6-point visual estimation		34		
Hickson et al 2011 ⁹⁸	UK 2 large teaching hospitals	60 patients One lunch meal only	Plated	Weighed		37	59	
Overall						Median 30 (6-65) n=32	Median 27 (9-43) n=13	Median 26 (24-59) n=8

Table 2. Reasons for plate waste in hospitals

		References
Clinical issues	Poor appetite (illness; medication)	16, 18, 57, 58, 64, 65, 68, 97, 99, 100
	Special diets - texture modified diets	16, 37, 66, 101
	Changes in sense of taste or smell	64, 102
	Dysphagia – swallowing difficulty	64, 97
	Pain/ too sick/ stress from treatment	64
	Cognitive problems (confusion; inability to recognise food)	18
	Long length of stay	16, 37
Food and menu issues	Portion sizes too large	16, 18, 24, 57, 64, 65, 68, 73, 100
	Food quality (not tasty/too spicy/over or undercooked food)	16, 18, 50, 57, 64, 100
	Menu choice (Limited food choice/lack selective menu/dislike food choices)	16, 18, 50, 64, 68
	Food presentation (not hot enough; poor appearance)	16, 18, 57, 65
Service issues	Physical problems (packaging; food out of reach; immobility; need for feeding assistance)	16, 18, 50, 97, 100, 103
	Plated food systems	16, 32, 51, 90, 104
	Ordering problems (insufficient information)	100, 103
	Negative attitude of those serving food	18
	Incorrect items delivered	16, 64
Environmental issues	Meal time inappropriate	16, 18, 64, 100, 103
	Ward environment (eg others moving; noise; smells)	16, 68, 100, 103
	Insufficient time to eat (slow eaters)	16, 18, 103
	Meal interruptions (ward rounds; tests)	18, 103

Table 3. Strategies to reduce plate waste in hospitals

	Strategies	References
Clinical issues	Flavour enhanced foods and appetite stimulants	102, 105
Food and menu issues	Flexibility of portion size ordering/reduced portion sizes	18, 72-77
	Selective menus/ increased choice	18, 50, 62, 106
	Improved food quality	96
	Improved presentation (eg temperature or appearance)	81
Service issues	Setting up, opening packaging, and feeding assistance	15, 82-84
	Bulk food service	55, 56, 107
	Room service delivery	64, 108, 109
	Assistance with meal ordering/ improved ordering system	18, 54
Environmental issues	Protected mealtimes	18, 69, 103
	Dining room for meals	18, 85, 110