The barriers to surgical patients' oral intake in the acute hospital setting

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Science

in

Nutrition and Dietetics

Massey University, Albany

New Zealand.

Olivia Stone

2018

Abstract

Background: Hospital patients worldwide often do not eat all of their meals, resulting in suboptimal food intakes. These patients are more likely to experience numerous undesirable health outcomes as a consequence of not meeting their nutritional requirements.

Aim: To investigate the barriers to surgical patients' oral intake in an acute hospital setting in New Zealand (NZ).

Objectives: To conduct a pilot study to test the usability of the validated Patient Mealtime and Nutrition Care Survey (PMNCS) in a NZ setting, and to adapt the PMNCS to include the most relevant barriers to oral intake in NZ. Further, to conduct a feasibility study to test the effectiveness of the NZ-PMNCS independently, and paired with patient meal observations to confirm the effectiveness of the tool.

Methods/Design: A single-centre cross-sectional study conducted at North Shore Hospital, NZ. A sample of 100 surgical in-patients participated in the pilot study and 65 patients in the feasibility study.

Results: The most frequently reported barriers were food brought into the hospital by visitors (81.5%) and a loss of appetite (70.8%). Six barrier domains were explored revealing significant findings for: younger (<65 years) compared to older (≥65 years) age associated with more hunger domain barriers (1.47 ± 0.81 versus 0.90 ± 0.67, *P*=0.003); longer (>5 days) versus shorter (≤5 days) length of stay associated with more food quality domain barriers (1.20 ± 1.26 versus 0.40 ± 0.81, *P*=0.003). Comparing the NZ-PMNCS and meal observation results showed that patients consuming ≤½ of their meals more frequently reported inability to make informed menu choices (50.0%)(*P*=0.027) and that consumption of their prescribed nutritional supplements affected their food intake negatively (50%)(*P*=0.001).

Conclusion: Compared to earlier studies using previous versions of the PMNCS, the NZ-PMNCS captured similar results in the NZ hospital setting. Key issues identified include a younger age being associated with experiencing more hunger domain barriers, and patients consuming less food experienced difficulty choosing menu options and found prescribed nutritional supplements interfered with their food intake. The NZ-PMNCS was practical to use and feasible in identifying barriers to food intake. These findings could contribute to changing practices to improve hospital food intake.

Keywords: barriers, oral intake, foodservice, surgical patients, hospital

Acknowledgements

There are numerous people that I would like to acknowledge for their contributions throughout my research project. I would like to start by thanking the 165 patients at North Shore Hospital, who participated in this study, for volunteering their time. Without sharing their honest thoughts and experiences this project would not have been possible.

I would like to thank my Massey University supervisors Rozanne Kruger and Deirdre Johnson, you have been incredibly supportive over the last two years and I have enjoyed working with you both. Rozanne, thank you for your guidance and feedback, your wealth of knowledge has been extremely helpful from the beginning to the end of this project. Deidre, thank you for your encouragement and input getting this project started. To the wider Massey University staff within the Institute of Food, Nutrition and Human Health, your help along this journey has not gone unnoticed.

I owe another thank you to my Medirest supervisor, Laura Mash, and advisor, Charlotte Moor. Laura, thank you for all of the advice, from a foodservice point of view, you have given throughout the duration of this project. Charlotte, I appreciate all of the help you provided coordinating and getting this research project up and running.

To the Charge Nurse Managers, Susan Johnston, Roslyn Bell, Frances Scheirlinck and Suzanne Huskinson, thank you for allowing me to be in and amongst your wards. I appreciate you all taking time out of your busy schedules to facilitate data collection. Thank you also to Roslyn Norrie, for coordinating all foodservice related matters at North Shore Hospital.

I would like to thank all of my class mates for your continual support. I look forward to progressing onto the next chapter in our lives. I can't wait to see what the future holds for each and every one of us.

To my family, Mum, Dad and Hamish, I don't think this would have been possible without you. You have provided me with so much encouragement and continually kept me motivated throughout this research project. I don't know if I can ever repay you for your assistance and ongoing emotional and financial support! Lastly, to all of my friends who constantly reminded me that anything was possible, you mean so much to me.

Table of Contents

List of Tables

Chapter 1. Introduction

Chapter 3. Research Study Manuscript

Appendix A. Supplementary Results

List of Figures

Chapter 1. Introduction

Chapter 3. Research Study Manuscript

Abbreviations

ANCDS - Australasian Nutrition Care Day Survey
BMI - Body Mass Index
CI - Confidence Interval
HDEC - Health and Disability Ethics Committee
MAT - Mealtime Audit Tool
MST - Malnutrition Screening Tool
MUHEC - Massey University Human Ethics Committee
NBM - Nil by Mouth
NZ - New Zealand
NZ-PMNCS - New Zealand Patient Mealtime and Nutrition Care Survey
ONS - Oral Nutritional Supplements
PMNCS - Patient Mealtime and Nutrition Care Survey
PONV - Postoperative Nausea and Vomiting
RDI - Recommended Daily Intake
REE - Resting Energy Expenditure
RR - Relative Risk
SD - Standard Deviation
SE - Standard Error
SGA - Subjective Global Assessment
SPSS - Statistical Package for the Social Sciences
TPN - Total Parenteral Nutrition
UK - United Kingdom
USA - United States of America
WDHB - Waitemata District Health Board

Chapter 1. Introduction

1.1 Background

Nutrition plays an important role in the health and wellbeing of all individuals. The food and drink we consume on an everyday basis provides us with the nutrients we need to survive. It is important we meet our requirements to ensure optimal health in the contexts of physiological, social, environmental and spiritual wellbeing (Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999). Within the acute hospital setting, nutrition plays a crucial role in promoting recovery and preventing undesirable health outcomes for patients (Dupertuis et al., 2003; Naber et al., 1997). The majority of patients in hospital are able to eat and drink a variety of foods and fluids orally, these patients will be the focus of this thesis.

Although the benefits for adequate nutrition are known, it has been observed that many patients around the world do not eat the meals they have been provided with while in hospital; these patients are predicted to have a suboptimal intake (Agarwal et al., 2012; Barton, Beigg, Macdonald, & Allison, 2000; Dupertuis et al., 2003; Kondrup et al., 2002). This is concerning as they are unlikely to be meeting their nutritional requirements based on the amount of hospital food they are consuming, which is associated with many undesirable health outcomes (Almdal, Viggers, Beck, & Jensen, 2003; Barton et al., 2000; Dupertuis et al., 2003; Kondrup et al., 2002). These issues are compounded by the fact that energy and protein requirements for patients often increase while in hospital (Dietitians New Zealand Inc, 2016). A study conducted across Australia and New Zealand (NZ) highlighted that 23% of patients only consumed ≤25% of the offered hospital food (Agarwal et al., 2013). Many international studies have reported similar findings, in the United Kingdom (UK) patients met less than 80% of their recommended energy and protein needs, and in Switzerland 70% of patients did not consume enough to meet their recommended nutritional requirements (Barton et al., 2000; Dupertuis et al., 2003).

While in hospital, patients who have a sustained suboptimal intake are likely to experience weight loss during their admission (Löser, 2010). A review article by Löser (2010) found that clinical studies reported 30% to >80% of inpatients lose a substantial amount of weight during their hospital stay. Weight loss varied between studies, as it depended on the hospital specialty and the type of patient population that was being investigated. Significant weight loss correlates to an increased risk of becoming malnourished while in hospital (Agarwal et al., 2013). Hospitals across NZ commonly use the National Institute for Clinical Excellence (NICE) guidelines to diagnose malnutrition. To be diagnosed patients must have a Body Mass Index (BMI) <18.5 kg/m^2, or unintentional weight loss >10% within the last 3-6 months, or BMI <20 kg/m^2 and unintentional weight loss >5% within the last 3-6 months (National Institute for Clinical Excellence, 2006). In Australia and NZ, it was found that 28% of patients were found to be malnourished on admission and 32% of hospital in-patients were malnourished, calculated through the use of the Malnutrition Screening Tool (MST) followed by the Subjective Global

Assessment (SGA) (Agarwal et al., 2013). Not only is the prevalence of malnutrition high on admission, the prevalence increases within hospitals, highlighting patients are nutritionally deteriorating within our health care system (Agarwal et al., 2013). As shown in **Figure 1.1**, a compromised nutritional status directly impacts a patient's underlying disease and can also impact the complications a patient may experience (Naber et al., 1997).

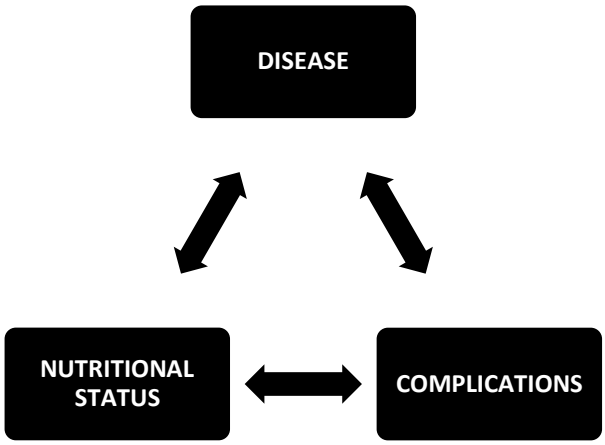

Figure 1.1: *Mutual relations between nutritional status, underlying disease, and complications during the course of the disease (Naber et al., 1997).*

Reprinted from *Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications*, by Naber et al., 1997, The American Journal of Clinical Nutrition, 66(5), 1232-1239. Copyright 1997 by American Society for Clinical Nutrition. Reprinted with permission.

There are many consequences for patients who are undernourished, which are highlighted in **Table 1.1**. Patients who have a sustained suboptimal intake, leading to undernutrition or malnutrition, can experience an increased number of complications during their admission (Löser, 2010; Robinson, Goldstein, & Levine, 1987). The length of hospital stay and readmission rate can both increase for patients who have a deteriorated nutritional state (Löser, 2010; Sullivan, Sun, & Walls, 1999). Other correlations to undernutrition include increased morbidity, decreased quality of life and increased mortality (Löser, 2010). These health outcomes place additional stresses on patients, their families, health care workers and hospital resources. Patients who are not eating their meals contribute to the amount of hospital food wasted, which can also lead to many environmental and social implications (Goonan, Mirosa, & Spence, 2014; Sonnino & McWilliam, 2011).

Research studies report the clinical consequences of poor nutrition from a variety of patient wards and hospital specialties. Results reported exclusively from surgical patients reflect the same themes as the wider hospital population. Many surgical patients also have a suboptimal intake during their admission, which can lead to weight loss (Agarwal et al., 2013; Bruun, Bosaeus, Bergstad, & Nygaard, 1999). In NZ, 52% of surgical patients in the acute setting were considered malnourished or at risk of malnutrition on admission (Kahokehr et al., 2010). The consequences of poor nutrition for surgical patients also includes an increased length of stay,

more frequent readmissions, decreased quality of life and increased morbidity and mortality (Bruun et al., 1999). Poor nutrition and malnutrition in surgical patients can additionally lead to a decrease in muscle function, respiratory function and immune function (Bruun et al., 1999). Surgical patients that are malnourished or have suboptimal preoperative food intake also have an impaired wound healing response (Bruun et al., 1999; Haydock & Hill, 1986; Windsor, Knight, & Hill, 1988).

Table 1.1: *Clinical consequences of progressive under-/ malnutrition demonstrated in scientific studies (Löser, 2010).*

Immunocompetence	↓
Rate, duration, and severity of infections	↑
Overall complication rate	↑
Healing disorders, decubitus ulcers	↑
Immobility, risk of falling	↑
General health	↓
Mental state	↓
Need of help and care, infirmity	↑
Tolerance of treatment	↓
Quality of life	↓
Morbidity	↑
Mortality	↑
Prognosis	↓

Note: Reprinted from *Malnutrition in hospital: The clinical and economic implications*, by C. Löser, 2010, Deutsches Arzteblatt International, 107(51-52), 911-917. Copyright 2010 by Deutsches Arzteblatt International. Reprinted with permission.

Surgical patients are of particular interest as they not only have an increased risk of complications due to a suboptimal intake, they often have a unique nutritional journey while in hospital. After surgical procedures, it is common for patients to receive a postoperative diet to aid faster recovery and prevent complications (Ljungqvist, Scott, & Fearon, 2017). Postoperative diets vary, but often include a variety of diet codes such as clear oral fluids, smooth puree, minced and moist, finally progressing to a normal diet. Some patients who have undergone major surgery or have postoperative complications may have a delayed transition back onto a normal diet, in these cases nutritional support is available (Huckleberry, 2004). One form of nutritional support commonly used are oral nutritional supplements (ONS), which have shown to particularly benefit postoperative surgical patients and malnourished surgical

patients (Braga, Gianotti, Nespoli, Radaelli, & Di Carlo, 2002; Huckleberry, 2004). Studies have shown that ONS can help patients meet their nutritional requirements and hence reduce mortality, decrease rates of infection, prevent pressure ulcers, improve wound healing and retain skeletal muscle strength (Huckleberry, 2004; Stratton & Elia, 2007). Postoperative diets and ONS can not only improve outcomes for surgical patients, they provide a unique element to their nutritional experiences in hospital.

There are many reasons why patients might not eat their hospital meals; these reasons are seen as barriers to eating and have been specifically investigated in several studies (Keller et al., 2015; McCullough, Marcus, & Keller, 2017; Naithani, Thomas, Whelan, Morgan, & Gulliford, 2009). A study conducted by Naithani et al. (2009) used a 27-item questionnaire to explore patients' experiences of food access in the UK. This research consisted of two phases, questionnaire development and the patient survey. The barriers were categorised into five domains; hunger, organisational, physical, food choice and food quality barriers. The survey was validated for each of these domains and is a reliable measure of hospital food access. In the UK, the most prevalent barriers were found to be patients not always wanting the food they ordered (67%) and not receiving the food that was ordered (48%).

A follow-on study was conducted by Keller et al. (2015) who assessed the barriers to food intake in hospitals across Canada. A validated 38-item survey was adapted from the original created by Naithani et al. (2009) and termed the Patient Mealtime and Nutrition Care Survey (PMNCS). They used a similar method for classifying barriers within six domains; organisational, choice, hunger, eating difficulties, quality and effects of illness on food intake. This study provided a comprehensive insight to all of the issues patients face and the barriers they experience surrounding food consumption in hospital. The most prevalent barriers in Canada were not being given hospital food by staff when meals were missed (69.2%), loss of appetite affecting food intake (63.9%) and not wanting the food that had been ordered (58%).

A recent study conducted by McCullough et al. (2017) explored both physical and organisational barriers to patients' eating during a single meal using a Mealtime Audit Tool (MAT) in Canada. They firstly tested the feasibility of the MAT, and secondly tested the revised MAT for inter-rater reliability. The tool was an interview based questionnaire consisting of 18 questions about patient's meal experiences, and was completed by a health care professional. This study provided a novel tool that could support routine examination of mealtime barriers in hospitals (McCullough et al., 2017). They found that not being offered help with their meal (70.7%), and not being checked on by staff mid-meal (57.9%), were the most prevalent barriers. All of these studies allow hospitals to understand some of the reasons why patients may or may not be eating the food they have been served and encourages improvements to be made with the food provisions provided.

This thesis will present the barriers to patients' oral intake at North Shore Hospital, Waitemata District Health Board (WDHB). North Shore Hospital is one of two hospitals within the WDHB region. WDHB has the largest population amongst the 20 District Health Boards located all over NZ (Waitemata District Health Board, 2015). Surgical patients were chosen to be the focus of this research as they often have unique nutritional experiences in hospital involving multiple different diet codes and ONS. The foodservice at North Shore Hospital is contracted to Medirest, Compass Group New Zealand Ltd. They operate using a cook chill system for over 50 therapeutic diet codes. Food is served in a centralised trayline within the hospital. Meals are delivered to the ward by catering associates and delivered to the patients either by a catering associate or by nursing staff. Patients are provided with three main meals and two in-between meal snacks each day (Breakfast, Morning Tea, Lunch, Afternoon Tea and Dinner) with hot beverage rounds occurring five times throughout the day. Patients complete their meal selections up to 24 hours in advance through the use of a spoken menu or on a paper menu.

North Shore Hospital have implemented a Protected Mealtime Policy to support dedicated eating time for patients and limit mealtime interruptions by health care workers. This policy is designed to reduce the likelihood of organisational barriers affecting patients' food-related hospital experiences. A red tray system is another initiative that has been developed, which highlights to health care workers that a patient will need mealtime assistance. Although the red tray system was not implemented at the time of data collection. Currently there is no set protocol for assessing the difficulties and challenges that patients face surrounding food consumption while in hospital. Patient satisfaction surveys are conducted monthly across the hospital, these surveys only focus on food quality.

1.2 Purpose of the study

While all of the potential food-related barriers patients can face while in hospital have been established, there is currently no way of knowing their prevalence in NZ hospitals. It would be inappropriate to assume that the most prevalent barriers in other countries are likely to be universal and therefore also prevalent in NZ, due to the differences in foodservice, health care systems and the transient nature of hospital populations worldwide (Keller et al., 2015; Naithani et al., 2009). However, it can be hypothesised that these barriers may follow similar themes in NZ. Furthermore, the impact that these barriers may have on an individual's oral intake has not been established. This is an important association to consider, as the most prevalent barriers may not necessarily be the barriers having an impact on a patients' oral intake, and may not affect their nutritional status and recovery. Particular attention has been drawn to the surgical patient population, as the importance of meeting their nutritional needs has been emphasised and they often have unique food-related experiences in hospital.

There is a gap in the research investigating all of the barriers to patients eating in NZ. To provide an understanding on these issues, a single centre cross-sectional study was designed to test the PMNCS in NZ. Conducting a pilot study with the PMNCS facilitated testing the tool in a NZ

setting. The survey was then adapted to create the NZ version, NZ-PMNCS, to determine the barriers to surgical patients eating in the acute hospital setting. Findings from the NZ-PMNCS could then be paired with patient meal observations to confirm the effectiveness of the tool. This study was designed to additionally highlight significant associations these barriers have with certain patient, care and hospital characteristics, and the impact these barriers have on the amount of food patients are consuming. To be included in the study patients had to have been in hospital care for at least 48 hours, have an anticipated length of stay for at least the next 24 hours, speak English and be aged 16 years or older.

The findings from this study will guide foodservice organisations and health care professionals to reduce the barriers to patients eating in the future. It will further identify areas for improvement based on patient feedback and will allow the most important issues to be addressed first. However, without this valuable information, evidence based recommendations and optimisation of the current foodservice cannot occur.

1.3 Aim

To investigate the barriers to surgical patients' oral intake in an acute hospital setting, in NZ.

1.4 Objectives

1. To conduct a pilot study to test the usability of the validated PMNCS and identify the additional barriers to surgical patients' oral intake in the NZ setting.
2. To adapt the PMNCS to include the most relevant barriers to oral intake in the NZ setting, based on the pilot study findings.
3. To use a feasibility study to test the effectiveness of the NZ-PMNCS paired with patient meal observations and to identify the most prevalent barriers in the NZ setting.
4. To identify significant associations between barriers and patient, care and hospital characteristics to establish which barriers are most likely to impact surgical patients' oral intake during their hospital admission.

1.5 Thesis structure

The thesis consists of four chapters; the first chapter provides a context for the study by introducing the topic and highlighting the importance of completing this research. A narrative literature review manuscript is located in the second chapter, which covers the suboptimal oral intake often observed with hospital patients and the consequences this can have on patient health outcomes. A review of all of the potential barriers which can cause patients to have a poor oral intake is also included within this chapter. A research study manuscript is located in the third chapter, providing an evidenced based presentation of the research project. Both the second and third chapters were composed with the aim of publication within the Journal of the Academy of Nutrition and Dietetics under the categories of 'Narrative Review' and 'Research Paper' respectively. For editorial purposes and consistency within this thesis not all

elements of the journal guidelines were conformed to, for example referencing style and formatting of tables. The fourth chapter concludes the research and provides an overview of the new knowledge that has been generated. This chapter also includes the strengths and limitations of this project and recommendations for future researchers.

1.6 Researchers' contributions

Table 1.2: *Researchers' contributions towards the research project.*

Researcher	Contributions
Olivia Stone *Student*	Main researcher; completed the ethics application, developed the New Zealand Patient Mealtime and Nutrition Care Survey and associated documents, recruited participants, collected all data, completed data entry, conducted statistical analysis, interpreted and discussed results, author of thesis.
Rozanne Kruger *Main Supervisor*	Academic supervisor; assisted with the study design and ethics application, developed the New Zealand Patient Mealtime and Nutrition Care Survey and associated documents, assisted with interpretation of results, reviewed thesis.
Laura Mash *Co-Supervisor*	Professional supervisor; assisted with the study design, developed the New Zealand Patient Mealtime and Nutrition Care Survey and associated documents, liaised with hospital prior to data collection, assisted with interpretation of results, reviewed thesis.
Deirdre Johnston *Co-Supervisor*	Academic supervisor; assisted with the study design and ethics application, developed the New Zealand Patient Mealtime and Nutrition Care Survey and associated documents.
Charlotte Moor *Advisor*	Professional advisor; assisted with the study design, developed the New Zealand Patient Mealtime and Nutrition Care Survey and associated documents, liaised with hospital prior to data collection.

References

Agarwal, E., Ferguson, M., Banks, M., Batterham, M., Bauer, J., Capra, S., & Isenring, E. (2013). Malnutrition and poor food intake are associated with prolonged hospital stay, frequent readmissions, and greater in-hospital mortality: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 32*(5), 737-745. doi:10.1016/j.clnu.2012.11.021

Agarwal, E., Ferguson, M., Banks, M., Bauer, J., Capra, S., & Isenring, E. (2012). Nutritional status and dietary intake of acute care patients: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 31*(1), 41-47. doi:10.1016/j.clnu.2011.08.002

Almdal, T., Viggers, L., Beck, A. M., & Jensen, K. (2003). Food production and wastage in relation to nutritional intake in a general district hospital- Wastage is not reduced by training the staff. *Clinical Nutrition, 22*(1), 47-51.

Barton, A. D., Beigg, C. L., Macdonald, I. A., & Allison, S. P. (2000). High food wastage and low nutritional intakes in hospital patients. *Clinical Nutrition, 19*(6), 445-449. doi:10.1054/clnu.2000.0150

Braga, M., Gianotti, L., Nespoli, L., Radaelli, G., & Di Carlo, V. (2002). Nutritional approach in malnourished surgical patients: A prospective randomized study. *Archives of Surgery, 137*(2), 174-180.

Bruun, L. I., Bosaeus, I., Bergstad, I., & Nygaard, K. (1999). Prevalence of malnutrition in surgical patients: Evaluation of nutritional support and documentation. *Clinical Nutrition, 18*(3), 141-147. doi:10.1054/clnu.1999.0006

Dietitians New Zealand Inc. (2016). Dietitians New Zealand Clinical Handbook 2016: Eleventh Edition. In A. Sloan (Ed.), (Eleventh ed., pp. 23-34). Wellington, New Zealand: Ocular.

Dupertuis, Y. M., Kossovsky, M. P., Kyle, U. G., Raguso, C. A., Genton, L., & Pichard, C. (2003). Food intake in 1707 hospitalised patients: A prospective comprehensive hospital survey. *Clinical Nutrition, 22*(2), 115-123.

Goonan, S., Mirosa, M., & Spence, H. (2014). Getting a taste for food waste: A mixed methods ethnographic study into hospital food waste before patient consumption conducted at three New Zealand foodservice facilities. *Journal of the Academy of Nutrition and Dietetics, 114*(1), 63-71. doi:10.1016/j.jand.2013.09.022

Haydock, D. A., & Hill, G. L. (1986). Impaired wound healing in surgical patients with varying degrees of malnutrition. *Journal of Parenteral and Enteral Nutrition, 10*(6), 550-554. doi:10.1177/0148607186010006550

Huckleberry, Y. (2004). Nutritional support and the surgical patient. *American Journal of Health-System Pharmacy, 61*(7), 671-682.

Kahokehr, A. A., Sammour, T., Wang, K., Sahakian, V., Plank, L. D., & Hill, A. G. (2010). Prevalence of malnutrition on admission to hospital- Acute and elective general surgical patients. *e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism, 5*(1), e21-e25. doi:10.1016/j.eclnm.2009.11.001

Keller, H., Allard, J., Vesnaver, E., Laporte, M., Gramlich, L., Bernier, P., . . . Payette, H. (2015). Barriers to food intake in acute care hospitals: A report of the Canadian Malnutrition

Task Force. *Journal of Human Nutrition and Dietetics, 28*(6), 546-557. doi:10.1111/jhn.12314

Kondrup, J., Johansen, N., Plum, L. M., Bak, L., Larsen, I. H., Martinsen, A., . . . Lauesen, N. (2002). Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. *Clinical Nutrition, 21*(6), 461-468.

Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced recovery after surgery a review. *Journal of the American Medical Association Surgery, 152*(3), 292-298. doi:10.1001/jamasurg.2016.4952

Löser, C. (2010). Malnutrition in hospital: The clinical and economic implications. *Deutsches Arzteblatt International, 107*(51-52), 911-917. doi:10.3238/arztebl.2010.0911

McCullough, J., Marcus, H., & Keller, H. (2017). The mealtime audit tool (MAT)- Inter-rater reliability testing of a novel tool for the monitoring and assessment of food intake barriers in acute care hospital patients. *J Nutr Health Aging, 21*(9), 962-970. doi:10.1007/s12603-017-0890-7

Naber, T. H., Schermer, T., de Bree, A., Nusteling, K., Eggink, L., Kruimel, J. W., . . . Katan, M. B. (1997). Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications. *The American Journal of Clinical Nutrition, 66*(5), 1232-1239.

Naithani, S., Thomas, J. E., Whelan, K., Morgan, M., & Gulliford, M. C. (2009). Experiences of food access in hospital. A new questionnaire measure. *Clinical Nutrition, 28*(6), 625-630. doi:10.1016/j.clnu.2009.04.020

Robinson, G., Goldstein, M., & Levine, G. M. (1987). Impact of nutritional status on DRG length of stay. *Journal of Parenteral and Enteral Nutrition, 11*(1), 49-51. doi:10.1177/014860718701100149

Rozin, P., Fischler, C., Imada, S., Sarubin, A., & Wrzesniewski, A. (1999). Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: Possible implications for the diet-health debate. *Appetite, 33*(2), 163-180. doi:10.1006/appe.1999.0244

Sonnino, R., & McWilliam, S. (2011). Food waste, catering practices and public procurement: A case study of hospital food systems in Wales. *Food Policy, 36*(6), 823-829. doi:10.1016/j.foodpol.2011.09.003

Stratton, R. J., & Elia, M. (2007). Who benefits from nutritional support: What is the evidence? *European journal of gastroenterology & hepatology, 19*(5), 353-358.

Sullivan, D. H., Sun, S., & Walls, R. C. (1999). Protein-energy undernutrition among elderly hospitalized patients: A prospective study. *Journal of the American Medical Association, 281*(21), 2013-2019. doi:10.1001/jama.281.21.2013

Waitemata District Health Board. (2015). Population Health Profile. Retrieved from http://www.waitematadhb.govt.nz/assets/Documents/population-profile/WDHB2015PopulationHealthProfileWDHB.pdf

Windsor, J. A., Knight, G. S., & Hill, G. L. (1988). Wound healing response in surgical patients: Recent food intake is more important than nutritional status. *British Journal of Surgery, 75*(2), 135-137. doi:10.1002/bjs.1800750215

Chapter 2. Literature Review Manuscript

The barriers to surgical patients' oral intake in the acute hospital setting

2.1 Nutrition in the hospital setting

Nutrition plays an important role in the health and wellbeing of all individuals. Although the benefits for adequate nutrition are known, it has been observed that many patients in the acute hospital setting do not eat all of the meals they are provided with (Agarwal et al., 2012; Barton, Beigg, Macdonald, & Allison, 2000; Dupertuis et al., 2003; Kondrup et al., 2002). If patients aren't eating all of the food they have been given, they are unlikely to meet their energy and nutrient requirements, which can further impact their health outcomes (Corkins et al., 2014).

2.1.1 Oral intake

The food and drink we consume on an everyday basis provides us with the nutrients we need to survive. Within the hospital setting it is important for patients to obtain adequate nutrition for many reasons, the most evident is to promote recovery (Dupertuis et al., 2003). The body can receive nutrients through several routes. Most patients in hospital are able to eat and drink a variety of foods and fluids, including oral nutritional supplements (ONS). These patients consume nutrients orally (by eating and drinking) and will be the focus of this review. It has been observed that many patients do not eat some or all of the meals they have been provided with while in hospital, and are predicted to have a suboptimal intake (Agarwal et al., 2012; Barton et al., 2000; Dupertuis et al., 2003; Kondrup et al., 2002). It is possible that patients may also be consuming food from outside of the hospital, which is why their total intake often remains uncertain. Having a suboptimal intake may negatively impact patients meeting nutritional requirements based on the amount of hospital food consumed (Almdal, Viggers, Beck, & Jensen, 2003; Barton et al., 2000; Dupertuis et al., 2003; Kondrup et al., 2002). This is compounded by the fact that energy and protein requirements are often increased while in hospital (Dietitians New Zealand Inc, 2016).

2.1.2 Energy requirements

Many patients in hospital have increased energy needs compared to that of the general population. Patients' resting energy expenditure (REE) often increases based on certain illnesses, injuries or diseases such as burns, head trauma, fever and sepsis (Hoffer, 2003). In New Zealand (NZ) the guidelines for energy requirements in the general population are 25-30 kcal/kg, although when REE is increased (during sickness, injury and recovery), energy requirements can increase up to 40 kcal/kg (Dietitians New Zealand Inc, 2016). Numerous studies worldwide have investigated if patients are meeting their energy requirements. A study

conducted in Denmark found that only 25% of at-risk patients had between 75-99% of their nutritional needs covered (Kondrup et al., 2002). In the United Kingdom (UK) a hospital menu provided approximately 2,000 kcal/day to meet patients' nutritional requirements, although 40% of this food was not consumed and consequently discarded (Barton et al., 2000). This resulted in patients meeting less than 80% of their recommended energy and protein needs. Hospital meals in Switzerland provided 2007±479 kcal/day which exceeded patients' needs (Dupertuis et al., 2003). Despite the sufficient provision of food, 70% of these patients did not consume enough to meet their recommended nutritional requirements and 43% had a total food intake below their minimum nutritional needs. These findings highlight a key issue which is shared in hospitals across many countries; patients are often not consuming the food they have been provided with and are not likely to be meeting their energy requirements, which is likely to affect their health status.

A multicentre research study encompassing 56 hospitals across Australia and NZ, using the Australasian Nutrition Care Day Survey (ANCDS) supports the international findings (Agarwal et al., 2012). It was found that 55% of malnourished patients and 35% of well-nourished patients consumed ≤50% of the offered food. Furthermore, 23% of all patients consumed ≤25% of the offered food in hospital.

2.1.3 Protein requirements

Protein plays an important role in recovery and patients often have increased requirements during their admission in order to protect lean tissue mass and function (Hoffer, 2003). Most countries have their own guidelines for protein requirements, often based on body weight. In NZ, there are several recommendations for protein consumption. The recommended daily intake (RDI) for adults in the general population aged 19-70yrs is 46 g/day for women and 64g/day for men (New Zealand Ministry of Health, 2006), or can be calculated by using 0.8-1.5 g/kg BW/day (Dietitians New Zealand Inc, 2016). Patients with specific illnesses, injuries or diseases can have higher requirements, at 1.0-1.5 g/kg BW/day (Dietitians New Zealand Inc, 2016). Protein intake has been considered in studies conducted in hospitals around the world. Almdal et al. (2003) assessed protein consumption, in which a Danish hospital ordered 112 g/day for each patient, however patients only consumed 46g. This provided on average 0.75 g/kg BW/day, which falls short of the requirements for the general population, and likely the needs of patients in hospital, based on the NZ guidelines. In the UK, hospital meals provided a maximum of 67g protein per day, although patients only consumed 40-45g (Barton et al., 2000). Similarly, in Switzerland the hospital meals provided 67±10g of protein per patient per day, but an estimated 22-30% of food was wasted (Iff et al., 2008). It is likely these figures stated by Barton et al. (2000) and Iff et al. (2008) would also fall short of patient requirements according to the NZ guidelines. Many patients are not consuming the protein they have been provided with, making it unlikely they are meeting their requirements based on the food wastage that has been observed in research conducted worldwide.

2.2 The consequences of poor nutrition

The consequences of patients having a suboptimal intake and hence not meeting their energy and protein requirements are extensive. A sustained suboptimal intake can lead to both weight loss and malnutrition within a short timeframe (Bruun, Bosaeus, Bergstad, & Nygaard, 1999; Löser, 2010; McWhirter & Pennington, 1994). Poor nutrition can also impact on a patient's length of stay, readmissions, morbidity, quality of life, mortality and place an extra strain on hospital resources (Barker, Gout, & Crowe, 2011; Corkins et al., 2014).

2.2.1 Weight loss and muscle wasting

Patients with consistent suboptimal dietary intakes will have a negative energy balance, which can lead to weight loss over time (Hall et al., 2012). Although weight loss for some individuals may be advised or encouraged by health professionals, for many patients in hospital who are unwell and recovering weight loss during their admission is not desired, irrespective of their weight on admission (McWhirter & Pennington, 1994). This unintentional weight loss is considered a form of nutritional deterioration and has been reported in several studies (Löser, 2010; McWhirter & Pennington, 1994). A review article by Löser (2010) found that clinical studies reported 30% to >80% of inpatients lost a substantial amount of weight during their hospital stay. Weight loss varied between studies, depending on the hospital specialty and the type of patient population that was being investigated. In the UK, it was reported that 64% of patients who were admitted for more than one day lost weight during their hospital admission (mean weight loss of 5.4%) (McWhirter & Pennington, 1994). The greatest weight loss was observed in those who were the most undernourished on admission. The weight loss corresponded to decreases in mid-arm muscle circumference and triceps skinfold thickness, which are signs of muscle loss or wasting, indicating nutritional deterioration (McWhirter & Pennington, 1994).

2.2.2 Malnutrition

Malnutrition describes an imbalance in nutrition and can develop as a consequence of a deficiency in dietary intake, complications from underlying illness or increased requirements associated with disease (Barker et al., 2011; Marinos, 2017). There are numerous criteria for diagnosing malnutrition; hospitals in NZ commonly use the National Institute for Clinical Excellence (NICE) guidelines. To be diagnosed patients must have a Body Mass Index (BMI) <18.5 kg/m^2, or unintentional weight loss >10% within the last 3-6 months, or BMI <20 kg/m^2 and unintentional weight loss >5% within the last 3-6 months (National Institute for Clinical Excellence, 2006). Some studies may alternatively refer to patients as undernourished, nutritionally at risk or nutritionally deteriorated if patients meet some but not all of the criteria for malnutrition. The review article by Löser (2010) reported that undernutrition and malnutrition are becoming an increasingly common issue in hospitalised patients, with clinical trials showing that 20-60% of individuals are considered undernourished on admission. In the UK, 168 out of 850 patients (19.8%) were considered malnourished on admission (Edington et al., 2000), compared to 39 out of 69 patients (57%) found to be malnourished on admission in

Denmark (Almdal et al., 2003). A recently study conducted in the USA found an extremely low prevalence, with only 4.1% of patients malnourished on admission (Vest et al., 2017). The extreme variations of prevalence are likely due to the different criteria used to define and diagnose malnutrition in different countries (Marinos, 2017; Vest et al., 2017).

In the local multicentre study participants (n=3080) were screened with the Malnutrition Screening Tool (MST) and those who were deemed at risk underwent a more comprehensive assessment using the Subjective Global Assessment (SGA) (Agarwal et al., 2013; Agarwal et al., 2012). Of these participants, 28% were malnourished on admission and 32% were considered malnourished at the time of audit. In Iran, recent evidence using a nutrition risk screening (NRS) tool has shown that 30% of patients were nutritionally at risk on admission, compared to 33.3% at discharge (Vahabzadeh, 2017). These findings clearly show that malnutrition is not only prevalent on admission to hospital, additionally some patients are nutritionally deteriorating during their admission.

2.2.3 Length of stay

Poor nutrition, specifically malnutrition, can impact an individual's length of stay in hospital. A recent study in Canada showed that moderately malnourished patients were in hospital on average three days longer compared to well-nourished patients (Curtis et al., 2017). In Brazil, a retrospective cohort study reported malnutrition was an independent risk factor correlated to an increased length of stay, the average length of hospital stay was shorter (six days) for well-nourished patients compared to malnourished patients (nine days) (Correia & Waitzberg, 2003). Similar results have been reported in a retrospective review conducted in Ohio (USA), showing the median length of stay was four days for nutritionally not-at-risk patients compared with six days for nutritionally at-risk patients (Chima et al., 1997). In Pennsylvania (USA), the length of stay for patients that were considered well-nourished was shorter (8.2 days) compared to those who were borderline malnourished (10.2 days) or those who were malnourished (15.6 days) (Robinson, Goldstein, & Levine, 1987). Likewise, a Europe-wide multicentre study showed a significantly longer hospital stay for under-/malnourished patients (nine days) compared to six days for well-nourished individuals (Sorensen et al., 2008). Across Australia and NZ, the results were similar, with malnourished patients having a longer length of stay (15 days) compared to 10 days for well-nourished patients (Agarwal et al., 2013). In all of these studies, a malnourished nutritional state was linked to an increased length of hospital stay in hospital for patients.

Length of stay has also been correlated with other nutritional factors aside from malnutrition (Agarwal et al., 2013; Thibault et al., 2011) In Switzerland, patients consuming oral nutritional supplements (ONS) more frequently had a longer length of stay compared to those not consuming ONS (Thibault et al., 2011). These patients consuming ONS were more nutritionally at risk, they were significantly older, with a lower BMI and more frequently on a texture modified diet. Similar results were apparent across Australia and NZ; the length of stay was 13

days for those consuming ≤25% of the offered hospital food, whilst for those consuming ≥50% of the food, the length of stay was only 10 days (Agarwal et al., 2013).

2.2.4 Readmissions

Several studies have investigated the correlation between poor nutritional status and readmission rates. Protein-energy undernutrition was found to be a strong independent risk factor for non-elective hospital readmission in a sample of elderly patients in the USA (Sullivan, 1992). Another USA based study that included older adults found that weight loss, measured at one month post-discharge, was a highly significant predictor of readmission (Friedmann, Smiciklas-Wright, Jensen, & McCamish, 1995). Additionally, a prospective study conducted in Australia found an underweight BMI at discharge was considered a significant predictor of readmission after adjusting for age, length of stay and functional status (Mudge et al., 2011). In Spain, malnourished patients categorised based on anthropometric measures, showed a significantly increased readmission rate (30.7%) compared to those with normonutrition (20.7%) and overnutrition (17.7%) (Planas et al., 2004).

Results were not always consistent across all studies investigating readmissions. In a USA study, the number of readmissions were not significantly different between the nutritionally at-risk group and not-at-risk groups during the year following their hospital admissions (Chima et al., 1997). However, these findings may have been influenced by the high readmission rate of sickle cell disease and asthma patients. Across Australia and NZ, malnourished patients had a significantly higher readmission rate (35%) within 90 days from hospitalisation compared to well-nourished patients (27%), although no association was found between percentage of food intake and readmissions (Agarwal et al., 2013). Finally, in Singapore, malnourished patients had a 60% higher readmission risk within 15 days post-discharge, although no significant association was found within 90 days post-discharge (Lim et al., 2012).

2.2.5 Morbidity and quality of life

The effect of malnutrition on a patient developing complications has been explored in several studies. The incidence of developing complications was 16.8% for well-nourished patients and was significantly higher (27.0%) for malnourished patients (Relative Risk (RR)=1.60, *P*=<0.01) in a study conducted in Brazil (Correia & Waitzberg, 2003). Similar results have been demonstrated by Naber et al. (1997) showing a significantly higher number of complications for malnourished compared to well-nourished patients across the range of severe, non-severe, infectious and non-infectious complications. Higher complication rates may increase morbidity and reflect poorer health outcomes. Löser's review article (2010) concluded that malnutrition is an independent risk factor that significantly worsens a patient's quality of life and morbidity. Malnutrition has been shown to increase morbidity in both acute and chronic disease states, based on the conclusions made in another review article (Norman, Pichard, Lochs, & Pirlich, 2008). They found that the main contributors for increased morbidity in malnourished patients were impaired immune function, delayed wound healing and decreased functional status.

Malnutrition can therefore prolong recovery time, cause serious complications and ultimately reduce the quality of life for patients (Hartwell & Edwards, 2003).

2.2.6 Mortality

Mortality is a health outcome associated with poor nutritional status in hospital, based on a multitude of studies (Löser, 2010; Norman et al., 2008). Malnutrition leads to a poorer prognosis and survival, in both acute and chronic diseases (Norman et al., 2008). A Europe-wide multicentre study found that mortality for under-/malnourished patients was 12%, compared to 1% for well-nourished patients (Sorensen et al., 2008). Similarly, in Brazil mortality in malnourished patients was significantly higher (12.4%), compared to 4.7% in well-nourished individuals (RR=2.63, *P*=<0.05) (Correia & Waitzberg, 2003).

Food intake during a patient's admission and its impact on mortality has also been investigated. A multi-national cross-sectional survey found the cumulative incidence of death was lower (1%) for patients eating full meals compared to those eating nothing (9%) (Hiesmayr et al., 2009). They also found that consuming 50% of the food provided was associated with a trend for increased mortality (*P*=0.033), although eating 25% of the food significantly increased the risk of mortality (*P*=<0.001). In the USA, Sullivan et al. (1999) determined that patients who consumed <50% of their energy requirements experienced higher rates of both in-hospital mortality and 90-day mortality. As this was observational research, they could not determine if suboptimal intake was the sole cause of increased mortality as it was possible that these patients were actually more unwell. In hospitals across Australia and NZ, the odds of 90-day in-hospital mortality were twice as great for patients who consumed ≤25% of the offered food (CI: 1.13-3.51, *P*=0.017), and for malnourished patients (1.09-3.34, *P*=0.023) (Agarwal et al., 2013).

2.2.7 Hospital resources

Patients with a suboptimal intake place a large financial strain on the hospital system primarily due to the complications that arise from undernutrition and malnutrition (Amaral et al., 2007; Correia & Waitzberg, 2003; Curtis et al., 2017; Norman et al., 2008). The extra care, treatment, therapy, length of stay, medications and tests for malnourished patients all contribute to hospitalisation costs (Curtis et al., 2017; Norman et al., 2008). The mean hospitalisation cost for nutritionally at-risk patients were more than double those who were not nutritionally at-risk in research conducted in the USA and Portugal (Amaral et al., 2007; Robinson et al., 1987). In Brazil, treatment costs for malnourished patients increased by over 300% compared to well-nourished patients (Correia & Waitzberg, 2003). They concluded that promoting nutrition for these patients is not only beneficial for their health and wellbeing, it could also be financially beneficial for the hospital.

Another consequence of patient's suboptimal intake is food waste. It has been estimated that 25% of food was wasted in the hospital setting in Switzerland, compared to 30-40% in

Denmark, and more than 40% in the UK (Almdal et al., 2003; Barton et al., 2000; Dupertuis et al., 2003). These studies have reported limitations in establishing an exact figure for waste due to food being discarded on the ward, patients keeping food for later, staff consuming food, waste weighing methods and the differences between plate waste and tray waste (Almdal et al., 2003; Dupertuis et al., 2003). Although the values differ, one theme that is apparent is that food waste is a large issue for hospitals and this is worsened even further when patients are not eating their meals.

There are many factors that play a role on the amount of food wasted in hospitals. Waste can depend on a patient's age, gender, specialty of care, main meal and tray items served (Barton et al., 2000; Dupertuis et al., 2003; Edwards & Nash, 1999; Sonnino & McWilliam, 2011). Food waste was found to decline as age increases, until approximately 65 years, when waste then begins to increase again (Edwards & Nash, 1999). Food waste was higher with females (33.91%) compared to males (27.26%) (Edwards & Nash, 1999). More food is wasted in the acute care setting compared to areas such as rehabilitation or psychiatry (Dupertuis et al., 2003). Within specialties, waste is highest in elderly care wards (42%) compared to surgical wards (32%), with the lowest waste (Barton et al., 2000). Breakfast was the main meal with the lowest waste and dinner had the highest recorded waste (Edwards & Nash, 1999). Analysis of tray components showed that the main course had the smallest waste (33%) and the largest waste was seen with vegetables (46%) (Sonnino & McWilliam, 2011). The effects of food waste are becoming much more apparent with recent research, showing it impacts more than just the patient. There are social and environmental implications of waste that incorporate elements of responsibility, sustainability, guidelines and principles (Sonnino & McWilliam, 2011). The attitudes and habits of food service employees and the impact they have on the production of hospital food waste has been investigated in NZ (Goonan, Mirosa, & Spence, 2014). Issues surrounding waste were perceived differently; managers discussed financial problems such as stock monitoring and forecasting; whereas kitchen staff acknowledged both financial and social implications such as hunger and malnutrition (Goonan et al., 2014). The current issues surrounding food waste are not sustainable; if patients don't eat the food they are provided with, not only are they less likely to be meeting their nutritional requirements, it also has large negative impacts on the hospitals resources (Donini et al., 2008).

2.3 Nutrition in surgical patients

Many studies present data from a hospital population that contains a variety of wards and specialties. Results based exclusively from surgical patients reflects the same themes seen within the wider hospital population. Research conducted in Australia and NZ showed that 369 out of 1270 surgical patients (29%) consumed ≤25% of the offered hospital food (Agarwal et al., 2013). Research conducted in Norway found 53 out of 64 surgical patients (83%) lost weight during their admission, with the median duration of stay being 14 days (Bruun et al., 1999). Half of these patients lost up to 5% of their body weight during their admission; 25% of patients lost between 5-10% of their body weight and 8% lost between 10-15% of their body weight. In

NZ, more (52%) acute surgical patients were considered malnourished or at risk of malnutrition on admission, compared to 38% of elective surgical patients (Kahokehr et al., 2010). These results highlight that surgical patients display not only a suboptimal intake during their admission, but also encounter weight loss and have a high prevalence of malnutrition, much like the wider hospital population.

Surgical patients also experience consequences due to poor nutrition, which include an increased length of stay, more frequent readmissions, decreased quality of life and increased morbidity and mortality (Bruun et al., 1999). Poor nutrition and malnutrition in surgical patients can additionally lead to a decrease in muscle, respiratory and immune function (Bruun et al., 1999). Patients that are malnourished or have suboptimal pre-operative food intake also have an impaired wound healing response (Bruun et al., 1999; Haydock & Hill, 1986; Windsor, Knight, & Hill, 1988). This is problematic as many surgical patients have wounds present from their surgical procedure, or from the injury that caused their admission (Haydock & Hill, 1986; Windsor et al., 1988). By ensuring surgical patients are obtaining adequate nutrition from the food consumed, adverse health outcomes and many undesirable consequences can be prevented.

A nutritional point of difference for surgical patients is that they have a wide range of nutritional needs, and therefore commonly utilise a variety of diet codes during their admission (Reissman et al., 1995). After surgical procedures, it is common for patients to be put on a postoperative diet designed to aid faster recovery and prevent complications (Ljungqvist, Scott, & Fearon, 2017). Postoperative diets vary, but can include transitions from nil by mouth before surgery to a liquid diet or texture modified diet after surgery, finally resuming to a normal diet after allowing the body time to recover (Reissman et al., 1995). These changes and transitions depend on the individual patient, type of surgery and best practice guidelines within the country that the surgical procedure was performed (Ljungqvist et al., 2017). Surgical procedures involving the gastrointestinal (GI) tract are more likely to utilise different diet codes postoperatively to improve outcomes (Braga, Gianotti, Gentilini, Liotta, & Di Carlo, 2002; Keele, Bray, Emery, Duncan, & Silk, 1997; Lewis, Egger, Sylvester, & Thomas, 2001; Reissman et al., 1995). Experiencing a variety of diet codes during their admission is a point of difference for surgical patients.

The importance of nutritional support for surgical patients is an area that many studies have also examined. Most patients will progress to a normal diet after surgery without intervention, however patients who have undergone major surgery or have postoperative complications may have a delayed transition back onto a normal oral diet (Huckleberry, 2004). For these patients who are unable to consume foods or fluids orally, or present with a very poor appetite, nutritional support is available. The use of nutritional support in hospitals has been the focus of many studies which includes the use of ONS, enteral and parenteral nutrition for surgical patients (Abunnaja, Cuviello, & Sanchez, 2013; Heyland et al., 2001; Huckleberry, 2004;

Stratton & Elia, 2007). Surgical patients on total enteral tube feeds or total parenteral nutrition (TPN) do not consume food or fluid orally and are considered out of scope of this review. However, the use of ONS has been considered, with particular benefits seen for postoperative surgical patients and malnourished surgical patients (Braga, Gianotti, Nespoli, Radaelli, & Di Carlo, 2002; Huckleberry, 2004). Studies have shown that ONS can reduce mortality and complications including decreased rates of infection, prevention of pressure ulcers, improved wound healing and retained skeletal muscle strength, which in turn can reduce patients' length of stay and readmission rates (Huckleberry, 2004; Stratton & Elia, 2007). Providing ONS may improve total energy and nutrient intakes, making patients more likely to meet their increased requirements.

2.4 The barriers to patients eating

It has been acknowledged that when a patient's dietary intake is inadequate during their hospital stay, it may lead to undesirable health outcomes. There are many reasons why patients might not eat their meals; these are reported as barriers to eating, and have been specifically investigated in several studies (Keller et al., 2015; McCullough, Marcus, & Keller, 2017; Naithani, Thomas, Whelan, Morgan, & Gulliford, 2009). These barriers have been quantified in two studies using a survey that was developed by Naithani et al. (2009) and then adapted by Keller et al. (2015), to capture all of the barriers experienced during a patient's admission. More recently a Mealtime Audit Tool (MAT) has also been developed to assess the barriers a patient can experience during a single meal (McCullough et al., 2017). These studies allow hospitals to understand some of the reasons why patients may or may not be eating the food they have been served, and encourages improvements to be made with the food provisions provided.

A study conducted by Naithani et al. (2009) investigated the specific barriers to patients eating in hospital by using a 27-item survey to explore patient experiences of food access. The data were analysed for 764 patients who provided complete responses to all 27 questions. This research took place in four London hospitals and consisted of two phases, questionnaire development and the patient survey. It was designed to assesses all experiences patients had surrounding their access to food in hospital. The qualitative data were categorised into five domains; hunger, organisational, physical, food choice and food quality barriers. The survey was validated for each of these domains and is a reliable measure of hospital food access. This survey could then be used in hospitals to assess barriers to food intake in different wards, institutions or countries (Naithani et al., 2009).

A follow-on study was conducted by Keller et al. (2015) who assessed the barriers to food intake in 18 hospitals across Canada. A total of 890 patients at least partly completed the validated 38-item survey which was adapted from the original and termed the Patient Mealtime and Nutrition Care Survey (PMNCS). They used a similar method for classifying barriers within six domains, with the addition of an effects of illness on food intake domain.

This study provided a comprehensive insight to the issues patients face and the barriers they experience surrounding food consumption in hospital. All six of these domains will further be explored according to the classification used by Keller et al. (2015).

The most recent study was conducted in Canada by McCullough et al. 2017 who explored both physical and organisational barriers to patients eating during a single meal using a MAT. The study was conducted in two parts, the first involved 120 patients and was designed to test the feasibility of the MAT. The second involved 90 patients and the revised MAT was tested for inter-rater reliability. The tool was an interview based questionnaire including 18 questions about the meal experience designed to be completed by a health care professional. This study provided a novel tool that could support routine examination of mealtime barriers in hospitals (McCullough et al., 2017).

2.4.1 Organisational barriers

Organisational barriers are likely to vary between hospitals due to the differences in their protocols and procedures. Naithani et al. (2009) categorised organisational barriers as experiencing issues related to food access such as missing meals or not receiving ordered food and environmental factors such as being interrupted by staff during mealtimes or being disturbed by activities, noises and unpleasant smells. All of these barriers relate to the organisation and are mostly out of a patient's control (Keller et al., 2015). Naithani et al. (2009) reported the most commonly experienced organisational barriers as not receiving the food that had been ordered (48%) and being disturbed by activities and noises whilst eating (40%). They found that more organisational issues were reported on renal, elderly care and stroke wards, and from patients with 'poor' self-rated health. Common barriers reported by Keller et al. (2015) were not being given food by staff when a meal was missed (69.2%) and not always wanting the food that had been ordered (58%). Interestingly, patients who were malnourished or consumed <50% of food during their first week had more significant associations with organisational barriers (Keller et al., 2015). A recent study in Canada showed 70.7% of patients were not offered help with their meal and 57.9% were not visited by staff mid-meal (McCullough et al., 2017). In Australia, 19.1% of patients had a doctor's visit during their meal time and 51.1% had their mealtime interrupted by other people, such as nurses and visitors (Xia & McCutcheon, 2006). Another study in Australia found there were less organisational issues compared to food quality barriers (Fallon, Gurr, Hannan-Jones, & Bauer, 2008). Fallon et al. (2008) explained that organisational barriers were much easier to control as they often involved physical property, paid staff and interpersonal interactions; additionally, these barriers had less chance of being influenced by preferences and expectations. In the UK, the majority of wards were described as noisy during mealtimes, with noises coming from equipment, movement of other patients and medical staff (Naithani, Whelan, Thomas, Gulliford, & Morgan, 2008). Participants in this study explained that disruptive sounds, unsettling behaviours and unpleasant smells had a negative effect on food consumption and their eating experiences. The working practices of staff during mealtimes was disruptive for

23% of patients, with doctor's visits temporarily stopping patients from finishing their meal or from eating their meal altogether. The presence of organisational barriers, such as unpleasant odours and the behaviour of other patients, creates an unfamiliar environment which can interfere with a patients' desire to eat (Stanga et al., 2003).

2.4.2 Choice

The choice domain encompasses patient barriers regarding food related choices during their admission. In the UK, the most common barrier was not always wanting the food that was ordered (67%), compared to the most common barrier in Canada where patients found there was not enough information on the menu to make a selection (36.9%) (Keller et al., 2015; Naithani et al., 2009). Both studies also found that patients were not able to choose foods that they liked or preferred; affecting 33% of patients in the UK and 23.3% of patients in Canada. In the USA, problems related to food choice included the number of items to choose from, a constraining meal regime and ordering up to 24 hours before the meal often resulted in patients choosing the wrong option (Edwards & Hartwell, 2006; Johns, Hartwell, & Morgan, 2010). Stanga et al. (2003) found that 14% of patients in Switzerland reported language difficulties and did not understand the meal choices. These patients were unable to make appropriate selections which lead to a lower satisfaction of the food served. They concluded that choices should be made available, however healthy eating principles should be displayed to ensure patients can make informed choices. Feedback from patients in Australia and Turkey was that the variability of food was unsatisfactory and the menu didn't provide enough options, and in Denmark patients saw more choices as an improved quality of service (Engelund, Lassen, & Mikkelsen, 2007; Sahin, Demir, Celik, & Teke, 2006; Xia & McCutcheon, 2006). However, too much choice can be overwhelming for some patients, highlighted in a study conducted in Canada (Watters, Sorensen, Fiala, & Wismer, 2003). Issues within the choice domain were most important and more commonly reported by patients who are younger, women, longer stay, poorer self-rated health or following a therapeutic diet pre-admission (Engelund et al., 2007; Keller et al., 2015; Naithani et al., 2009; Watters et al., 2003).

2.4.3 Hunger

Hunger is a domain that can be difficult to quantify when conducting research, as hunger is relative to an individual's perception. Within this domain, both Naithani et al. (2009) and Keller et al. (2015) reported the same barriers with similar results. Both Naithani et al. (2009) and Keller et al. (2015) respectively reported that 40% and 24.4% of patients became hungry because the time between meals was too long, and secondly that 35% and 30% of patients' visitors brought in food because the patient was hungry. Furthermore, higher scores in the hunger domain were seen in younger patients compared to older adults in both studies (Keller et al., 2015; Naithani et al., 2009).

Apart from these two studies, limited evidence has been presented within the hunger domain. Naithani et al. (2008) found that almost half of patients feel hungry at some stage during their

stay and over half felt hungry because there was no hospital food available after their admission, between meals or after treatment. They also found an early dinner time contributed to patients hunger later in the evening. Patients reported limited access to snacks and drinks between meals causing them to become hungry, and therefore family members are often requested to bring in food (Naithani et al., 2008). In a study conducted in Switzerland, 25% of patients felt hungry and 48% felt thirsty on admission to the emergency department (Müller-Staub, Meer, Briner, Probst, & Needham, 2008). It is important to acknowledge that hunger and food insecurity are prevalent problems among many patients seeking hospital care (Kersey, Beran, McGovern, Biros, & Lurie, 1999; Nelson, Brown, & Lurie, 1998; Rosenberg & Bernabo, 1992). Hunger at admission does not reflect upon the hospital or foodservice, as it can be influenced by patients' access to food prior to admission.

2.4.4 Eating difficulties

The most common barrier within the eating difficulties domain was difficulty opening packets and unwrapping food, affecting 33% of patients in the UK and 30.1% of patients in Canada (Keller et al., 2015; Naithani et al., 2009). Not having enough time to finish the meal (24%) (Naithani et al., 2009), and being in an uncomfortable position to eat (27.2%) (Keller et al., 2015) followed closely. In Australia, majority (57.4%) of patients had some difficulty with eating, the most difficulty was specifically experienced with opening food (54.5%), followed by issues using cutlery (36.4%) and adding seasoning (31.8%) (Xia & McCutcheon, 2006). In the UK difficulties with food access during a patient's admission was often linked to the nature of their illness and treatment (Naithani et al., 2008). For example, stroke patients commonly experienced trouble transporting food to their mouth. Help was needed to eat by 25% of patients, of which 75% found it difficult to get a staff members attention for help and 42% were reluctant to ask staff for help. Experiencing barriers within the eating difficulties domain was more common for women, elderly, malnourished, post-surgical and stroke patients (Keller et al., 2015; Naithani et al., 2009; Naithani et al., 2008).

2.4.5 Quality and satisfaction

Food quality is determined through sensory satisfaction, including taste, appearance, smell, portion size and temperature of the food (Keller et al., 2015; Naithani et al., 2009). Naithani et al. (2009) and Keller et al. (2015) both found the most common food quality barrier patients were dissatisfied with was taste (34% and 28.8% respectively). This was followed by dissatisfaction with the smell of the food (28%) (Naithani et al., 2009), and dissatisfaction with the temperature of food (21%) (Keller et al., 2015). Overall patient dissatisfaction varies between countries; 60% of patients in Australia, 32.4% in Turkey and 19% in the UK reported dissatisfaction with the quality of the food (Fallon et al., 2008; Naithani et al., 2008; Sahin et al., 2006). The determinants of quality also change between studies, many of which are reported as having a strong relationship with patient satisfaction; taste was considered of importance in the UK, Turkey, Australia, Iran and Canada (Jessri et al., 2011; Naithani et al., 2008; O'Hara et al., 1997; Sahin et al., 2006; Wright, Connelly, & Capra, 2006); temperature

was concluded to be a determinant of satisfaction in the UK, Canada and Australia (Hartwell, Edwards, & Beavis, 2007; O'Hara et al., 1997; Wright et al., 2006); texture influenced quality in the UK and Australia (Hartwell et al., 2007; Wright et al., 2006); smell and appearance were also found to impact patients perceived quality in the UK and Turkey (Naithani et al., 2008; Sahin et al., 2006). Patient subgroups who commonly reported more issues with food quality include patients who are women, younger, have poorer self-rated health or were undergoing elective surgery (Johns et al., 2010; Keller et al., 2015; Naithani et al., 2009). In Switzerland, the most critical patient subgroup was those in psychiatric units, who primarily critiqued the taste of the meals (Dupertuis et al., 2003). Naithani et al. (2008) found that elderly patients in the UK were specifically dissatisfied with the portion size, as they were often put off by large meals (Naithani et al., 2008).

The type of food service system used by the hospital can impact the quality of food produced, which can further influence patient satisfaction (Edwards & Hartwell, 2006). Patients rated the trolley system superior in terms of appeal, temperature, flavour and presentation, compared to plated services in the UK and USA (Hartwell & Edwards, 2003; Williams, Virtue, & Adkins, 1998). Food quality has also been shown to improve with Steamplicity, a ward based service, as patients prefer the flavour, texture, presentation and temperature of the food compared to a cook-chill food service (Edwards & Hartwell, 2006).

Some studies have highlighted contradictory results regarding patients' experiences with food quality in hospital. In Switzerland patients were generally positive about quality, with 86% being satisfied or very satisfied with the hospital food, and 75% said the flavour was good (Stanga et al., 2003). Dissatisfied patients were more vocal compared to those who were satisfied, although dissatisfied patients made helpful suggestions for improvement (Stanga et al., 2003). Other studies also conducted in Switzerland reported over 90% of patients found the quality of food to be satisfactory (excellent, very good or acceptable) (Dupertuis et al., 2003; Thibault et al., 2011). Similar positive results were found regarding hospital food in Italy, patients reported sufficient portion size (85.2%), adequate temperature (85.2%) and good taste (70.7%) (Donini et al., 2008).

Many theories regarding these varied findings have been proposed, food quality is difficult to investigate within a food service due to the influence of individual perceptions (Fallon et al., 2008; Hartwell et al., 2007). Generally, satisfaction is established by contrasting expectations with reality or previous experiences. However, these are different for each patient, resulting in inconsistent findings (Fallon et al., 2008; Hartwell et al., 2007). Expectations vary between individuals, making it difficult to satisfy everyone at the same time (Fallon et al., 2008). This is often further compounded by the fact many patients have preconceived ideas about hospital food and expect poor quality (Hartwell, Edwards, & Symonds, 2006). Evidence for patient perceptions was presented by Johns et al. (2010) in the UK, for example some patients believed the bread was "lovely", compared to others who thought the same bread was "tasteless".

Comparisons were also made with previous hospital experiences, as some patients reported the food had improved from previous admissions and was better than expected (Johns et al., 2010; Watters et al., 2003). Previous experiences, perceptions and comparisons make hospital food quality difficult to address even though the quality domain is the most important factor in determining overall meal and food service satisfaction (Capra, Wright, Sardie, Bauer, & Askew, 2005; Fallon et al., 2008). As a result, improving food quality is usually the target across hospitals worldwide (Fallon et al., 2008).

2.4.6 Effects of illness on food intake

The effects of illness domain was added to the survey by Keller et al. (2015) and investigated issues such as chewing or swallowing difficulties, breathing difficulties and pain on a patients food intake (Keller et al., 2015). The most commonly experienced issue was a loss of appetite affecting food intake (63.9%), followed by sickness (42.7%). Higher scores in this domain was associated with patients who were female, malnourished, had a reduced food intake during the first week of admission, had a reported pre-admission weight loss or had a registered dietitian visit during their admission (Keller et al., 2015).

This domain is unique as many of the barriers can be controlled or minimised by medication or input from health care professionals. Medications that can be used include antiemetics for sickness and nausea, orexigenics for stimulating an appetite, analgesics for pain relief or hypnotics to induce sleep (Medical Associates Health Plan, 2018). Despite the ability to medically ease these barriers, issues such as a loss of appetite and sickness as reported by Keller et al. (2015) are also described in other countries around the world. In Switzerland, 50% of patients had a decreased appetite during their admission and 6% of patients had no appetite (Stanga et al., 2003). In Spain, 18.2% of male patients and 22.2% of female patients underwent changes in appetite, with a greater loss of appetite identified in malnourished patients (Pablo, Izaga, & Alday, 2003). Similar findings were reported by a study conducted in Norway where 43% of patients had a reduced appetite in hospital, of which 71% were considered undernourished (Mowe & Bohmer, 2002). Although the number of patients affected by a loss of appetite varies, patients are consistently affected by this barrier, likely due to the fact it is an adaptive, protective response in the acute phase of illness (Schütz, Bally, Stanga, & Keller, 2014). Sickness is a broad term and when left for patient interpretation, can include nausea and vomiting. Both nausea and vomiting can arise from a variety of causes, in hospital the most evident being postoperative nausea and vomiting (PONV). The overall incidence of PONV in hospitals is approximated at 25-30% in the USA, 38% in Germany and 41% in East Africa (Apfel, Kranke, Eberhart, Roos, & Roewer, 2002; Chalya, Mhewa, & Mabula, 2015; Gan, 2002; Kovac, 2000). An increased risk for PONV is seen in younger patients, women, elective procedures, longer duration of anaesthesia, non-smokers, obese patients and patients with a PONV history (Cohen, Duncan, DeBoer, & Tweed, 1994; Lerman, 1992). Although the effects of illness that fall within this domain (loss of appetite and sickness) have been investigated, their effect specifically on food consumption while in hospital remains largely unknown.

References

Abunnaja, S., Cuviello, A., & Sanchez, J. A. (2013). Enteral and parenteral nutrition in the perioperative period: State of the art. *Nutrients, 5*(2), 608-623.

Agarwal, E., Ferguson, M., Banks, M., Batterham, M., Bauer, J., Capra, S., & Isenring, E. (2013). Malnutrition and poor food intake are associated with prolonged hospital stay, frequent readmissions, and greater in-hospital mortality: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 32*(5), 737-745. doi:10.1016/j.clnu.2012.11.021

Agarwal, E., Ferguson, M., Banks, M., Bauer, J., Capra, S., & Isenring, E. (2012). Nutritional status and dietary intake of acute care patients: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 31*(1), 41-47. doi:10.1016/j.clnu.2011.08.002

Almdal, T., Viggers, L., Beck, A. M., & Jensen, K. (2003). Food production and wastage in relation to nutritional intake in a general district hospital- Wastage is not reduced by training the staff. *Clinical Nutrition, 22*(1), 47-51.

Amaral, T. F., Matos, L. C., Tavares, M. M., Subtil, A., Martins, R., Nazare, M., & Sousa Pereira, N. (2007). The economic impact of disease-related malnutrition at hospital admission. *Clinical Nutrition, 26*(6), 778-784. doi:10.1016/j.clnu.2007.08.002

Apfel, C. C., Kranke, P., Eberhart, L. H. J., Roos, A., & Roewer, N. (2002). Comparison of predictive models for postoperative nausea and vomiting. *British Journal of Anaesthesia, 88*(2), 234-240. doi:10.1093/bja/88.2.234

Barker, L. A., Gout, B. S., & Crowe, T. C. (2011). Hospital Malnutrition: Prevalence, identification and impact on patients and the healthcare system. *International Journal of Environmental Research and Public Health, 8*(2), 514-527. doi:10.3390/ijerph8020514

Barton, A. D., Beigg, C. L., Macdonald, I. A., & Allison, S. P. (2000). High food wastage and low nutritional intakes in hospital patients. *Clinical Nutrition, 19*(6), 445-449. doi:10.1054/clnu.2000.0150

Braga, M., Gianotti, L., Gentilini, O., Liotta, S., & Di Carlo, V. (2002). Feeding the gut early after digestive surgery: Results of a nine-year experience. *Clinical Nutrition, 21*(1), 59-65. doi:10.1054/clnu.2001.0504

Braga, M., Gianotti, L., Nespoli, L., Radaelli, G., & Di Carlo, V. (2002). Nutritional approach in malnourished surgical patients: A prospective randomized study. *Archives of Surgery, 137*(2), 174-180.

Bruun, L. I., Bosaeus, I., Bergstad, I., & Nygaard, K. (1999). Prevalence of malnutrition in surgical patients: Evaluation of nutritional support and documentation. *Clinical Nutrition, 18*(3), 141-147. doi:10.1054/clnu.1999.0006

Capra, S., Wright, O., Sardie, M., Bauer, J., & Askew, D. (2005). The acute hospital foodservice patient satisfaction questionnaire: The development of a valid and reliable tool to measure patient satisfaction with acute care hospital foodservices. *Foodservice Research International, 16*(1-2), 1-14. doi:10.1111/j.1745-4506.2005.00006.x

Chalya, P. L., Mhewa, O. Z., & Mabula, J. B. (2015). Postoperative nausea and vomiting at a tertiary care hospital in north-western Tanzania. *Tanzania Journal of Health Research, 17*(3). doi:10.4314/thrb.v17i3.7

Chima, C. S., Barco, K., Dewitt, M. L. A., Maeda, M., Teran, J. C., & Mullen, K. D. (1997). Relationship of nutritional status to length of stay, hospital costs, and discharge status of patients hospitalized in the medicine service. *Journal of the American Dietetic Association, 97*(9), 975-978. doi:10.1016/S0002-8223(97)00235-6

Cohen, M. M., Duncan, P. G., DeBoer, D. P., & Tweed, W. A. (1994). The postoperative interview: Assessing risk factors for nausea and vomiting. *Anesthesia & Analgesia, 78*(1), 7-16.

Corkins, M. R., Guenter, P., DiMaria-Ghalili, R. A., Jensen, G. L., Malone, A., Miller, S., . . . Nutrition, E. (2014). Malnutrition diagnoses in hospitalized patients. *Journal of Parenteral and Enteral Nutrition, 38*(2), 186-195. doi:10.1177/0148607113512154

Correia, M. I., & Waitzberg, D. L. (2003). The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. *Clinical Nutrition, 22*(3), 235-239.

Curtis, L. J., Bernier, P., Jeejeebhoy, K., Allard, J., Duerksen, D., Gramlich, L., . . . Keller, H. H. (2017). Costs of hospital malnutrition. *Clinical Nutrition, 36*(5), 1391-1396. doi:10.1016/j.clnu.2016.09.009

Dietitians New Zealand Inc. (2016). Dietitians New Zealand Clinical Handbook 2016: Eleventh Edition. In A. Sloan (Ed.), (Eleventh ed., pp. 23-34). Wellington, New Zealand: Ocular.

Donini, L. M., Castellaneta, E., De Guglielmi, S., De Felice, M. R., Savina, C., Coletti, C., . . . Cannella, C. (2008). Improvement in the quality of the catering service of a rehabilitation hospital. *Clinical Nutrition, 27*(1), 105-114. doi:10.1016/j.clnu.2007.10.004

Dupertuis, Y. M., Kossovsky, M. P., Kyle, U. G., Raguso, C. A., Genton, L., & Pichard, C. (2003). Food intake in 1707 hospitalised patients: A prospective comprehensive hospital survey. *Clinical Nutrition, 22*(2), 115-123.

Edington, J., Boorman, J., Durrant, E. R., Perkins, A., Giffin, C. V., James, R., . . . Coles, S. J. (2000). Prevalence of malnutrition on admission to four hospitals in England. *Clinical Nutrition, 19*(3), 191-195. doi:10.1054/clnu.1999.0121

Edwards, J. S. A., & Hartwell, H. J. (2006). Hospital food service: A comparative analysis of systems and introducing the 'Steamplicity' concept. *Journal of Human Nutrition and Dietetics, 19*(6), 421-430. doi:10.1111/j.1365-277X.2006.00730.x

Edwards, J. S. A., & Nash, A. H. M. (1999). The nutritional implications of food wastage in hospital food service management. *Nutrition & Food Science, 99*(2), 89-98. doi:doi:10.1108/00346659910254394

Engelund, E. H., Lassen, A., & Mikkelsen, B. E. (2007). The modernization of hospital food service- Findings from a longitudinal study of technology trends in Danish hospitals. *Nutrition & Food Science, 37*(2), 90-99. doi:doi:10.1108/00346650710736354

Fallon, A., Gurr, S., Hannan-Jones, M., & Bauer, J. D. (2008). Use of the Acute Care Hospital Foodservice Patient Satisfaction Questionnaire to monitor trends in patient satisfaction with foodservice at an acute care private hospital. *Nutrition & Dietetics, 65*(1), 41-46. doi:10.1111/j.1747-0080.2007.00219.x

Friedmann, J. M., Smiciklas-Wright, H., Jensen, G. L., & McCamish, M. (1995). Factors predicting early non-elective hospital readmission of nutritionally compromised older adults. *Journal of the American Dietetic Association, 95*(9, Supplement), A89. doi:10.1016/S0002-8223(95)00659-1

Gan, T. J. (2002). Postoperative nausea and vomiting- Can it be eliminated? *Journal of the American Medical Association, 287*(10), 1233-1236.

Goonan, S., Mirosa, M., & Spence, H. (2014). Getting a taste for food waste: A mixed methods ethnographic study into hospital food waste before patient consumption conducted at three New Zealand foodservice facilities. *Journal of the Academy of Nutrition and Dietetics, 114*(1), 63-71. doi:10.1016/j.jand.2013.09.022

Hall, K. D., Heymsfield, S. B., Kemnitz, J. W., Klein, S., Schoeller, D. A., & Speakman, J. R. (2012). Energy balance and its components: Implications for body weight regulation. *The American Journal of Clinical Nutrition, 95*(4), 989-994.

Hartwell, H. J., Edwards, J. S., & Beavis, J. (2007). Plate versus bulk trolley food service in a hospital: Comparison of patients' satisfaction. *Nutrition, 23*(3), 211-218. doi:10.1016/j.nut.2006.12.005

Hartwell, H. J., & Edwards, J. S. A. (2003). A comparative analysis of 'plated' and 'bulk trolley' hospital food service systems. *Food Service Technology, 3*(3-4), 133-142. doi:10.1111/j.1471-5740.2003.00077.x

Hartwell, H. J., Edwards, J. S. A., & Symonds, C. (2006). Foodservice in hospital: Development of a theoretical model for patient experience and satisfaction using one hospital in the UK National Health Service as a case study. *Journal of Foodservice, 17*(5-6), 226–238. doi:10.1111/j.1745-4506.2006.00040.x

Haydock, D. A., & Hill, G. L. (1986). Impaired wound healing in surgical patients with varying degrees of malnutrition. *Journal of Parenteral and Enteral Nutrition, 10*(6), 550-554. doi:10.1177/0148607186010006550

Heyland, D. K., Montalvo, M., MacDonald, S., Keefe, L., Su, X. Y., & Drover, J. W. (2001). Total parenteral nutrition in the surgical patient: A meta-analysis. *Canadian Journal of Surgery, 44*(2), 102-111.

Hiesmayr, M., Schindler, K., Pernicka, E., Schuh, C., Schoeniger-Hekele, A., Bauer, P., . . . Ljungqvist, O. (2009). Decreased food intake is a risk factor for mortality in hospitalised patients: The NutritionDay survey 2006. *Clinical Nutrition, 28*(5), 484-491. doi:10.1016/j.clnu.2009.05.013

Hoffer, L. J. (2003). Protein and energy provision in critical illness. *American Journal of Clinical Nutrition, 78*(5), 906-911.

Huckleberry, Y. (2004). Nutritional support and the surgical patient. *American Journal of Health-System Pharmacy, 61*(7), 671-682.

Iff, S., Leuenberger, M., Rosch, S., Knecht, G., Tanner, B., & Stanga, Z. (2008). Meeting the nutritional requirements of hospitalized patients: An interdisciplinary approach to hospital catering. *Clinical Nutrition, 27*(6), 800-805. doi:10.1016/j.clnu.2008.07.008

Jessri, M., Mirmiran, P., Jessri, M., Johns, N., Rashidkhani, B., Amiri, P., . . . Azizi, F. (2011). A qualitative difference. Patients' views of hospital food service in Iran. *Appetite, 57*(2), 530-533. doi:10.1016/j.appet.2011.06.012

Johns, N., Hartwell, H., & Morgan, M. (2010). Improving the provision of meals in hospital. The patients' viewpoint. *Appetite, 54*(1), 181-185. doi:10.1016/j.appet.2009.10.005

Kahokehr, A. A., Sammour, T., Wang, K., Sahakian, V., Plank, L. D., & Hill, A. G. (2010). Prevalence of malnutrition on admission to hospital- Acute and elective general surgical patients. *e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism, 5*(1), e21-e25. doi:10.1016/j.eclnm.2009.11.001

Keele, A. M., Bray, M. J., Emery, P. W., Duncan, H. D., & Silk, D. B. (1997). Two phase randomised controlled clinical trial of postoperative oral dietary supplements in surgical patients. *Gut, 40*(3), 393-399. doi:10.1136/gut.40.3.393

Keller, H., Allard, J., Vesnaver, E., Laporte, M., Gramlich, L., Bernier, P., . . . Payette, H. (2015). Barriers to food intake in acute care hospitals: A report of the Canadian Malnutrition Task Force. *Journal of Human Nutrition and Dietetics, 28*(6), 546-557. doi:10.1111/jhn.12314

Kersey, M. A., Beran, M. S., McGovern, P. G., Biros, M. H., & Lurie, N. (1999). The prevalence and effects of hunger in an emergency department patient population. *Academic Emergency Medicine, 6*(11), 1109-1114. doi:10.1111/j.1553-2712.1999.tb00112.x

Kondrup, J., Johansen, N., Plum, L. M., Bak, L., Larsen, I. H., Martinsen, A., . . . Lauesen, N. (2002). Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. *Clinical Nutrition, 21*(6), 461-468.

Kovac, A. L. (2000). Prevention and treatment of postoperative nausea and vomiting. *Drugs, 59*(2), 213-243. doi:10.2165/00003495-200059020-00005

Lerman, J. (1992). Surgical and patient factors involved in postoperative nausea and vomiting. *British Journal of Anaesthesia, 69, Supplement 1*, 24S-32S. doi:10.1093/bja/69.supplement_1.24S

Lewis, S. J., Egger, M., Sylvester, P. A., & Thomas, S. (2001). Early enteral feeding versus “nil by mouth” after gastrointestinal surgery: Systematic review and meta-analysis of controlled trials. *British Medical Journal, 323*(7316), 773. doi:10.1136/bmj.323.7316.773

Lim, S. L., Ong, K. C. B., Chan, Y. H., Loke, W. C., Ferguson, M., & Daniels, L. (2012). Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. *Clinical Nutrition, 31*(3), 345-350. doi:10.1016/j.clnu.2011.11.001

Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced recovery after surgery a review. *Journal of the American Medical Association Surgery, 152*(3), 292-298. doi:10.1001/jamasurg.2016.4952

Löser, C. (2010). Malnutrition in hospital: The clinical and economic implications. *Deutsches Arzteblatt International, 107*(51-52), 911-917. doi:10.3238/arztebl.2010.0911

Marinos, E. (2017). Defining, recognizing, and reporting malnutrition. *The International Journal of Lower Extremity Wounds, 16*(4), 230-237. doi:10.1177/1534734617733902

McCullough, J., Marcus, H., & Keller, H. (2017). The mealtime audit tool (MAT)- Inter-rater reliability testing of a novel tool for the monitoring and assessment of food intake barriers in acute care hospital patients. *J Nutr Health Aging, 21*(9), 962-970. doi:10.1007/s12603-017-0890-7

McWhirter, J. P., & Pennington, C. R. (1994). Incidence and recognition of malnutrition in hospital. *British Medical Journal, 308*(6934), 945-948.

Medical Associates Health Plan. (2018, 12th January 2018). 2018 Formulatory List. Retrieved from https://magellan.adaptiverx.com/web/pdf?key=cnhmbGV4LnBsYW4uUGxhblBkZlR5cGUtNzk=

Mowe, M., & Bohmer, T. (2002). Reduced appetite. A predictor for undernutrition in aged people. *Journal of Nutrition, Health & Aging, 6*(1), 81-83.

Mudge, A. M., Kasper, K., Clair, A., Redfern, H., Bell, J. J., Barras, M. A., & Pachana, N. A. (2011). Recurrent readmissions in medical patients: A prospective study. *Journal of Hospital Medicine, 6*(2), 61-67. doi:10.1002/jhm.811

Müller-Staub, M., Meer, R., Briner, G., Probst, M. T., & Needham, I. (2008). Measuring patient satisfaction in an emergency unit of a Swiss university hospital: Occurrence of anxiety, insecurity, worry, pain, dyspnoea, nausea, thirst and hunger, and their correlation with patient satisfaction (part 2). *Pflege, 21*(3), 180-188.

Naithani, S., Thomas, J. E., Whelan, K., Morgan, M., & Gulliford, M. C. (2009). Experiences of food access in hospital. A new questionnaire measure. *Clinical Nutrition, 28*(6), 625-630. doi:10.1016/j.clnu.2009.04.020

Naithani, S., Whelan, K., Thomas, J., Gulliford, M. C., & Morgan, M. (2008). Hospital inpatients' experiences of access to food: A qualitative interview and observational study. *Health Expectations, 11*(3), 294-303. doi:10.1111/j.1369-7625.2008.00495.x

National Institute for Clinical Excellence. (2006). Nutrition Support for Adults: Oral Nutrition Support, Enteral Tube Feeding and Parenteral Nutrition. Clinical guideline [CG32]. Retrieved from https://www.nice.org.uk/guidance/cg32

Nelson, K., Brown, M. E., & Lurie, N. (1998). Hunger in an adult patient population. *Journal of the American Medical Association, 279*(15), 1211-1214. doi:10.1001/jama.279.15.1211

New Zealand Ministry of Health. (2006). *Nutrient Reference Values for Australia and New Zealand.* Canberra: National Health and Medical Research Council. Retrieved from https://www.nhmrc.gov.au/_files_nhmrc/file/your_health/healthy/nutrition/17599_nhmrc_nrv_update-dietary_intakes_0.pdf

Norman, K., Pichard, C., Lochs, H., & Pirlich, M. (2008). Prognostic impact of disease-related malnutrition. *Clinical Nutrition, 27*(1), 5-15. doi:10.1016/j.clnu.2007.10.007

O'Hara, P. A., Harper, D. W., Kangas, M., Dubeau, J., Borsutzky, C., & Lemire, N. (1997). Taste, temperature, and presentation predict satisfaction with foodservices in a Canadian continuing-care hospital. *Journal of the American Dietetic Association, 97*(4), 401-405. doi:10.1016/S0002-8223(97)00100-4

Pablo, A. M. R., Izaga, M. A., & Alday, L. A. (2003). Assessment of nutritional status on hospital admission: Nutritional scores. *European Journal Of Clinical Nutrition, 57*, 824. doi:10.1038/sj.ejcn.1601616

Planas, M., Audivert, S., Pérez-Portabella, C., Burgos, R., Puiggrós, C., Casanelles, J. M., & Rosselló, J. (2004). Nutritional status among adult patients admitted to an university-affiliated hospital in Spain at the time of genoma. *Clinical Nutrition, 23*(5), 1016-1024. doi:10.1016/j.clnu.2004.01.003

Reissman, P., Teoh, T. A., Cohen, S. M., Weiss, E. G., Nogueras, J. J., & Wexner, S. D. (1995). Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial. *Annals of Surgery, 222*(1), 73-77.

Robinson, G., Goldstein, M., & Levine, G. M. (1987). Impact of nutritional status on DRG length of stay. *Journal of Parenteral and Enteral Nutrition, 11*(1), 49-51. doi:10.1177/014860718701100149

Rosenberg, E., & Bernabo, L. (1992). Hunger: A hospital survey. *Social Work in Health Care, 16*(3), 83-95. doi:10.1300/J010v16n03_08

Sahin, B., Demir, C., Celik, Y., & Teke, A. K. (2006). Factors affecting satisfaction level with the food services in a military hospital. *Journal of Medical Systems, 30*(5), 381-387.

Schütz, P., Bally, M., Stanga, Z. G., & Keller, U. (2014). Loss of appetite in acutely ill medical inpatients: Physiological response or therapeutic target? *Swiss medical weekly, 144*, w13957.

Sonnino, R., & McWilliam, S. (2011). Food waste, catering practices and public procurement: A case study of hospital food systems in Wales. *Food Policy, 36*(6), 823-829. doi:10.1016/j.foodpol.2011.09.003

Sorensen, J., Kondrup, J., Prokopowicz, J., Schiesser, M., Krähenbühl, L., Meier, R., & Liberda, M. (2008). EuroOOPS: An international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. *Clinical Nutrition, 27*(3), 340-349. doi:10.1016/j.clnu.2008.03.012

Stanga, Z., Zurflüh, Y., Roselli, M., Sterchi, A. B., Tanner, B., & Knecht, G. (2003). Hospital food: A survey of patients' perceptions. *Clinical Nutrition, 22*(3), 241-246. doi:10.1016/S0261-5614(02)00205-4

Stratton, R. J., & Elia, M. (2007). Who benefits from nutritional support: What is the evidence? *European journal of gastroenterology & hepatology, 19*(5), 353-358.

Sullivan, D. H. (1992). Risk factors for early hospital readmission in a select population of geriatric rehabilitation patients: The significance of nutritional status. *Journal of the American Geriatrics Society, 40*(8), 792-798. doi:10.1111/j.1532-5415.1992.tb01851.x

Thibault, R., Chikhi, M., Clerc, A., Darmon, P., Chopard, P., Genton, L., . . . Pichard, C. (2011). Assessment of food intake in hospitalised patients: A 10-year comparative study of a

prospective hospital survey. *Clinical Nutrition, 30*(3), 289-296. doi:10.1016/j.clnu.2010.10.002

Vahabzadeh, D. (2017). *Food intake, plate waste and its association with malnutrition in hospitalized patients*.

Vest, M. T., Papas, M. A., Shapero, M., McGraw, P., Capizzi, A., & Jurkovitz, C. (2017). Characteristics and outcomes of adult inpatients with malnutrition. *Journal of Parenteral and Enteral Nutrition*. doi:10.1002/jpen.1042

Watters, C. A., Sorensen, J., Fiala, A., & Wismer, W. (2003). Exploring patient satisfaction with foodservice through focus groups and meal rounds. *Journal of the American Dietetic Association, 103*(10), 1347-1349.

Williams, R., Virtue, K., & Adkins, A. (1998). Room service improves patient food intake and satisfaction with hospital food. *Journal of Pediatric Oncology Nursing, 15*(3), 183-189. doi:10.1177/104345429801500307

Windsor, J. A., Knight, G. S., & Hill, G. L. (1988). Wound healing response in surgical patients: Recent food intake is more important than nutritional status. *British Journal of Surgery, 75*(2), 135-137. doi:10.1002/bjs.1800750215

Wright, O. R., Connelly, L. B., & Capra, S. (2006). Consumer evaluation of hospital foodservice quality: An empirical investigation. *International Journal of Health Care Quality Assurance, 19*(2-3), 181-194.

Xia, C., & McCutcheon, H. (2006). Mealtimes in hospital - Who does what? *Journal of Clinical Nursing, 15*(10), 1221-1227. doi:10.1111/j.1365-2702.2006.01425.x

Chapter 3. Research Study Manuscript

The barriers to surgical patients' oral intake in the acute hospital setting

Olivia Stone[a], Rozanne Kruger[a] & Laura Mash[b].

[a] School of Sport, Exercise and Nutrition, Massey University, Auckland 0632, New Zealand; olivia.hannah.stone@gmail.com; R.Kruger@massey.ac.nz

[b] Medirest, Compass Group New Zealand Ltd, Auckland, New Zealand; lauram@compass-group.co.nz

3.1 Abstract

Background: Hospital patients worldwide often do not eat all of their meals; these patients are more likely to experience undesirable health outcomes as a consequence of not meeting their nutritional requirements.

Aim: To investigate the barriers to surgical patients' oral intake in an acute hospital setting in New Zealand (NZ).

Objectives: To conduct a pilot study to test the usability of the validated Patient Mealtime and Nutrition Care Survey (PMNCS) in a NZ setting, and to adapt the PMNCS to include the most relevant barriers to oral intake in NZ. Further, to conduct a feasibility study to test the effectiveness of the NZ-PMNCS independently, and paired with patient meal observations to confirm the effectiveness of the tool.

Methods/Design: A single-centre cross-sectional study conducted at North Shore Hospital, NZ. A sample of surgical in-patients participated in the pilot study (n=100) and feasibility study (n=65).

Results: The most frequently reported barriers were food brought into the hospital by visitors (81.5%) and a loss of appetite (70.8%). Six barrier domains were explored revealing significant findings for: younger (<65 years) compared to older (≥65 years) age associated with more hunger domain barriers (1.47 ± 0.81 versus 0.90 ± 0.67, *P*=0.003); longer (>5 days) versus shorter (≤5 days) length of stay associated with more food quality domain barriers (1.20 ± 1.26 versus 0.40 ± 0.81, *P*=0.003). Comparison of the NZ-PMNCS and meal observations showed that patients consuming ≤½ of their meals more frequently reported inability to make

informed menu choices (50.0%)(*P*=0.027) and that prescribed nutritional supplements affected their food intake (50%)(*P*=0.001).

Conclusion: The NZ-PMNCS was found to be feasible to use in the NZ setting. Key issues identified were patients consuming less than half their food reporting difficulty making menu choices with limited information and consuming prescribed nutritional supplements affecting their food intake. These findings may contribute to changing hospital practices to improve food intake.

Keywords: barriers, oral intake, foodservice, surgical patients, hospital

3.2 Introduction

Nutrition plays an important role in the health and wellbeing of all individuals. Within the acute hospital setting, nutrition plays a crucial role in promoting recovery and preventing undesirable health outcomes for patients (Dupertuis et al., 2003; Naber et al., 1997). Many patients do not eat all of the meals they have been provided with while in hospitals around the world, these patients are predicted to have a suboptimal intake (Agarwal et al., 2012; Barton, Beigg, Macdonald, & Allison, 2000; Dupertuis et al., 2003; Kondrup et al., 2002). Having a suboptimal intake is of concern as these patients are not likely to be meeting their nutritional requirements based on the amount of hospital food they are consuming orally (Almdal, Viggers, Beck, & Jensen, 2003; Barton et al., 2000; Dupertuis et al., 2003; Kondrup et al., 2002). This is compounded by the fact their nutritional requirements, such as energy and protein, often increase while in hospital (Dietitians New Zealand Inc, 2016).

Patients who have a sustained suboptimal intake in hospital are likely to lose weight during their admission, have a higher risk of becoming malnourished, increased length of stay, increased readmission rate, increased morbidity, decreased quality of life and increased mortality (Agarwal et al., 2013; Löser, 2010; K. Norman, Pichard, Lochs, & Pirlich, 2008; Planas et al., 2004; Robinson, Goldstein, & Levine, 1987; Vahabzadeh, 2017). These undesirable health outcomes place a financial strain on hospital resources and staff (Curtis et al., 2017). Patients who are not eating their hospital meals also contribute to increased food wastage, which can lead to environmental and social implications (Almdal et al., 2003; Dupertuis et al., 2003; Goonan, Mirosa, & Spence, 2014).

Surgical patients often have a suboptimal intake during their admission and as a result they can also experience many complications, much like the wider group of hospital patients (Agarwal et al., 2013; Bruun, Bosaeus, Bergstad, & Nygaard, 1999; Kahokehr et al., 2010). Poor nutrition for surgical patients can also lead to an impaired wound healing response and decreased muscle function, respiratory function and immune function (Bruun et al., 1999; Haydock & Hill, 1986; Windsor, Knight, & Hill, 1988). Surgical patients may follow a postoperative diet regime, sometimes involving numerous diet codes and oral nutritional supplements (ONS) to aid recovery and prevent complications (Huckleberry, 2004; Ljungqvist, Scott, & Fearon, 2017).

Many theories have been proposed to explain why a patient may or may not eat their meals while in hospital. The various barriers to eating while in hospital have been investigated in several studies (Keller et al., 2015; Naithani, Thomas, Whelan, Morgan, & Gulliford, 2009). Naithani et al. (2009) developed a survey to explore patient experiences of food access in the United Kingdom (UK). Keller et al. (2015) assessed the barriers to food intake in hospitals across Canada using an adapted and validated version of the original survey created by Naithani et al. (2009), called the Patient Mealtime and Nutrition Care Survey (PMNCS). Barriers were classified under six domains; organisational, choice, hunger, eating difficulties, quality and

effects of illness on food intake. Due to the worldwide differences in foodservices and the transient nature of hospital populations (Naithani et al., 2009), the present study aims to assess the barriers to surgical patients' oral intake in an acute hospital setting in New Zealand (NZ).

3.3 Methods

Study Design

This is a single-centre cross-sectional study which was conducted to further understand the barriers to patients' oral intake. The chosen location was in the acute hospital setting at North Shore Hospital, Waitemata District Health Board (WDHB). North Shore Hospital is one of two hospitals within the WDHB region. A sample of surgical (general and orthopaedic) patients from four wards at North Shore Hospital were included in the study. At any given time, the total population could be up to 140 patients (35 on each ward). This study was conducted in two phases. Phase one was a pilot study to test and adapt the validated PMNCS for use in a NZ hospital setting. Phase two was a feasibility study to trial the NZ-PMNCS in the hospital setting.

Ethical and Locality Approval

Ethical approval was obtained for this study from the Massey University Human Ethics Committee (MUHEC): Southern A, Application 16/66. This study was also reviewed by the Māori Research Committees, for Massey University and for Waitemata and Auckland District Health Boards, and the Awhina Research and Knowledge Centre.

Inclusion criteria

Pilot study & Feasibility study

- Patients who have been in hospital care for at least 48 hours
- Have an anticipated length of stay for at least the next 24 hours
- Can speak English
- Are aged 16 years or older
- Have consumed at least one hospital meal during current hospital admission (pilot study) or will be consuming one hospital meal during the next 24 hours (feasibility study)

Exclusion criteria

Pilot study & Feasibility study

- Patients under the age of 16 years
- Have been Nil by Mouth (NBM) for the entire hospital stay (pilot study only)

Charge Nurse Managers and researcher had the ability to further exclude patients for both studies under their discretion if patients were too unwell to participate on the day.

Sample Size

Pilot study- 100 surgical in-patients completed the validated PMNCS.
Feasibility study- 65 surgical in-patients completed the NZ-PMNCS. Of these, 60 patients also had a meal observation completed in the 24 hours following completion of the survey. Five patients were discharged before a meal observation could occur **(Figure 3.1).**

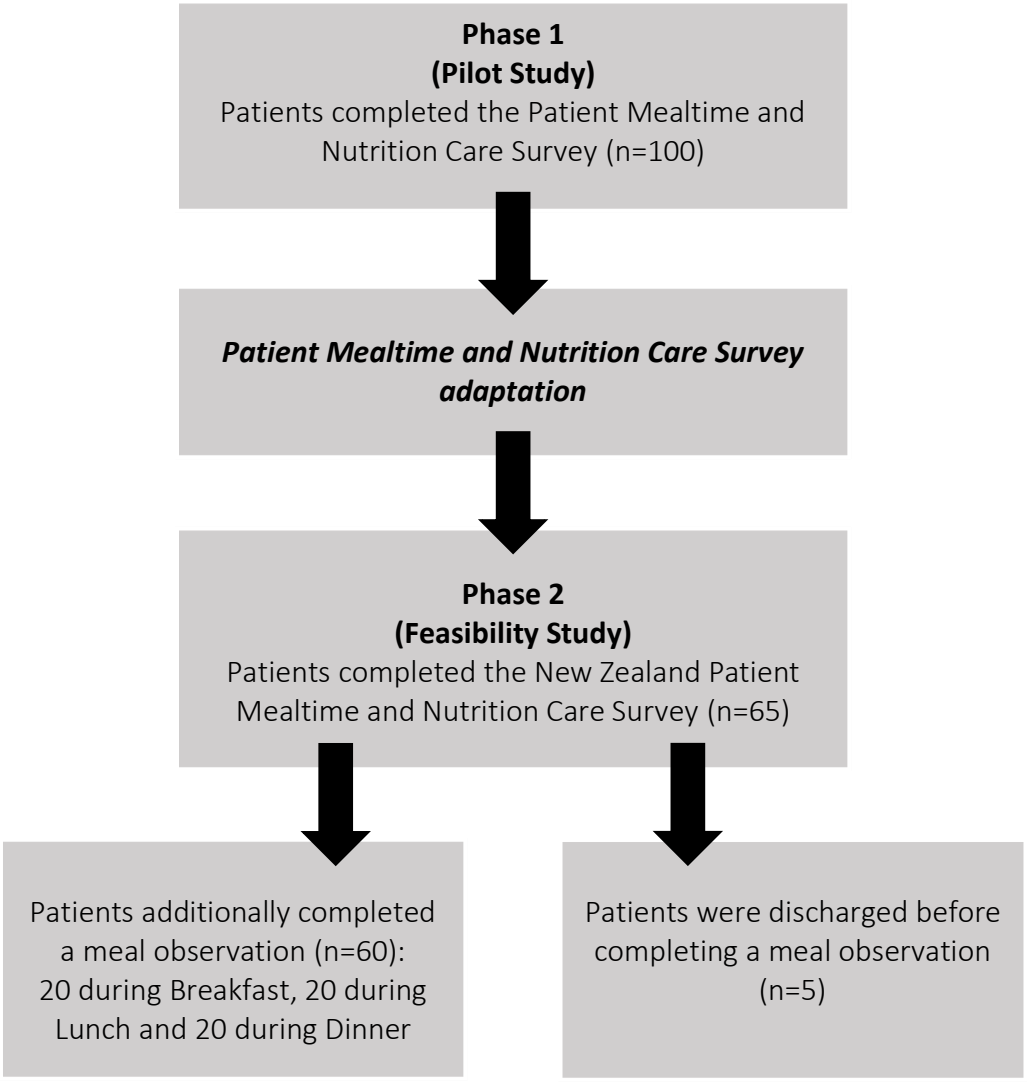

Figure 3.1: *Visual representation of the two phases of research*

Participant recruitment

Pilot study & Feasibility study - on each day of data collection, the Charge Nurse Managers assisted in identifying the patients who met the inclusion and exclusion criteria. Only these patients were approached for recruitment. All patients had the opportunity to read the Participant Information Sheet and to discuss the research project with the researcher prior to signing the Participant Consent Form. Patients were advised of the estimated 10-15 minute timeframe to complete the survey, as well as their right to withdraw at any time. Patients who did not wish to participate in the research project were excluded from further recruitment during their admission. One researcher conducted data collection to reduce interrater bias.

Data collection

Pilot study- patients had the option of completing the survey independently or with assistance from the researcher and they were encouraged to ask questions throughout the process. After consenting to the study, patients then self-completed the first four questions providing demographic information on the Participant Background Information Sheet. The remaining

information was collected by the researcher from the patient notes, from the Charge Nurse Managers and from Saffron (the electronic menu management/ meal ordering system), to reduce respondent burden. Data collection for the pilot study occurred in January 2017.

Patients then completed the validated PMNCS, which was chosen as it had been tested in several studies. It is a concise tool which is both valid and reliable. The survey was designed for hospital in-patients and covers a wide variety of barriers they may have experienced during their admission. This survey consists of 38 questions that fall under six domains of barriers; organisational, choice, hunger, eating difficulties, food quality and effects of illness. All questions required answers in a Likert scale format, which produced quantitative data.

Survey adaptation- the Participant Background Information Sheet was altered to capture a greater range of demographic information in the feasibility study. The changes made to adapt the PMNCS for the feasibility study were based on statistical analysis of data collected during the pilot study, feedback from patients and from experience with data collection. Sixteen changes were made to the PMNCS to create the NZ-PMNCS. Five open-ended questions with answer boxes were added into the survey where patients commonly made verbal and written comments during the pilot study. This also brought in a new element of qualitative data to the survey, which the original survey did not contain. Previous research has highlighted the use of comments within surveys as critical, as qualitative data can support the understanding of quantitative results (Messina et al., 2013). Eleven questions, in a Likert scale format, were added or reworded in the adapted survey to provide further detail where deemed necessary and allowed for further exploration of concepts and themes.

Feasibility study- patients also had the option of self-completing the survey or with assistance from the researcher. They were encouraged to ask questions throughout the process. After consenting to the study, patients self-completed the first four questions on the Participant Background Information Sheet. The remaining information was collected by the researcher to reduce respondent burden. Data collection spanned across June and July 2017.

Patients then completed the NZ-PMNCS, consisting of 51 questions, categorised under the same six barrier domains. Meal observations were a unique addition to the final study to capture a holistic view of all patient mealtime experiences. After a patient had completed the NZ-PMNCS, a meal observation was conducted during the following 24 hours of their admission. Any assistance, interruptions or consumption of non-hospital food was recorded on the Participant Background Information Sheet. As a patient was delivered their meal, their unique patient code was placed on their tray and a photograph of their meal was taken by the researcher before they started eating. The researcher did not remain with each patient for the full duration of their meal, but recorded any relevant observations that they witnessed while circulating the wards during the mealtime period. A second photograph was taken after the patient stated they had finished their meal or when the meal trays were collected.

Data handling

Pilot study & Feasibility study

Data were collected using both paper surveys and electronic photographs, both were de-identified with the use of unique patient codes. Patients' survey responses were coded and entered manually into a Microsoft Excel spreadsheet. All of the data were double-checked for transfer errors during the data handling process.

Feasibility study

Electronic photographs were analysed by comparing before and after photos. Oral intake was estimated from the photographic data by recording the mean proportion of food consumed based on the meal components each individual was served. The proportion of each meal component consumed was visually estimated to the nearest 10% (smallest feasible proportion from photographs) and recorded on a Microsoft Excel spreadsheet. This gave an indication of the amount of food that was consumed, but by no means was an exact measure. The mean proportion consumed of each meal component was also recorded to give an indication of which components patients commonly received based on their menu order and which components they consumed the most of. Both aspects are important as one provides useful information for menu planning within the food service and the other provides information required for a case-by-case analysis.

Statistical analysis

Pilot study & Feasibility study

The coded data were imported into SPSS 24 for Windows (SPSS Inc, Chicago IL) for statistical analysis. Proportions were used to describe the patient, care and hospital characteristics, the barriers to oral intake, patients' opinions and comments and meal observations. Both the age and length of stay were checked for normality in the pilot study and final study using the Kolmogorov-Smirnov and Shapiro-Wilk tests, with significance set at $p \leq 0.05$. As the data were not normally distributed, the median, 25th and 75th percentiles were used for analysis.

Feasibility study

The prevalence of barriers within patient sub-groups (based on length of stay and oral intake) were examined with Pearson Chi-Square and Fisher's Exact Test. The overall barrier score for each domain was reported as a mean and standard deviation (SD) after applying the central limit theorem (Hill, 1998; G. Norman, 2010). Patients were separated into sub-groups for analysis based on certain characteristics (patient, care and hospital), the differences between these characteristics and their barrier scores were examined with a paired t-test ($p \leq 0.05$).

Informing Participants of Results

Pilot study & Feasibility study

Patients had the option of being contacted after the results from both phases had been analysed. A brief summary of findings was sent to patients at conclusion of the study.

3.4 Results

Results from the pilot study, involving 100 patients, were used to adapt the PMNCS. These are reported in Appendix A. The findings from the 65 patients involved in the feasibility study are described below.

Patient, care and hospital characteristics

The demographic characteristics of the patients in the feasibility study (n=65) are presented in **Table 3.1**. Most of the patients were aged under 65yrs (55.4%) and the majority of patients were women (53.8%). The most common primary ethnicity was NZ European (75.4%). The majority of the patients had a length of stay of five days or less (56.9%) and the median length of stay was 6 days (25th percentile = 4 days; 75th percentile = 10 days).

The majority of patients were admitted for orthopaedic surgery (63.1%), and 78.5% of this cohort were postoperative when approached to complete the survey. A standard diet code was the most common current diet code (75.4%) and the most common diet code experienced during the previous 7 days of admission (81.5%). Most patients (73.8%) had one diet code during their admission, whilst 26.2% of patients experienced changes to their diet code during their admission (two diet codes or more).

In terms of patients self-reported food intake in hospital, 38.5% consumed ≤½, 61.5% consumed >½ and 33.8% reported consuming all of their food. Many patients (56.9%) reported being constipated while in hospital and 12.3% reported having diarrhoea.

Table 3.1: *Summary of demographic information including patient, care and hospital characteristics*

	Total with characteristic (N=65)	**Median (25th, 75th percentile)**
Parameter	**n (%)**	
Age		62 [47,76]
<65 years	36 (55.4)	
≥65 years	29 (44.6)	
Gender		
Female	35 (53.8)	
Male	30 (46.2)	
Primary Ethnicity		
New Zealand European	49 (75.4)	
European	6 (9.2)	
Pacific	4 (6.4)	
Māori	3 (4.6)	
Asian	3 (4.6)	
Secondary Ethnicities[×]		
No secondary ethnicity	60 (92.3)	
Māori	3 (4.6)	
Pacific	2 (3.1)	

	Total with characteristic (N=65)	Median (25th, 75th percentile)
Parameter	**n (%)**	
Length of stay		6 [4,10]
≤5 days	37 (56.9)	
>5 days	28 (43.1)	
Type of surgical ward		
Orthopaedic (Wards 7 and 9)	47 (72.3)	
General (Wards 4 and 8)	18 (27.7)	
Stage of admission		
Post-operation/s	51 (78.5)	
Pre-operation	14 (21.5)	
Type of surgery		
Orthopaedic	41 (63.1)	
Other[β]	9 (13.8)	
Lower gastrointestinal tract	8 (12.3)	
Neurological	5 (7.7)	
Upper gastrointestinal tract	2 (3.1)	
Diet code; current		
Standard[#]	49 (75.4)	
Composition modified[†]	13 (20.0)	
Texture modified[‡]	2 (3.1)	
Liquid diet[Ω]	1 (1.5)	
Diet code; experienced during previous 7 days of admission		
Standard[#]	53 (81.5)	
Composition modified[†]	13 (20.0)	
Nil by mouth	11 (16.9)	
Liquid diet[Ω]	9 (13.8)	
Texture modified[‡]	2 (3.1)	
Number of diet codes during previous 7 days of admission		
1	48 (73.8)	
2	8 (12.3)	
3	5 (7.7)	
4	4 (6.2)	
Had a registered dietitian visit		
No	54 (83.1)	
Yes	11 (16.9)	
Self-reported food intake		
All	22 (33.8)	
¾	18 (27.7)	
½	16 (24.6)	
¼	9 (13.8)	
None	0 (0.0)	
Self-reported bowel motions		
Constipated	37 (56.9)	
Normal	20 (30.8)	
Diarrhoea	8 (12.3)	

[×]Patients can identify with more than one secondary ethnicity.

[β]Other surgical admissions included: hernia repair, pancreatectomy, cellulitis, cholecyctitis, hepatoctomy, eye trauma, skin excision and cholangitis.

[#]Standard diet code is designed for patients who are nutritionally well and able to eat normally with no restrictions (a full adult diet)

[†]Composition modified diet codes included: High Energy High Protein, Enhanced Recovery After Surgery, Restricted Fibre, Vegetarian and Low Sodium.

[‡]Texture modified diet codes included: Soft Mechanical and Soft Dysphagic.

[Ω]Liquid diet included: Free Oral Fluids and Clear Oral Fluids.

Food related barriers

The prevalence of food related barriers within the hospital are presented in **Table 3.2.** Common barriers include >30% of patients who report being affected (Keller et al., 2015), with 15 individual barriers meeting this criterion. The 10 most commonly reported barriers were: visitors bringing in food for patients (81.5%), a loss of appetite affecting food intake (70.8%), nausea affecting food intake (56.9%), sickness affecting food intake (49.2%), not always wanting the food that had been ordered (46.2%), did not receive the ordered food (46.2%), missed meals due to not being available when they were served (40.0%), pain affecting food intake (40.0%), tiredness affecting food intake (36.9%) and bowel motions affecting appetite (36.9%).

The most common barriers within each barrier domain were also identified. Within the organisational domain, not always wanting the food that had been ordered was the barrier that overall affected the most patients (46.2%). In the choice domain, the common barrier was that patients were not provided with enough information to choose the right food (30.8%). In the hunger domain, 81.5% of visitors brought in food for the patient. Within the eating difficulties domain, the most common barrier was that 35.4% of patients had difficulty opening packets or unwrapping food. The quality domain showed that 23.1% of patients were dissatisfied with the taste of the food and 23.1% of patients were dissatisfied with the temperature of the food. Finally, in the effects of illness domain, 70.8% of patients reported a loss of appetite affecting food intake.

Patients were deemed to have had a short stay (brief hospitalisation) if their length of stay was five days or less, and a long stay if their length of stay was more than five days (Damiani et al., 2011). Within the eating difficulties domain, short stay patients (6.7%) significantly reported fewer issues with difficulty cutting up their food compared to long stay patients (25.7%) (P=0.041). Within the food quality domain, short stay patients experienced significantly less issues with taste (10.0%) and temperature (10.0%) compared to long stay patients (34.3%) (P=0.021) and (34.3%) (P=0.021) respectively. Within the illness domain, 26.7% of short stay patients reported that pain has affected their food intake, which was significantly less compared to long stay patients (51.4%) (P=0.042).

Table 3.2: *Prevalence of food related barriers, for the total patient sample and short/ long stay patients, within food intake barrier domains*

	Total number affected N=65	Number of short stay affected (≤5days) N=30	Number of long stay affected (>5days) N=35	
Barriers to food intake reported by patients[×]	**n (%)**	**n (%)**	**n (%)**	**p-value**
Organisational				
Did not always want food that has been ordered	30 (46.2)	14 (46.7)	16 (45.7)	0.939
Did not receive ordered food	30 (46.2)	11 (36.7)	19 (54.3)	0.155
Missed meals due to not being available when they were served	26 (40.0)	12 (40.0)	14 (40.0)	1.000
Missed meals due to avoiding food for tests	20 (30.8)	9 (30.0)	11 (31.4)	0.901
Did not get help when needed (restricted to patients who needed help)[‡]	2 (28.6)	1 (33.3)	1 (25.0)	1.000
When meals missed, not given hospital food by staff (restricted to patients who missed meals)[†]	10 (27.8)	4 (26.7)	6 (28.6)	1.000
Disturbed by activities, noises or unpleasant smells	17 (26.2)	7 (23.3)	10 (28.6)	0.632
Interrupted by the hospital staff	17 (26.2)	5 (16.7)	12 (34.3)	0.107
Choice				
Not enough information provided to choose the right food	20 (30.8)	8 (26.7)	12 (34.3)	0.507
Not being able to choose preferred foods	12 (18.5)	5 (16.7)	7 (20.0)	0.730
Meals not served at times that suit patient	7 (10.8)	1 (3.3)	6 (17.1)	0.112
Do not understand how to complete the menu selections	1 (1.5)	0 (0.0)	1 (2.9)	1.000
Hunger				
Visitors bring in food	53 (81.5)	24 (80.0)	29 (82.9)	0.767
Become hungry as the time between meals is too long	18 (27.7)	8 (26.7)	10 (28.6)	0.864
Felt hungry but could not ask staff for food	6 (9.2)	3 (10.0)	3 (8.6)	1.000
Felt hungry but no food was available from the hospital	2 (3.1)	1 (3.3)	1 (2.9)	1.000
Eating difficulties				
Difficulty opening packets or unwrapping food	23 (35.4)	11 (36.7)	12 (34.3)	0.841
In an uncomfortable position to eat	22 (33.8)	9 (30.0)	13 (37.1)	0.544
Difficulty reaching food	18 (27.7)	7 (23.3)	11 (31.4)	0.467
Difficulty cutting up food	11 (16.9)	2 (6.7)	9 (25.7)	**0.041***
Difficulty feeding self	4 (6.2)	1 (3.3)	3 (8.6)	0.618
Not enough time to eat all the food	3 (4.6)	2 (6.7)	1 (2.9)	0.591
Needed help to eat meals	2 (3.1)	0 (0.0)	2 (5.7)	0.495
Food quality; dissatisfied with:				
Taste	15 (23.1)	3 (10.0)	12 (34.3)	**0.021***
Temperature of food	15 (23.1)	3 (10.0)	12 (34.3)	**0.021***
Appearance	10 (15.4)	3 (10.0)	7 (20.0)	0.319
Portion size	10 (15.4)	3 (10.0)	7 (20.0)	0.319
Smell	4 (6.2)	0 (0.0)	4 (11.4)	0.118

	Total number affected N=65	Number of short stay affected (≤5days) N=30	Number of long stay affected (>5days) N=35	
Barriers to food intake reported by patients[×]	**n (%)**	**n (%)**	**n (%)**	**p-value**
Illness; effect on food intake:				
Loss of appetite	46 (70.8)	18 (60.0)	28 (80.0)	0.077
Nausea	37 (56.9)	16 (53.3)	21 (60.0)	0.588
Sickness	32 (49.2)	14 (46.7)	18 (51.4)	0.702
Pain	26 (40.0)	8 (26.7)	18 (51.4)	**0.042***
Tired	24 (36.9)	8 (26.7)	16 (45.7)	0.113
Bowel motions affected appetite	24 (36.9)	9 (30.0)	15 (42.9)	0.284
Vomiting	22 (33.8)	8 (26.7)	14 (40.0)	0.257
Medication	19 (29.2)	9 (30.0)	10 (28.6)	0.900
Worried	15 (23.1)	4 (13.3)	11 (31.4)	0.084
Prescribed nutritional supplements	13 (20.0)	3 (10.0)	10 (28.6)	0.062
Chewing or swallowing difficulties	12 (18.5)	4 (13.3)	8 (22.9)	0.324
Depressed	10 (15.4)	3 (10.0)	7 (20.0)	0.319
Breathing difficulties	5 (7.7)	2 (6.7)	3 (8.6)	1.000

[×]Based on the number of patients who reported experiencing the barrier at least once during their admission.
[†]Sub-question; patients who answered 'did not miss a meal' were excluded.
[‡]Sub-question; patients who answered 'did not need any help' were excluded.
*Pearson Chi-Square and Fisher's Exact Test, p<0.05 indicates statistical significance.

The associations between barriers and certain characteristics (patient, care and hospital) are reported in **Table 3.3** and **Table 3.4.** The highest mean barrier score for all patients was calculated within the illness domain being 4.38 ± 2.95 from 13 possible barriers, followed by an organisational barrier score of 2.34 ± 1.74 from eight barriers. The lowest mean barrier score for all patients was within the choice domain, being 0.62 ± 0.76 from four possible barriers.

Significant associations were found between many barrier domains and characteristics. Younger age (<65 years) was significantly associated with experiencing more barriers within the hunger domain compared to those who were older (≥65 years) (1.47 ± 0.81 versus 0.90 ± 0.67, *P*=0.003). A longer length of stay (>5 days) was significantly associated with experiencing more barriers from the food quality domain compared to those with a shorter length of stay (≤5 days) (1.20 ± 1.26 versus 0.40 ± 0.81, *P*=0.003), and more barriers from the illness domain (5.11 ± 3.00 versus 3.53 ± 2.69, *P*=0.030). Patients undergoing general surgery significantly experienced more barriers within the illness domain compared to those undergoing orthopaedic surgery (5.75 ± 2.86 versus 3.59 ± 2.72, *P*=0.003). Being located on a general surgical ward was significantly associated with experiencing less hunger barriers compared to those on an orthopaedic ward (0.89 ± 0.68 versus 1.34 ± 0.81, *P*=0.041), and more barriers from the illness domain (6.61 ± 2.43 versus 3.53 ± 2.69, *P*=<0.001). Patients who had one diet code during the previous 7 days of admission experienced significantly more barriers from the hunger domain compared to those who had two or more diet codes (1.31 ± 0.85 versus 0.94 ± 0.56, *P*=0.048), and less barriers from the illness domain (3.83 ± 2.71 versus 5.94 ± 3.11,

P=0.010). Patients currently on a standard diet code was significantly associated with experiencing less barriers from the illness domain compared to those on a therapeutic diet code (3.71 ± 2.77 versus 6.44 ± 2.56, *P*=0.001). Patients with low self-reported food intake (≤½) reported more barriers from the food quality domain compared to those who reported consuming more food (>½) (1.28 ± 1.34 versus 0.55 ± 0.90, *P*=0.011), and more barriers from the illness domain (5.56 ± 2.87 versus 3.65 ± 2.78, *P*=0.010). Patients with a low observed food intake (≤½) reported more barriers from the choice domain compared to those who consumed more food (>½) (0.89 ± 0.90 versus 0.43 ± 0.67, *P*=0.032). Finally, patients who reported abnormal bowel motions experienced more barriers within the illness domain compared to those with normal bowel motions (5.04 ± 2.91 versus 2.90 ± 2.51, *P*=0.006). There were no significant associations found with gender (male and female) and stage of admission (pre-operation and post-operation) within any of the barrier domains.

Table 3.3: *Patient gender, age, length of stay, stage of admission and type of surgery associations with food intake barrier domains*

	Total number of barriers in domain	**All patients** Mean barrier score[×] ± SD	**Gender** Mean barrier score[×] ± SD			**Age** Mean barrier score[×] ± SD			**Length of stay** Mean barrier score[×] ± SD			**Stage of admission** Mean barrier score[×] ± SD			**Type of surgery** Mean barrier score[×] ± SD		
Food intake barrier domains			Male	Female	p-value	<65 years	≥65 years	p-value	≤5 days	>5 days	p-value	Pre-operation	Post-operation	p-value	Ortho-paedic [†]	General [‡]	p-value
Organisational	8	2.34 ± 1.74	2.47 ± 1.91	2.23 ± 1.61	0.587	2.50 ± 1.95	2.14 ± 1.46	0.410	2.10 ± 1.67	2.54 ± 1.80	0.311	3.07 ± 2.20	2.14 ± 1.56	0.076	2.44 ± 1.78	2.17 ± 1.71	0.548
Choice	4	0.62 ± 0.76	0.50 ± 0.68	0.71 ± 0.83	0.263	0.58 ± 0.73	0.66 ± 0.81	0.710	0.47 ± 0.73	0.74 ± 0.78	0.148	0.79 ± 0.80	0.57 ± 0.76	0.351	0.54 ± 0.74	0.75 ± 0.79	0.281
Hunger	4	1.22 ± 0.80	1.23 ± 0.86	1.20 ± 0.76	0.869	1.47 ± 0.81	0.90 ± 0.67	**0.003***	1.20 ± 0.81	1.23 ± 0.81	0.887	1.43 ± 1.02	1.16 ± 0.73	0.264	1.22 ± 0.79	1.21 ± 0.83	0.957
Eating difficulties	7	1.28 ± 1.31	1.20 ± 1.49	1.34 ± 1.14	0.664	1.14 ± 1.44	1.45 ± 1.12	0.346	1.07 ± 1.17	1.46 ± 1.40	0.232	1.43 ± 1.60	1.24 ± 1.23	0.627	1.29 ± 1.38	1.25 ± 1.19	0.900
Food quality	5	0.83 ± 1.14	0.60 ± 1.04	1.03 ± 1.20	0.132	0.81 ± 1.14	0.86 ± 1.16	0.844	0.40 ± 0.81	1.20 ± 1.26	**0.003***	0.93 ± 1.27	0.80 ± 1.11	0.720	0.88 ± 1.10	0.75 ± 1.22	0.666
Illness	13	4.38 ± 2.95	4.00 ± 2.88	4.71 ± 3.01	0.334	3.94 ± 2.96	4.93 ± 2.89	0.182	3.53 ± 2.69	5.11 ± 3.00	**0.030***	3.64 ± 3.27	4.59 ± 2.85	0.291	3.59 ± 2.72	5.75 ± 2.86	**0.003***

[×]Mean barrier score calculated as the mean number of barriers experienced within that domain. A higher mean barrier score indicates more barriers were experienced within that domain.

[†]Orthopaedic: limited to orthopaedic surgery only.

[‡]General surgery: includes upper gastrointestinal, lower gastrointestinal, neurological and other surgeries.

*Independent samples t-test, $p<0.05$ indicates statistical significance.

Table 3.4: *Patient ward, diet codes, intake and bowel motion associations with food intake barrier domains*

	Type of surgical ward Mean barrier score[×] ± SD			**Number of diet codes during previous 7 days** Mean barrier score[×] ± SD			**Current diet code** Mean barrier score[×] ± SD			**Self-reported food intake** Mean barrier score[×] ± SD			**Observed food intake** Mean barrier score[×] ± SD			**Self-reported bowel motions** Mean barrier score[×] ± SD		
Food intake barrier domains	Ortho-paedic[†]	General[‡]	p-value	1 diet code	≥2 diet codes	p-value	Standard[β]	Therapeutic[Ω]	p-value	≤½	>½	p-value	≤½	>½	p-value	Normal[#]	Ab-normal[α]	p-value
Organisational	2.43 ± 1.68	2.11 ± 1.94	0.520	2.23 ± 1.64	2.65 ± 2.03	0.400	2.31 ± 1.79	2.44 ± 1.63	0.796	2.44 ± 1.83	2.28 ± 1.71	0.714	2.44 ± 1.85	2.19 ± 1.73	0.612	2.80 ± 2.19	2.13 ± 1.49	0.156
Choice	0.51 ± 0.72	0.89 ± 0.83	0.074	0.52 ± 0.68	0.88 ± 0.93	0.094	0.59 ± 0.70	0.69 ± 0.95	0.667	0.72 ± 0.89	0.55 ± 0.68	0.387	0.89 ± 0.90	0.43 ± 0.67	**0.032***	0.60 ± 0.82	0.62 ± 0.75	0.915
Hunger	1.34 ± 0.81	0.89 ± 0.68	**0.041***	1.31 ± 0.85	0.94 ± 0.56	**0.048***	1.29 ± 0.82	1.00 ± 0.73	0.218	1.12 ± 0.67	1.28 ± 0.88	0.452	1.28 ± 0.83	1.19 ± 0.80	0.704	1.25 ± 0.91	1.20 ± 0.76	0.818
Eating difficulties	1.30 ± 1.38	1.22 ± 1.11	0.836	1.29 ± 1.35	1.24 ± 1.20	0.880	1.31 ± 1.36	1.19 ± 1.17	0.755	1.48 ± 1.23	1.15 ± 1.35	0.325	1.44 ± 1.29	1.21 ± 1.39	0.551	1.45 ± 1.50	1.20 ± 1.22	0.480
Food quality	0.81 ± 1.06	0.89 ± 1.37	0.801	0.69 ± 0.93	1.24 ± 1.56	0.188	0.67 ± 1.01	1.31 ± 1.40	0.051	1.28 ± 1.34	0.55 ± 0.90	**0.011***	1.06 ± 1.16	0.67 ± 1.07	0.215	0.75 ± 1.07	0.87 ± 1.18	0.706
Illness	3.53 ± 2.69	6.61 ± 2.43	**<0.001***	3.83 ± 2.71	5.94 ± 3.11	**0.010***	3.71 ± 2.77	6.44 ± 2.56	**0.001***	5.56 ± 2.87	3.65 ± 2.78	**0.010***	5.17 ± 3.28	3.93 ± 2.84	0.145	2.90 ± 2.51	5.04 ± 2.91	**0.006***

[×]Mean barrier score calculated as the mean number of barriers experienced within that domain. A higher mean barrier score indicates more barriers were experienced within that domain.

[†]Orthopaedic wards: includes ward seven and ward nine.

[‡]General wards: includes ward four and ward eight.

[β]Standard: includes standard diet code only.

[Ω]Therapeutic: includes composition modified, texture modified and liquid diet codes.

[#]Normal: defined as a patient responding 'normal' to the question 'since I came into hospital, my bowel motions have been mostly…'.

[α]Abnormal: defined as a patient responding 'diarrhoea' or 'constipated' to the question 'since I came into hospital, my bowel motions have been mostly…'.

*Independent samples t-test, $p<0.05$ indicates statistical significance.

Patient opinions and comments

The prevalence of patient opinions and comments for the final study are presented in **Table 3.5**. The most common comment by patients regarding difficulty choosing the right food was surrounding a lack of information provided about the food and/or menu (27.7%). Examples include *"the descriptions can be misleading due to the lack of information"* and *"sometimes the staff taking orders complete the selections for patients".* Disruptions or interruptions by staff were reported by 12.3% of patients regarding organisational barriers. Comments included *"occasionally a blood test is taken during breakfast time"* and *"doctors in the morning often interrupt breakfast".*

The most common outcome for patients who missed a meal while in hospital was that the hospital provided food (72.2%), followed by a visitor bringing food (16.7%). The reasons for visitors bringing in food were further established; 66.0% brought food out of care e.g., *"they bring in snacks and treat foods because they care*"; and 49.1% of patients requested food to be brought into the hospital e.g., *"I ask them to bring in dinner, coffee and snacks because I am a fussy eater"*.

The most frequent comment made by patients regarding eating difficulties surrounded having difficulty opening, cutting, reaching and/or eating food (41.5%). One patient stated, *"I find it hard to open the lids on drinks and lids on porridge"* whilst another said, *"I have difficulty with orange juice and ice cream, the lids are hard to open"*. Portion size was considered to be alright (70.8%), scoring higher than too large or too small. The temperature of the hot and cold food was considered to be alright (64.6% and 92.3% respectively), i.e. not too hot or too cold.

In terms of food quality and satisfaction, taste (35.4%) was the most commented on. Examples include *"the risotto tasted chalky"*, *"I need to add salt for flavour"*, *"soup tastes like packet-soup"* and *"tea and coffee taste the same"*. Temperature of food (27.7%) was also an issue; *"the porridge is luke warm"*, *"the toast is always cold"* and *"yoghurt is at room temperature"*. These comments were categorised to include both positive, negative and/or constructive ideas. Patients' comments were challenging to interpret as opinions are unique and it was often difficult to determine if the comment should be interpreted positively or negatively. Interestingly, the survey specifically asked for ideas on how these issues could be overcome, and only 15 patients came up with practical suggestions, including *"the toast is often cold, could consider wrapping it up in tinfoil or have a toaster on the ward"*; *"desserts are very sweet, can use less sugar in baking";* or *"the tea and coffee tastes the same, I think the containers are used for both, you can consider having separate containers"*.

Table 3.5: *Prevalence of patient opinions and comments*

	Total number of patients* N=65
Patient opinions and comments	**n (%)**
Comments regarding difficulty choosing the right food	
Lack of information provided about the food and/or menu	18 (27.7)
Uncontrollable hospital-related factors	4 (6.2)
Options aren't appealing	3 (4.6)
Comments regarding organisational barriers	
Disruptions or interruptions by staff	8 (12.3)
Mistake with patient's meal order	6 (9.2)
Time of ordering and/or meal service undesirable	6 (9.2)
Uncontrollable hospital-related factors	1 (1.5)
Outcomes for patients who missed a meal†	
The hospital provided food	26 (72.2)
A visitor brought them food	6 (16.7)
They had nothing to eat	4 (11.1)
Reasons why visitors bring in food‡	
Food brought in out of care	35 (66.0)
Food requested by the patient	26 (49.1)
Eating difficulties comments	
Difficulty opening, cutting, reaching and/or eating food	27 (41.5)
Surgery and/or injury has made it difficult to eat	9 (13.8)
Rated portion size	
Alright	46 (70.8)
Too large	10 (15.4)
Too small	9 (13.8)
Rated temperature of the hot food	
Alright	42 (64.6)
Too cold	23 (35.4)
Too hot	0 (0.0)
Rated temperature of the cold food	
Alright	60 (92.3)
Too hot	5 (7.7)
Too cold	0 (0.0)
Comments regarding food quality/satisfaction×	
Taste mentioned	23 (35.4)
Temperature mentioned	18 (27.7)
Hospital menu mentioned	10 (15.4)
Texture mentioned	9 (13.8)
Portion mentioned	5 (7.7)
Appearance mentioned	4 (6.2)
Smell mentioned	4 (6.2)

*Based on the comments made within the New Zealand Patient Mealtime and Nutrition Care Survey.

†Sub-question; patients who answered 'did not miss a meal' or 'always received hospital food when a meal was missed' were excluded (N=36).

‡Sub-question; patients who answered 'my visitors never bring in food' were excluded (N=53).

×Comments that were considered positive, negative and/or constructive were included.

Meal observations

Meal observations are presented in **Table 3.6**. Sixty meal observations took place; 20 each at breakfast, lunch and dinner. The most common meal size was medium (81.7%), followed by large (10.0%) and small (8.3%). Most patients (91.7%) received no assistance during their meal, 5.0% of patients received staff assistance and 3.3% of patients received assistance from a visitor. It was noted that 30.0% of all patients had at least one mealtime interruption during the meal observations. Patient mealtime interruptions included having visitors (21.7%), receiving medical care (5.0%), and showering (5.0%).

During the meal observations, 75.0% of patients consumed only hospital food, whereas 16.7% also consumed a non-hospital addition to their hospital meal and/or non-hospital snack foods and 8.3% consumed an entire meal replacement of non-hospital food. Tray accuracy was observed based on a comparison of the meal order slip and what was served on the tray. Most meals (83.3%) were accurate and 11.7% of meals were inaccurate, either missing a meal component, receiving an extra component or the wrong component arrived on the tray. Meal substitutes (5.0%) were given if a patient's selected option was not available, hence a note was seen on their tray and an alternative meal item replaced their choice. Some patients (13.3%) saved food from their tray to consume at a later time.

Table 3.6: *Meal observations associated with patient, care and hospital characteristics*

	Number of patients N=60
Observations	**n (%)**
Meal observed	
Breakfast	20 (30.8)
Lunch	20 (30.8)
Dinner	20 (30.8)
Meal size	
Medium	49 (81.7)
Large	6 (10.0)
Small	5 (8.3)
Assistance[×]	
No red tray and no assistance observed	55 (91.7)
No red tray; but staff assistance observed	3 (5.0)
No red tray; but visitor assistance observed	2 (3.3)
Mealtime interrupted	
No	42 (70.0)
Yes	18 (30.0)
Types of mealtime interruptions	
Visitors present during mealtime	13 (21.7)
Medical care received during mealtime	3 (5.0)
Showering during mealtime	3 (5.0)
Food consumed during observation	
Only hospital food	45 (75.0)
Addition to hospital meal and/or snack foods	10 (16.7)
Entire replacement meal	5 (8.3)

	Number of patients N=60
Observations	**n (%)**
Tray accuracy	
Tray accurate	50 (83.3)
Tray inaccurate[ϕ]	7 (11.7)
Meal substitute provided[±]	3 (5.0)
Other observations	
Saving food for later	8 (13.3)
Miscommunication when ordering[*]	2 (3.3)
Meal delivery error[β]	2 (3.3)
Nausea and/or vomiting during meal	2 (3.3)
Sleeping during meal	2 (3.3)

[×]A red tray indicates to health care professionals that a patient requires help/assistance with their meal.
[ϕ]The foods delivered to the patient did not match the foods written on the meal order slip.
[±]Meal substitutes are provided when the patients selected option is not available. In these circumstances, a note explaining the situation is placed on the patient's meal tray and an alternative meal item replaces their selection.
[*]Patients reported the order they placed did not match the meal order slip.
[β]Meal was incorrectly delivered to the wrong patient or not delivered at all.

Photographic analysis

Photographs were taken before and after a meal for the patients who participated in the meal observation. The proportion of food consumed could then be determined.

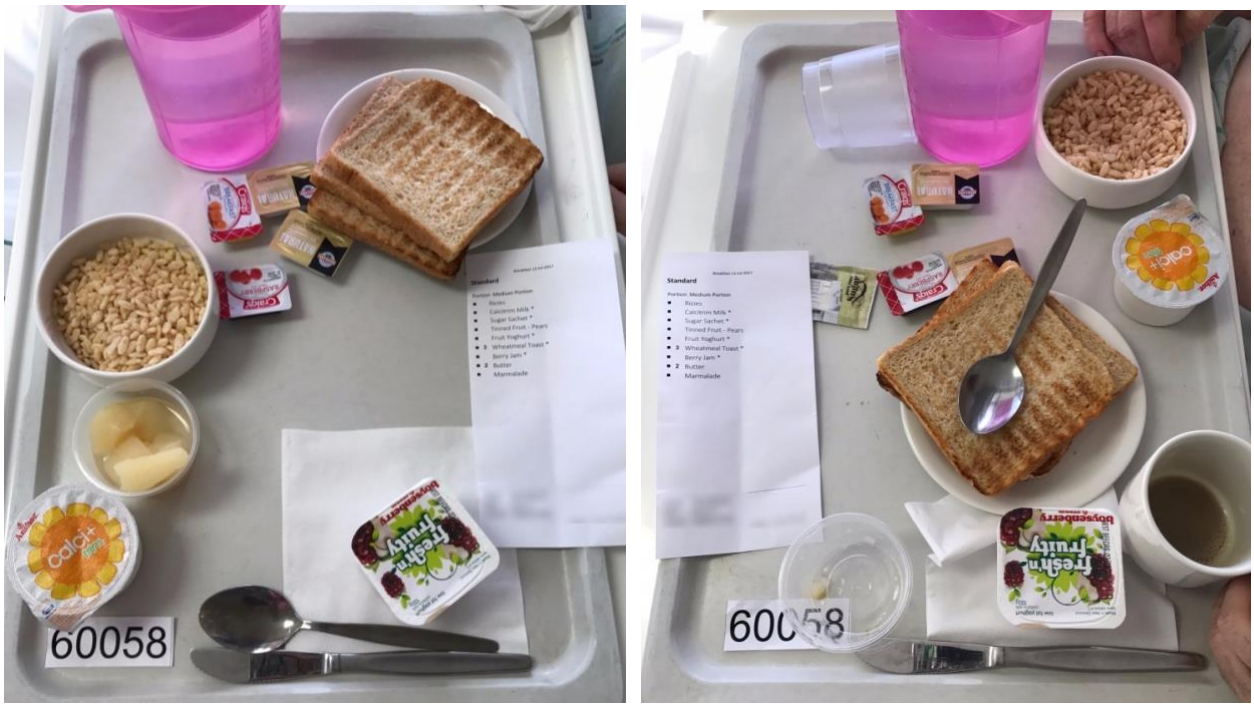

Figure 3.2: *Photographic example of a patient who proportionally consumed between none to ¼ of their meal*

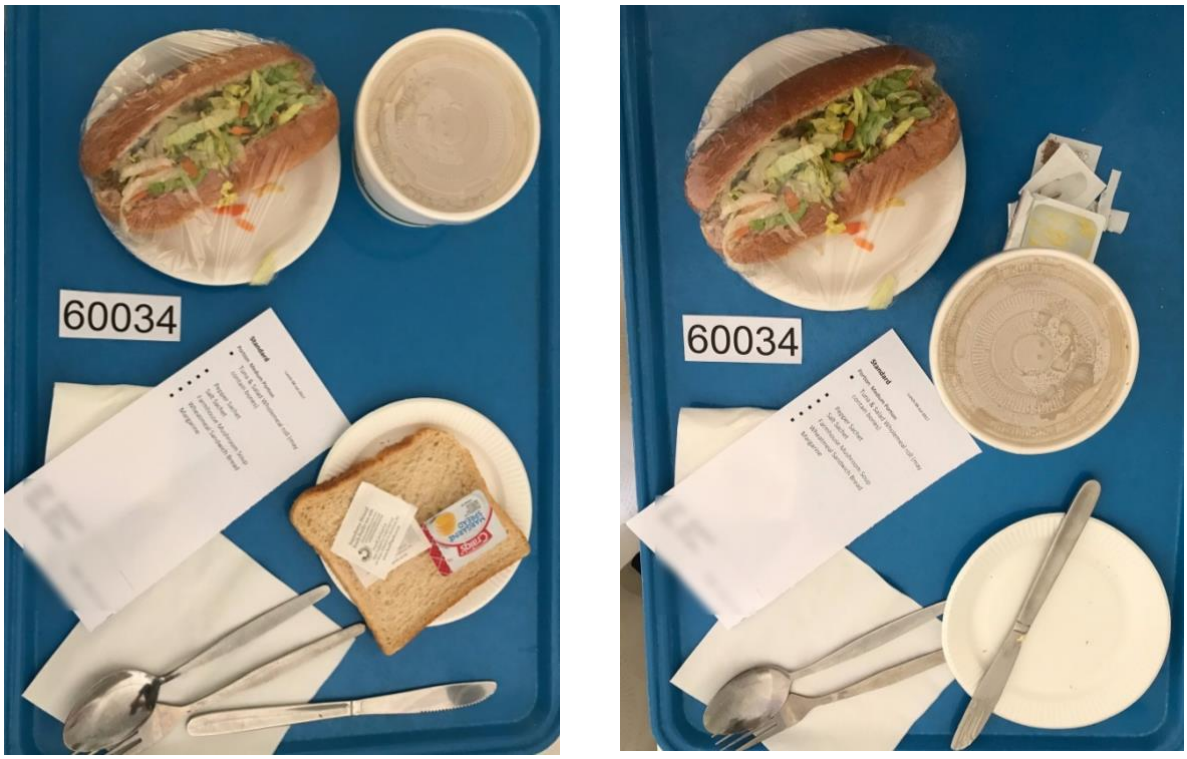

Figure 3.3: *Photographic example of a patient who proportionally consumed between ¼ to ½ of their meal*

Figure 3.4: *Photographic example of a patient who proportionally consumed between ½ to ¾ of their meal*

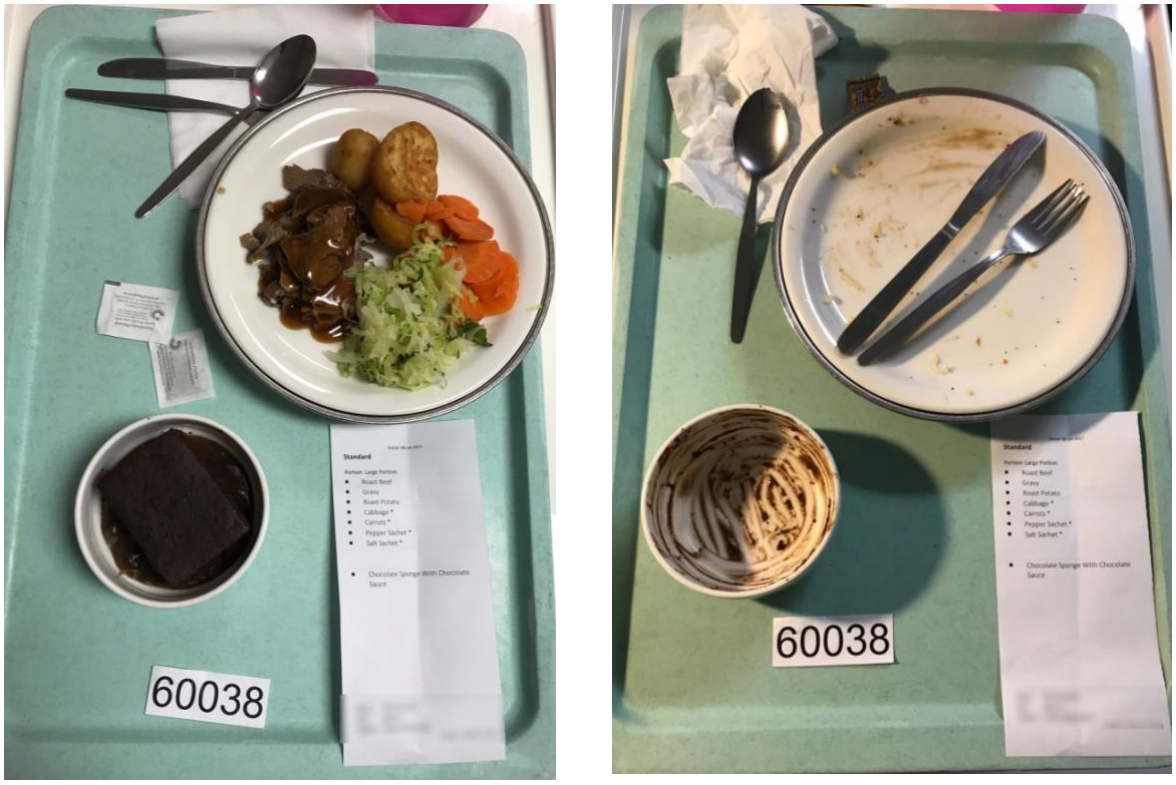

Figure 3.5: *Photographic example of a patient who proportionally consumed between ¾ to all of their meal*

The meal observation photographs were analysed for each patient to establish proportionally how much food they consumed **(Table 3.7).** Overall, the majority (56.7%) of patients consumed >¾ of their meal, the minority (11.7%) consumed ≤¼ of their meal. Similar themes were seen for breakfast, lunch and dinner meal observations; with 55-60% of patients consuming >¾ of their meal, and 5-20% consuming ≤¼ of their meal.

Table 3.7: *Proportional intake of patients' food during meal observations*

	Number of patients n (%)			
Proportional intake of food during all meal observations*	**All meals N=60**	**Breakfast N=20**	**Lunch N=20**	**Dinner N=20**
≤ ¼	7 (11.7)	2 (10.0)	4 (20.0)	1 (5.0)
>¼ to ≤ ½	11 (18.3)	3 (15.0)	2 (10.0)	6 (30.0)
>½ to ≤ ¾	8 (13.3)	4 (20.0)	3 (15.0)	1 (5.0)
>¾	34 (56.7)	11 (55.0)	11 (55.0)	12 (60.0)

*Proportional intake indicates the mean amount of each food consumed based on the number of meal components a patient received. Does not reflect the quantity of food or energy content of food.

Comparing food related barriers with meal observations

A comparison of barriers affecting patients who consumed ≤½ or >½ of their meal during a meal observation was conducted in order to confirm results from the NZ-PMNCS **(Table 3.8).** Within the organisational domain, patients who consumed less food (≤½) frequently reported

not wanting the food that had been ordered (55.6%); and patients who consumed more food (>½) reported missing meals because they weren't available when they were served (42.9%). Within the choice domain the patients who consumed ≤½ of their meal reported significantly more issues with not enough information provided to choose the right food (50.0%), compared to those who ate >½ of the food (21.4%) (*P*=0.027). Interestingly, within the hunger domain, 33.3% of patients who ate ≤½ of the food reported becoming hungry as the time between meals was too long, compared to only 23.8% of patients who ate >½ of the food. Within the eating difficulties domain, patients who consumed less food (≤½) frequently reported being in an uncomfortable position to eat (44.4%); and patients who consumed more food (>½) reported difficulty opening packets or unwrapping food (33.3%). Concerning food quality, all five components (taste, temperature, appearance, portion size and smell) had higher dissatisfaction in the group of patients who consumed ≤½ of their meal, compared to those who consumed >½. A significant finding was identified within the effects of illness domain, 50.0% of patients who consumed ≤½ of their meal reported consumption of their prescribed nutritional supplements affected their food intake, compared to only 9.5% (*P*=0.001) of patients who reported this as a barrier in the group that consumed >½ of their meal. It is also important to note that no differences (*P*=1.000) were found for the following barriers between patients who consumed ≤½ or >½ of their meal: help with meals, meals not served at suitable times, visitors bringing in food, not enough time to eat, appearance, portion size and chewing or swallowing difficulties.

Table 3.8: *Prevalence of food related barriers within food intake barrier domains compared to patients' food intake during their meal observation*

	Number of affected patients		
	Consumed ≤½ of meal during observation N=18	**Consumed >½ of meal during observation N=42**	
Barriers to food intake reported by patients[×]	**n (%)**	**n (%)**	**p-value**
Organisational			
Did not always want food that has been ordered	10 (55.6)	17 (40.5)	0.282
Did not receive ordered food	9 (50.0)	17 (40.5)	0.495
Missed meals due to not being available when they were served	6 (33.3)	18 (42.9)	0.490
Missed meals due to avoiding food for tests	3 (16.7)	15 (35.7)	0.140
Did not get help when needed (restricted to patients who needed help)[‡]	1 (5.6)	1 (2.4)	1.000
When meals missed, not given hospital food by staff (restricted to patients who missed meals)[†]	3 (16.7)	6 (14.3)	0.370
Disturbed by activities, noises or unpleasant smells	6 (33.3)	8 (19.0)	0.319
Interrupted by the hospital staff	6 (33.3)	10 (23.8)	0.529

	Number of affected patients		
	Consumed ≤50% of meal during observation N=18	Consumed >50% of meal during observation N=42	
Barriers to food intake reported by patients[×]	**n (%)**	**n (%)**	**p-value**
Choice			
Not enough information provided to choose the right food	9 (50.0)	9 (21.4)	**0.027***
Not being able to choose preferred foods	4 (22.2)	5 (11.9)	0.431
Meals not served at times that suit patient	2 (11.1)	4 (9.5)	1.000
Do not understand how to complete the menu selections	1 (5.6)	0 (0.0)	0.300
Hunger			
Visitors bring in food	15 (83.3)	34 (81.0)	1.000
Become hungry as the time between meals is too long	6 (33.3)	10 (23.8)	0.529
Felt hungry but could not ask staff for food	1 (5.6)	5 (11.9)	0.658
Felt hungry but no food was available from the hospital	1 (5.6)	1 (2.4)	0.514
Eating difficulties			
Difficulty opening packets or unwrapping food	7 (38.9)	14 (33.3)	0.679
In an uncomfortable position to eat	8 (44.4)	13 (31.0)	0.315
Difficulty reaching food	4 (22.2)	13 (31.0)	0.492
Difficulty cutting up food	4 (22.2)	7 (16.7)	0.719
Difficulty feeding self	2 (11.1)	2 (4.8)	0.576
Not enough time to eat all the food	0 (0.0)	1 (2.4)	1.000
Needed help to eat meals	1 (5.6)	1 (2.4)	0.514
Food quality; dissatisfied with:			
Taste	5 (27.8)	7 (16.7)	0.482
Temperature of food	6 (33.3)	8 (19.0)	0.319
Appearance	3 (16.7)	6 (14.3)	1.000
Portion size	3 (16.7)	6 (14.3)	1.000
Smell	2 (11.1)	1 (2.4)	0.212
Illness; effect on food intake:			
Loss of appetite	13 (72.2)	28 (66.7)	0.672
Nausea	11 (61.1)	23 (54.8)	0.649
Sickness	10 (55.6)	19 (45.2)	0.464
Pain	9 (50.0)	14 (33.3)	0.224
Tired	7 (38.9)	15 (35.7)	0.815
Bowel motions affected appetite	8 (44.4)	14 (33.3)	0.413
Vomiting	7 (38.9)	15 (35.7)	0.815
Medication	2 (11.1)	13 (31.0)	0.192
Worried	7 (38.9)	7 (16.7)	0.095
Prescribed nutritional supplements	9 (50.0)	4 (9.5)	**0.001***
Chewing or swallowing difficulties	3 (16.7)	7 (16.7)	1.000
Depressed	5 (27.8)	4 (9.5)	0.111
Breathing difficulties	2 (11.1)	2 (4.8)	0.576

[×]Based on the number of patients who reported experiencing the barrier at least once during their admission.
[†]Sub-question; patients who answered 'did not miss a meal' were excluded.
[‡]Sub-question; patients who answered 'did not need any help' were excluded.
*Pearson Chi-Square and Fisher's Exact Test, $p<0.05$ indicates statistical significance.

Results from the meal observation photographs were further analysed to assess the proportion of individual meal components ordered versus consumed, this is displayed in **Table A.4** in Appendix A. For breakfast, the most commonly ordered meal components were milk (100%) and yoghurt (85%). The most consumed items were fruit (75%) and supplements (75%). For lunch meal observations, the most commonly ordered meal components were bread (65%), soup (60%). The most consumed items were nutritional supplements (100%) and yoghurt (100%). For dinner, 100% of patients ordered the hot main, followed by the carbohydrate (95%). The most consumed items were the soup (95%) and vegetables (79%). Across all meals the least consumed items were cheese and crackers at lunch (0%), nutritional supplements at dinner (0%), dessert at lunch (35%) and the soup at lunch (45%).

Exploring the reasons for suboptimal intake

Further exploration as to why patients may have had a suboptimal intake (only consuming between none to ¼ of the served food) are displayed in **Table A.5** found in Appendix A. Seven patients consumed between none to ¼ of their meal; two during a breakfast observation, four during a lunch observation and one during a dinner observation. The highest mean proportion of the meal consumed was 20% and the lowest being 0% for the entire meal. Reasons included: nausea and/or vomiting during their meal, therefore impacting their ability to eat (two patients); sleeping throughout their meal as they were too tired to eat (two patients); consuming an entire meal replacement of non-hospital food reducing the desire to eat the hospital food (three patients).

Barrier scores were also analysed for these individual patients compared to the mean barrier scores for all patients. Six out of seven patients scored higher than the means for the choice and food quality domains. This was followed by organisational and illness with five out of seven patients scoring higher than the means. The eating difficulties domain showed four out of seven patients scored higher than the mean and the hunger domain showed two out of seven patients scored higher than the mean.

Types of food brought into the hospital

The types of food brought into the hospital by visitors or brought in by the patient are displayed in **Table A.6** found in Appendix A. The most common food brought into the hospital was fruit (43.1%), followed by baked items (16.9%) (cakes, biscuits and pastries), chocolate (9.2%), sweets (9.2%) and coffee (9.2%). Three common themes were identified related to foods brought to hospital. Firstly, snack foods (67.7%); patients used the key word 'snack' or the foods mentioned suggested consumption of snacks. For example, "*my visitors bring in-between meal snacks because they care, things like fresh fruit, cake and biscuits"*. Secondly, an entire meal being brought into the hospital (24.6%), based on the key word 'meal' or foods mentioned suggested consumption of main meals. For example, *"they bring in a few meals, sometimes the food doesn't taste good so I request it on those occasions".* Lastly, treat foods

(9.2 %), when patients used the key word 'treat'. For example, *"my wife brings in sweet treats out of kindness e.g. chocolate"*.

3.5 Discussion

Overall, there are few validated tools that address the barriers to patients' food related experiences while in hospital. The PMNCS was adapted to better suit its use in the NZ setting. This study describes hospital patients' experiences of access to food during their admission.

Patient, care and hospital characteristics

The variety of patients within different demographics can be predicted to experience different barriers whist in hospital based on results from previous studies. In this study, most (55.4%) of the patients were aged under 65yrs. Patients of a younger age often report different issues whilst in hospital, such as more food related barriers from the hunger and food quality domains (Engelund, Lassen, & Mikkelsen, 2007; Johns, Hartwell, & Morgan, 2010; Keller et al., 2015; Naithani et al., 2009; Watters, Sorensen, Fiala, & Wismer, 2003). In contrast, older patients often report more eating difficulties, issues with choice and problems with portion size (Keller et al., 2015; Naithani et al., 2009; Naithani, Whelan, Thomas, Gulliford, & Morgan, 2008). The majority of patients included in this study were women (53.8%), who have previously experienced more issues within the eating difficulties, choice and food quality domains compared to males (Engelund et al., 2007; Johns et al., 2010; Keller et al., 2015; Naithani et al., 2009; Naithani et al., 2008; Watters et al., 2003).

The four primary ethnic groups in NZ are European, Māori, Pacific people and Asian (Marriott & Sim, 2014). The most common primary ethnicity in this study was identification with a European ethnicity (84.6%), followed by Pacific (6.4%), Māori (4.6%) and Asian (4.6%). Based on findings from the latest NZ census, 74% of individuals identified with a European ethnicity, 15% with Māori, 12% Asian and 7% Pacific (Statistics New Zealand, 2013). Although the demographics of the sample in this study follow the general trend of the wider population, minority groups such as Māori, Pacific and Asian were underrepresented. The patterns of inequality in NZ are well-established, differences can be found among ethnic groups for a range of health measures (Marriott & Sim, 2014). The life expectancy, on average, is less for Māori compared to non-Māori individuals (7.4 years less for males and 7.2 years less for females) (Marriott & Sim, 2014). Based on the NZ Health Survey, a higher proportion of Pacific (89.5%) and Māori (78.5%) are overweight or obese compared to those who identified as European/Other (66.6%) (Ministry of Health, 2017). As the sample is not an exact representation of society in NZ, the results may not accurately indicate the barriers all of our patients face.

From the sample of surgical patients recruited during this study, the majority were admitted for orthopaedic surgery (63.1%), which included both elective and non-elective admissions. A study in the UK also included surgical patients (13.5%) and orthopaedic patients (15.6%)

(Naithani et al., 2009). They found that orthopaedic patients reported more hunger, physical barriers, issues with food choice and problems with food quality. In Canada, surgical patients were recruited (32.7%), they reported more eating difficulties, issues with food quality and effects of illness (Keller et al., 2015). Additionally, it is expected that orthopaedic patients have better overall health, quality of life and optimism as their health impairment is temporary, compared to general surgical patients who often present with chronic diseases (Kreitler, Chaitchik, Rapoport, Kreitler, & Algor, 1993).

In this study, many patients (38.4%) self-reported proportionally consuming ≤½ of their meal. Previous research conducted across Australia and NZ similarly found that 55% of malnourished patients and 35% of well-nourished patients consumed ≤½ of the food they were offered. Research conducted in the UK, Denmark and Switzerland also concluded that despite sufficient provision of food in all hospital, patients are often not consuming the food they have been provided with and are not likely to be meeting their nutritional requirements (Barton et al., 2000; Dupertuis et al., 2003; Kondrup et al., 2002). Self-reported food intake should be interpreted with caution, it is often found to be lower than the true intake, due to individuals underestimating the amount of food consumed and wanting to be closer to the perceived norm (Schoeller, 1990, 1995).

The majority of patients in this study (56.9%) self-reported being constipated while in hospital, although no definition of constipation was provided, making it difficult to determine an exact prevalence. This was much higher compared to the 4.9% of the NZ population reporting constipation that requires regular laxative use and 26.2% that reported they increase fibre consumption to avoid constipation (Lynch, Dobbs, Keating, & Frizelle, 2001). It's not surprising that the prevalence of constipation was found to be higher in hospital, due to the effects of disease, diet, inactivity and medication (Monson, 2008).

Food related barriers

The food related barriers with the highest prevalence were the same amongst all patients, and within short and long stay patient subgroups. The majority (81.5%) of all surgical patients had food brought in for them by visitors. The reasons for visitors bringing in food were both out of care (66.0%) and because food was requested (49.1%). In the UK, 35% of patients had food brought in for them because they were hungry, compared to 30.1% in Canada and 42% of patients in our pilot study (Keller et al., 2015; Naithani et al., 2009). It is surprising that the majority of patients have food brought in, as hospital menus are designed to meet patients' nutritional requirements. For some patients having food brought into the hospital is not a barrier to oral intake as it encourages them to eat, especially if preferences are not being met or there is not enough food provided (Keller et al., 2015). For others, this food is consumed as an alternative and can replace their hospital meal unnecessarily, resulting in hospital food being wasted. Preventing visitors bringing in food to the hospital out of care is not viable as it would create many social and cultural issues, instead efforts could be made to adapt or

reorganise the meal service to provide patients with the foods they desire (Almdal et al., 2003; Barrie, 1996; Dupertuis et al., 2003). This in turn would reduce the amount of food requested to be brought in and minimise waste (Dupertuis et al., 2003).

Having a loss of appetite is the next most common barrier (70.8%) affecting the amount of food consumed in surgical patients. This is similar to the Canadian study by Keller et al. (2015) reporting that 63.9% of patients experienced a loss of appetite, which was also one of the most prevalent barriers in their research. A decreased appetite has also been found respectively in 56%, 20% and 43% of patients in Switzerland, Spain and Norway (Mowe & Bohmer, 2002; Pablo, Izaga, & Alday, 2003; Stanga et al., 2003). Although a loss of appetite is an adaptive, protective response in the acute phase of illness, and falls within the effects of illness domain, it is important to consider the role that foodservice and hospital staff have in minimising patients' experience with this barrier (Schütz, Bally, Stanga, & Keller, 2014). Conventional methods of stimulating appetite include behavioural, environmental and medical techniques such as consuming small frequent meals, eating with others, appealing food presentation and smell, a low residue diet and in some cases the use of ONS or medications (Haber, Heaton, Murphy, & Burroughs, 1977; Hetherington, Anderson, Norton, & Newson, 2006; Keller et al., 2015; Simmons, Lam, Rao, & Schnelle, 2003). In Switzerland, Stanga et al. (2003) found there was a strong positive relationship (P=0.019) between reported appetite and the proportion of food consumed. They found that hospital food was not always targeted to patients' needs and their altered appetite or taste. Although 70.8% of patients reported a loss of appetite affecting food consumption, only 30% of patients consumed ≤½ of their meal during the observations, indicating not all of these patients had a suboptimal intake. Monitoring systems that identify a loss of appetite and its subsequent impact on food intake are needed for all patients, such as observation charts and food records (Keller et al., 2015).

Characteristics associated with food related barriers

There were many significant associations between barrier domains and patient, care and hospital characteristics. Exploration of these associations can help guide evidenced based changes to practice in order to benefit patients.

Younger patients (aged <65 years) experienced more barriers within the hunger domain compared to those who were older (≥65 years) (1.47 ± 0.81 versus 0.90 ± 0.67, P=0.003). This is similar to findings from the UK study (Naithani et al., 2009), reporting that hunger also decreased with age; older patients (≥75 years) had lower relative odds of hunger compared to younger patients (45-54 years) (0.42 (95%CI 0.23-0.79) versus 1.08 (0.63-1.87)). Similarly, in Canada, Keller et al. (2015) found the mean hunger domain score for patients <65 years was also significantly higher compared to those aged ≥65 years (0.93 (SE 0.09) versus 0.65 (SE 0.06)). Finding a significant association between age and hunger is not surprising, as younger patients likely have an increased appetite and energy needs, especially if they are in a state of recovery and if they are active (Keller et al., 2015). Keller et al. (2015) hypothesised that this

higher metabolic demand may indicate that the hospital food is not sufficient as younger patients report more issues surrounding hunger, hence younger patients could be a subgroup that requires increased food provision in hospitals.

In this study, a longer length of stay (>5 days) was significantly associated with experiencing more barriers from the food quality domain compared to shorter length of stay (≤5 days) (1.20 ± 1.26 versus 0.40 ± 0.81, *P*=0.003). Similar findings were presented in Switzerland, there was a negative relationship (*P*=0.005) between duration of hospital stay and satisfaction with hospital food, patients who stayed the longest were the most dissatisfied (Stanga et al., 2003). This dissatisfaction could be due to patients becoming bored with the menu the longer they stay in hospital (Stanga et al., 2003). In our study, a longer length of stay was also associated with experiencing more barriers from the illness domain compared to shorter stay (5.11 ± 3.00 versus 3.53 ± 2.69, *P*=0.030). This may be due to a greater severity of their illness (Stanga et al., 2003) or more medically complex conditions (having complications, comorbidities or more than one diagnosis) which can prolong discharge (Keller et al., 2015).

Patients undergoing general surgery significantly experienced more illness domain barriers compared to those undergoing orthopaedic surgery (5.75 ± 2.86 versus 3.59 ± 2.72, *P*=0.003). Likewise, being located on a general surgical ward was associated with experiencing more barriers from the illness domain compared to those on an orthopaedic ward (6.61 ± 2.43 versus 3.53 ± 2.69, *P*=<0.001). Patients on surgical wards in Canada similarly reported more illness barriers compared to those on medical wards (2.53 (SE 0.17) versus 2.21 (SE 0.18)) (Keller et al., 2015). These results are not surprising as orthopaedic patients generally have better overall health and quality of life due to their health impairment being temporary, likely resulting in a lower score for illness barriers (Kreitler et al., 1993). General surgical patients often present with long term or permanent diseases, which could be why they reported more barriers in the illness domain (Kreitler et al., 1993).

Patients located on a general surgical ward also significantly experienced less hunger barriers compared to those on an orthopaedic ward (0.89 ± 0.68 versus 1.34 ± 0.81, *P*=0.041). Similarly, Naithani et al. (2009) also found that UK patients on orthopaedic wards had higher relative odds of hunger compared to surgical patients (1.73 (95% CI 0.80-3.72) versus 1.32 (95% CI 0.60-2.90)). Keller et al. (2015) concluded that low food intakes are more likely when patients reported more effects from illness. It could be hypothesised using similar rationale, that orthopaedic patients may have better overall health, have less issues with illness, and hence felt hungrier during their admission. Additionally, it has been found that general surgical procedures, specifically involving the gastrointestinal system, can cause many physiological changes postoperatively (Ward, 2003). Intestinal permeability increases between two to four-fold and villous height decreases postoperatively, which can lead to nutrient depletion (Ward, 2003). Increased permeability indicates failure of the gut barrier function, which also limits the ability of the intestine to protect the body against bacteria and toxins (Ward, 2003). In some

cases, this can lead to inflammation, sepsis and multi-organ failure (Ward, 2003). Hence it can also be hypothesised that general surgical procedures, involving or in close proximity to the gastrointestinal system, will likely have an impact on gut function, appetite and hunger; compared to patients undergoing orthopaedic surgery.

Patients who had one diet code during the previous seven days of admission experienced less barriers from the illness domain compared to those who had two or more diet codes (3.83 ± 2.71 versus 5.94 ± 3.11, *P*=0.010). Likewise, patients currently on a standard diet code experienced significantly less barriers from the illness domain compared to those on a therapeutic diet code (3.71 ± 2.77 versus 6.44 ± 2.56, *P*= 0.001). Although similar findings have not yet been reported, it is understood that a standard diet code is used for patients who are nutritionally well and able to eat normal foods with no restrictions (Agency for Clinical Innovation, 2011). Therapeutic diet codes alter the nutrients, textures or presence of allergens found within food. These therapeutic diet codes are designed to meet the needs of patients who have altered requirements during their admission (Agency for Clinical Innovation, 2011). Additionally, changes to a patient's diet code often occur postoperatively to aid faster recovery and reduce complications (Ljungqvist et al., 2017; Reissman et al., 1995). It can be speculated that patients who had changes to their diet code are likely to have had an operation during their admission or be more medically complex, increasing the likelihood of reporting more illness barriers.

Additionally, it was found that patients with only one diet code during the previous seven days of admission experienced significantly more barriers from the hunger domain compared to those who had two or more diet codes (1.31 ± 0.85 versus 0.94 ± 0.56, *P*= 0.048). It is likely that patients who changed between diet codes also felt less hungry, as they were more unwell. In Italy, somewhat contradictory results were found; patients on texture modified (minced/puree) or high protein diet codes felt significantly hungrier after their meals (*P*=0.003) (Messina et al., 2013). However, 85% of patients on a special diet ate inadequately and did not meet their individually determined energy and protein requirements (Messina et al., 2013). The authors hypothesised that patients may not have liked the food they were provided with on a special diet code, therefore they did not eat it, and as a consequence felt hungrier (Messina et al., 2013). It is possible that patients in our study may have reported not feeling hungry for the food they were served, for similar reasons, as they transitioned through different diet codes.

Patients with low (≤50%) compared to high (>51%) self-reported food intake respectively reported more barriers from the food quality domain (1.28 ± 1.34 versus 0.55 ± 0.90, *P*=0.011), and the illness domain (5.56 ± 2.87 versus 3.65 ± 2.78, *P*=0.010). In Canada, Keller et al. (2015) reported similar findings for patients with food intake <50% during their first week of hospitalisation, they reported more barriers from the quality domain compared to those who consumed ≥51% (1.51 (SE 0.11) versus 0.85 (SE 0.11)); and more barriers within the illness

domain (3.38 (SE 0.17) versus 1.93 (0.17)). Low intakes are likely when patients are dissatisfied with the quality of the hospital food or have more effects from illness (Keller et al., 2015). Our results should be considered with caution, as they are based on self-reported food intake, which is not always an accurate representation of the truth (Schoeller, 1990). Patients with a low versus high observed food intake further reported more barriers from the choice domain (0.89 ± 0.90 versus 0.43 ± 0.67, P=0.032). Food choice is an important aspect of a patient's experience (Naithani et al., 2009). It can be hypothesised that patients who found it difficult to make food related choices or obtain preferred foods whilst in hospital, are less likely to eat the food they are served.

Finally, patients who reported abnormal compared to normal bowel motions respectively experienced more barriers within the illness domain (5.04 ± 2.91 versus 2.90 ± 2.51, P=0.006). No previous studies found this association with bowel motions. However, associations between illness, diet, inactivity and medications with bowel motions have been established by Monson (2008). Patients perceptions of both constipation and diarrhoea can vary, it can be hypothesised that patients linked these perceptions (abdominal pain, sickness, nausea, food avoidance, loss of appetite or worry) with barriers within the illness domain (Agachan, Chen, Pfeifer, Reissman, & Wexner, 1996; Zhu et al., 2015).

Patient opinions and comments

Based on the qualitative data obtained from the NZ-PMNCS, the most common comment about difficulty choosing the right food was due to a lack of information about the food and/or menu (27.7%). The UK study reported similar findings, where 25% of patients also claimed that menus did not provide enough information, particularly about the ingredients used and the nutritional value of the meal, in order to make an informed decision (Naithani et al., 2008). Written and spoken menus are both currently used to provide information to patients at North Shore Hospital. The delivery of information in appropriate formats to patients, such as utilising written, auditory and/or pictorial methods, are imperative to tailor the presentation of information to suit individual patient's needs (Houts, Doak, Doak, & Loscalzo, 2006; Naithani et al., 2008).

Disruptions or interruptions by staff were responsible for 12.3% of organisational barrier comments. Although no similar qualitative comparisons can be made, quantitative data reflects that 26.2% of patients in this study, 41.8% of patients in the Canadian and 21% of patients in the UK studies, reported being interrupted by hospital staff (Keller et al., 2015; Naithani et al., 2009). To reduce the likelihood of these barriers at North Shore Hospital a Protected Mealtime Policy is implemented, which aims to support patients eating by keeping mealtimes free from unnecessary and non-urgent clinical interruptions (Vaimoso, 2015). Despite North Shore Hospital having this initiative, patients still reported that these interruptions occurred. It is understood that some medical treatments, procedures or discussions cannot be delayed or avoided. However, staff need to recognise that having

procedures during a mealtime can leave patients feeling nauseated, in too much pain or too weak to eat their meal (Vaimoso, 2015). Food quality also declines when mealtimes are disrupted or prolonged, the food can be cold by the time patients get to eat it, resulting in poor intakes (Vaimoso, 2015).

Many (41.5%) patients described difficulties opening, cutting, reaching and/or eating food. Patients found it challenging to open the lids on milk, juice, ice cream and yoghurt containers, or difficult to eat with an arm cast or IV lines coming out of their hand. The most common barrier within the eating difficulties domain was having difficulty opening packets or unwrapping food (35.4%). In the UK (Naithani et al., 2009) and Canada (Keller et al., 2015), the most common barrier within the eating difficulties domain was also difficulty opening packets or unwrapping food (33% and 30.1% respectively). Based on these findings, Keller et al. (2015) stated that food packaging needed to be reviewed in Canada, to ensure food safety and accessibility for patients who are weak, tired and have impaired mobility.

Meal observations

Observations provided an insight into the types of interruptions that occurred during patient meal times. It was found that 30.0% of patients had at least one mealtime interruption, including having visitors (21.7%), receiving medical care (5.0%) and showering (5.0%). Having a visitor present was the most common interruption, which can be a barrier, as some patients may stop eating and therefore consume less food. For others, it may act as an enabler, especially if visitors are helping the patient to eat. Similar findings were reported in the UK, as 20-25% of patients had a visitor present during their mealtime, and only 42-46% of visitors provided feeding assistance (Hickson, Connolly, & Whelan, 2011). Despite efforts to minimise organisational barriers in NZ, such as implementing a Protected Mealtime Policy, some patients still received medical care or were showering during their mealtime. Meal observations have been conducted in several other hospitals around the world when implementing protected mealtimes; in Australia (27%) (Huxtable & Palmer, 2013; Young, Mudge, Banks, Ross, & Daniels, 2013) and in the UK (25-30%) (Hickson et al., 2011) of patients were also interrupted during their mealtime. The most common interruptions during mealtimes were from nursing staff (Huxtable & Palmer, 2013; Xia & McCutcheon, 2006), which included nursing observations, transfers, procedures, toileting and medications (Huxtable & Palmer, 2013).

Another observation of note was the number of patients who saved food from their hospital tray (13.3%) to consume at a later time. This may mean that patients are actually consuming more food than is observed, or it may just show intent and not actual consumption. It is difficult and outside of the scope of this research to quantify how much of the food or drink is actually consumed. However, Almdal et al., (2003) suggested food at the ward level has many fates, including being consumed by staff, visitors or being thrown away. Evidence of patients saving food for later does highlight the benefits of flexible mealtime services and newer concepts such as Steamplicity where food is heated on the ward when the patient chooses. This also

eliminates the food safety concerns associated with food being left with patients (Dillon, McDonald, & Jonus, 2012; Reglier-Poupet et al., 2005).
Many (56.7%) patients consumed >¾ of their meal during the meal observation and 30.0% consumed ≤½ of their meal. It is interesting to compare patients' actual intake to the self-reported intake provided by patients, as more patients (38.5%) self-reported proportionally consuming ≤½ of their meals. It is expected that more patients self-report eating less, as self-reported food intake is often found to be underestimated (Schoeller, 1990, 1995). Similar findings were also found in observations by Agarwal et al. in a study conducted across Australia and NZ, where 35% of well-nourished patients consumed ≤½ of the offered food.

Meal items that were received by the most patients include milk at breakfast (100%), hot main at dinner (100%) and carbohydrate at dinner (95%). Interestingly, these items were not necessarily the items that had the highest mean consumption; which include nutritional supplements at lunch (100%), yoghurt at lunch (100%) and soup at dinner (95%). The menu items that were the least consumed included cheese and crackers at lunch (0%), nutritional supplements at dinner (0%), dessert at lunch (35%) and soup at lunch (45%). In the UK, Sonnino & McWilliam (2011) also looked at food waste of individual meal components; they found that the main course was the most consumed with only 33% of food wasted, compared to the vegetables which were the least consumed with 46% wasted. In Switzerland, brown bread was most the preferred food at breakfast (57%), vegetables at lunch (83%) and brown bread at dinner (64%). Although these findings show variances in food consumption and patient preferences, it is to be expected based on the differences in foodservice, health care systems and cultures around the world (Keller et al., 2015; Naithani et al., 2009).

Comparing food related barriers with meal observations

Meal observations and food related barriers were compared to confirm results from the NZ-PMNCS. Patients who consumed ≤½ of their meal reported significantly more issues regarding a lack of information provided to choose the right food (50.0%), compared to those who ate >½ of their meal (21.4%) (P=0.027). This indicates that providing an adequate amount of accurate information surrounding the menu may play a crucial role in determining if patients make the correct selections and therefore eat the food provided. The most surprising significant finding was that 50.0% of patients who consumed ≤½ of their meal reported that consumption of their prescribed nutritional supplements affected their food intake, this was only the case for 9.5% (P=0.001) of patients who consumed >½ of their meal. This is somewhat concerning from a nutrition perspective, as traditionally a 'food first' approach to prescribing (and consuming) of nutritional supplements should be taken (Smith, 2012). However, based on these findings it can be speculated that patients are placing a large emphasis on the consumption of their supplements compared with their meals. They therefore find it challenging to eat their meal, and as a consequence they are only eating a small amount of food.

Interestingly, 33.3% of patients who ate ≤½ of their meal reported becoming hungry as the time between meals was too long, compared to fewer patients (23.8%) who ate >½ of their food. This is a fascinating result, there is an expectation that patients who are truly hungry would consume the meal they have been provided with, although these results suggest this may not be the case. In respect to food quality, patients who consumed ≤½ of their meal reported more dissatisfaction with taste, temperature, appearance, portion size and smell, compared to those who consumed >½. This indicates that the quality of food may impact oral intake, as those who ate less were less satisfied with the quality of the hospital food. For patients who consumed ≤½ or >½ of their meal, no differences (*P*=1.000) were found for barriers such as needing help with meals, meals not served at suitable times, visitors bringing in food, not enough time to eat, appearance, portion size and chewing or swallowing difficulties. This indicates that these barriers may not have any impact on the amount of food patients consume.

Exploring the reasons for a suboptimal intake

The observational data were further analysed for the seven patients who proportionally only consumed ≤¼ of their meal during a meal observation. Two patients had nausea and/or were vomiting during their meal which severely impacted their desire to eat. Nausea has been found to put people off the sight and smell of food, decrease appetite, alter taste and consequently decrease intake of foods and fluids (Bergkvist & Wengström, 2006; O'Brien & Naber, 1992). Two patients slept throughout their meal, meaning they were perhaps too tired to consume food. Fatigue within the hospital setting is common and affects between 24-58% of patients, depending on the patient group under investigation (Kroenke, Wood, Mangelsdorff, Meier, & Powell, 1988; Stone et al., 2000). Patients often report poor sleep quality and duration throughout admission to hospital, which leaves them feeling tired and fatigued, this is likely due to a combination of environmental (noise), physiological (pain, disease, mediation) and psychological (anxiety) factors (Reid, 2001). In Canada, 41.1% of patients reported tiredness affecting food intake, and 36.9% of patients in this study also reported this barrier (Keller et al., 2015). One of these patients also received medical treatment during the mealtime, which is likely to have impacted their energy levels. After a procedure, patients may feel nauseated, in too much pain or too weak to eat (Vaimoso, 2015). The remaining three patients consumed entire meals of non-hospital food, which reduced their appetite for the hospital food that was served. From a nutrition perspective, this is less concerning as they were still consuming a meal, even though it was not the food they had been provided with. Nausea, vomiting, sleeping or receiving medical treatment were found to be the key issues impacting patients' oral intake. Due to the small sample size, no associations can be statistically confirmed.

Food brought into the hospital

The types of food brought into hospital varied greatly. The most commonly brought in item was fruit (43.1%), which is considered a healthy choice (Ministry of Health, 2015). Fruit should be regularly consumed as part of a healthy balance diet as they contain nutrients such as fibre

and a variety of vitamins and minerals, all of which can help reduce the risks of developing many chronic diseases (Ministry of Health, 2015; Van Duyn & Pivonka, 2000). Treat food such as bakery items (16.9%) (cakes, biscuits and pastries), chocolate (9.2%) and sweets (9.2%) were also commonly brought into the hospital. These items often have little nutritional value and should be consumed in moderation due to their high saturated fat, salt and sugar content (Ministry of Health, 2015). North Shore Hospital provides guidelines that encourages visitors bringing in food to make healthy choices and bring food that is safe and hygienic (Waitemata District Health Board, 2016). However, it has been observed that many visitors are bringing undesirable foods into the hospital. In the UK, Naithani et al. (2008) found that 6% of patients consumed food brought in by visitors as their main meal of the day; the types of food included sandwiches, casseroles and pies. In conjunction with promotion of healthy choices, focus should also be placed on food safety (preparation and storage) of food brought into the hospital, with the aim of eliminating food poisoning (Barrie, 1996).

Strengths and limitations

Completing a pilot study was a major strength for this research project, as it allowed the feasibility of conducting this study, participant recruitment strategies, completion of the PMNCS and data handling to be tested. The sample size for the pilot and feasibility studies exceeded guidelines, allowing for participant drop-out and thoroughly capturing a wide variety of responses in the NZ setting. The data for both the pilot study and the final study was collected by one researcher, which eliminated any inter-rater discrepancies. A unique addition to this study, in contrast to other studies, were the meal observations to further explore the barriers to oral intake and assist in confirming the findings from the NZ-PMNCS.

The limitations of this study include the lack of diversity within the sample. Most participants in both the pilot and feasibility studies had a primary ethnicity of NZ European, which is not a true representation of the NZ population, however it reflects the population at North Shore Hospital at the given time. Efforts were made to minimise participant burden for patients who were unwell, which eliminated many patients from participating in the study. It is likely these patients who were excluded may have different food related experiences while in hospital.

The plate waste assessment was a visual estimation to the nearest 10%, using photographs, which is not an accurate measure of oral intake. However, it provided a crude estimation of non-consumed food. Having a one-off meal observation (either breakfast, lunch or dinner) is also limiting as it only captures what a patient consumed at one meal, which can be influenced by hospital activities, menu options, effects of illness on that particular day or between meal snacking. The study design also has limitations, as it was a cross-sectional study, it can only provide an overview of the issues patients experienced at a certain point in time and cannot determine causality or directionality.

3.6 Conclusion

Compared to earlier studies using previous versions of the PMNCS, the NZ-PMNCS captured similar results in the NZ hospital setting. This tool highlighted many significant findings, which allowed key issues to be identified. Patients of a younger age experienced more barriers within the hunger domain, indicating that younger patients could be a subgroup that requires increased food provision while in hospital. Comparison of results from the NZ-PMNCS and meal observations highlighted that patients who consumed less food reported there was a lack of information provided to choose the right food from the menu. Improving processes surrounding menu orders may help patients make the correct selections and therefore eat more of the food they are provided with. Additionally, patients who consumed less food reported that consumption of prescribed nutritional supplements affected their food intake. This may mean that they consumed supplements too close to mealtimes, and indicates a need for an investigation into the guidelines around supplement provision. The NZ-PMNCS was feasible in identifying barriers to oral intake in the NZ hospital setting. These findings could guide future changes to hospital practice in order to better support patients' food intake.

3.7 Acknowledgements

Acknowledgement is given to the 165 patients at North Shore Hospital who participated in this study. The contribution of health care professionals on the surgical wards is also recognised, with a special acknowledgement to the Charge Nurse Managers for their support; Susan Johnston, Roslyn Bell, Frances Scheirlinck and Suzanne Huskinson. Further recognition is given to Deirdre Johnson and Charlotte Moor who assisted with the study design, development of the NZ-PMNCS and liaised with hospital prior to data collection.

3.8 Author contributions

Olivia Stone- completed the ethics application, developed patient survey and associated documents, recruited patients, collected all data, completed data entry, conducted statistical analysis, interpreted and discussed results, author of the manuscript.

Rozanne Kruger- assisted with the study design and ethics application, developed patient survey and associated documents, assisted with interpretation of results, reviewed manuscript.

Laura Mash- assisted with the study design, developed patient survey and associated documents, liaised with hospital prior to data collection, assisted with interpretation of results, reviewed manuscript.

3.9 Conflicts of interest

The authors have no conflicts of interest to declare.

References

Agachan, F., Chen, T., Pfeifer, J., Reissman, P., & Wexner, S. D. (1996). A constipation scoring system to simplify evaluation and management of constipated patients. *Diseases of the Colon & Rectum, 39*(6), 681-685.

Agarwal, E., Ferguson, M., Banks, M., Batterham, M., Bauer, J., Capra, S., & Isenring, E. (2013). Malnutrition and poor food intake are associated with prolonged hospital stay, frequent readmissions, and greater in-hospital mortality: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 32*(5), 737-745. doi:10.1016/j.clnu.2012.11.021

Agarwal, E., Ferguson, M., Banks, M., Bauer, J., Capra, S., & Isenring, E. (2012). Nutritional status and dietary intake of acute care patients: Results from the Nutrition Care Day Survey 2010. *Clinical Nutrition, 31*(1), 41-47. doi:10.1016/j.clnu.2011.08.002

Agency for Clinical Innovation. (2011). *Diet Specifications for Adult Inpatients*. NSW, Australia. Retrieved from https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0006/160557/ACI_AdultDietSpecs-march2017.pdf

Almdal, T., Viggers, L., Beck, A. M., & Jensen, K. (2003). Food production and wastage in relation to nutritional intake in a general district hospital- Wastage is not reduced by training the staff. *Clinical Nutrition, 22*(1), 47-51.

Barrie, D. (1996). The provision of food and catering services in hospital. *Journal of Hospital Infection, 33*(1), 13-33. doi:10.1016/S0195-6701(96)90026-2

Barton, A. D., Beigg, C. L., Macdonald, I. A., & Allison, S. P. (2000). High food wastage and low nutritional intakes in hospital patients. *Clinical Nutrition, 19*(6), 445-449. doi:10.1054/clnu.2000.0150

Bergkvist, K., & Wengström, Y. (2006). Symptom experiences during chemotherapy treatment—with focus on nausea and vomiting. *European Journal of Oncology Nursing, 10*(1), 21-29.

Bruun, L. I., Bosaeus, I., Bergstad, I., & Nygaard, K. (1999). Prevalence of malnutrition in surgical patients: Evaluation of nutritional support and documentation. *Clinical Nutrition, 18*(3), 141-147. doi:10.1054/clnu.1999.0006

Curtis, L. J., Bernier, P., Jeejeebhoy, K., Allard, J., Duerksen, D., Gramlich, L., . . . Keller, H. H. (2017). Costs of hospital malnutrition. *Clinical Nutrition, 36*(5), 1391-1396. doi:10.1016/j.clnu.2016.09.009

Damiani, G., Pinnarelli, L., Sommella, L., Vena, V., Magrini, P., & Ricciardi, W. (2011). The Short Stay Unit as a new option for hospitals: A review of the scientific literature. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 17*(6), SR15-SR19. doi:10.12659/MSM.881791

Dietitians New Zealand Inc. (2016). Dietitians New Zealand Clinical Handbook 2016: Eleventh Edition. In A. Sloan (Ed.), (Eleventh ed., pp. 23-34). Wellington, New Zealand: Ocular.

Dillon, H. A., McDonald, S., & Jonus, I. (2012). Steamplicity: An innovative meal system that delivers. *Healthcare Management Forum, 25*(3), S20-S28. doi:10.1016/j.hcmf.2012.07.010

Dupertuis, Y. M., Kossovsky, M. P., Kyle, U. G., Raguso, C. A., Genton, L., & Pichard, C. (2003). Food intake in 1707 hospitalised patients: A prospective comprehensive hospital survey. *Clinical Nutrition, 22*(2), 115-123.

Engelund, E. H., Lassen, A., & Mikkelsen, B. E. (2007). The modernization of hospital food service- Findings from a longitudinal study of technology trends in Danish hospitals. *Nutrition & Food Science, 37*(2), 90-99. doi:doi:10.1108/00346650710736354

Goonan, S., Mirosa, M., & Spence, H. (2014). Getting a taste for food waste: A mixed methods ethnographic study into hospital food waste before patient consumption conducted at three New Zealand foodservice facilities. *Journal of the Academy of Nutrition and Dietetics, 114*(1), 63-71. doi:10.1016/j.jand.2013.09.022

Haber, G. B., Heaton, K. W., Murphy, D., & Burroughs, L. F. (1977). Depletion and disruption of dietary fibre: effects on satiety, plasma-glucose, and serum-insulin. *The Lancet, 310*(8040), 679-682.

Haydock, D. A., & Hill, G. L. (1986). Impaired wound healing in surgical patients with varying degrees of malnutrition. *Journal of Parenteral and Enteral Nutrition, 10*(6), 550-554. doi:10.1177/0148607186010006550

Hetherington, M. M., Anderson, A. S., Norton, G. N. M., & Newson, L. (2006). Situational effects on meal intake: A comparison of eating alone and eating with others. *Physiology & Behavior, 88*(4), 498-505. doi:10.1016/j.physbeh.2006.04.025

Hickson, M., Connolly, A., & Whelan, K. (2011). Impact of protected mealtimes on ward mealtime environment, patient experience and nutrient intake in hospitalised patients. *Journal of Human Nutrition and Dietetics, 24*(4), 370-374. doi:10.1111/j.1365-277X.2011.01167.x

Hill, R. (1998). What sample size is “enough” in internet survey research. *Interpersonal Computing and Technology: An electronic journal for the 21st century, 6*(3-4), 1-12.

Houts, P. S., Doak, C. C., Doak, L. G., & Loscalzo, M. J. (2006). The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence. *Patient Education and Counseling, 61*(2), 173-190. doi:10.1016/j.pec.2005.05.004

Huckleberry, Y. (2004). Nutritional support and the surgical patient. *American Journal of Health-System Pharmacy, 61*(7), 671-682.

Huxtable, S., & Palmer, M. (2013). The efficacy of protected mealtimes in reducing mealtime interruptions and improving mealtime assistance in adult inpatients in an Australian hospital. *European Journal Of Clinical Nutrition, 67*(9), 904.

Johns, N., Hartwell, H., & Morgan, M. (2010). Improving the provision of meals in hospital. The patients' viewpoint. *Appetite, 54*(1), 181-185. doi:10.1016/j.appet.2009.10.005

Kahokehr, A. A., Sammour, T., Wang, K., Sahakian, V., Plank, L. D., & Hill, A. G. (2010). Prevalence of malnutrition on admission to hospital- Acute and elective general surgical

patients. *e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism, 5*(1), e21-e25. doi:10.1016/j.eclnm.2009.11.001

Keller, H., Allard, J., Vesnaver, E., Laporte, M., Gramlich, L., Bernier, P., . . . Payette, H. (2015). Barriers to food intake in acute care hospitals: A report of the Canadian Malnutrition Task Force. *Journal of Human Nutrition and Dietetics, 28*(6), 546-557. doi:10.1111/jhn.12314

Kondrup, J., Johansen, N., Plum, L. M., Bak, L., Larsen, I. H., Martinsen, A., . . . Lauesen, N. (2002). Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. *Clinical Nutrition, 21*(6), 461-468.

Kreitler, S., Chaitchik, S., Rapoport, Y., Kreitler, H., & Algor, R. (1993). Life satisfaction and health in cancer patients, orthopedic patients and healthy individuals. *Social Science & Medicine, 36*(4), 547-556. doi:10.1016/0277-9536(93)90415-Z

Kroenke, K., Wood, D. R., Mangelsdorff, A., Meier, N. J., & Powell, J. B. (1988). Chronic fatigue in primary care: Prevalence, patient characteristics, and outcome. *Journal of the American Medical Association, 260*(7), 929-934. doi:10.1001/jama.1988.03410070057028

Larby, A., Roberts, S., & Desbrow, B. (2016). Accuracy and adequacy of food supplied in therapeutic diets to hospitalised patients: An observational study. *Nutrition & Dietetics, 73*(4), 342-347. doi:10.1111/1747-0080.12270

Ljungqvist, O., Scott, M., & Fearon, K. C. (2017). Enhanced recovery after surgery a review. *Journal of the American Medical Association Surgery, 152*(3), 292-298. doi:10.1001/jamasurg.2016.4952

Löser, C. (2010). Malnutrition in hospital: The clinical and economic implications. *Deutsches Arzteblatt International, 107*(51-52), 911-917. doi:10.3238/arztebl.2010.0911

Lynch, A. C., Dobbs, B. R., Keating, J., & Frizelle, F. A. (2001). The prevalence of faecal incontinence and constipation in a general New Zealand population; A postal survey. *The New Zealand medical journal, 114*(1142), 474-477.

Marriott, L., & Sim, D. (2014). *Indicators of Inequality for Māori and Pacific People*. Wellington, New Zealand: Victoria University of Wellington. Retrieved from https://www.victoria.ac.nz/sacl/centres-and-institutes/cpf/publications/pdfs/2015/WP09_2014_Indicators-of-Inequality.pdf

Messina, G., Fenucci, R., Vencia, F., Niccolini, F., Quercioli, C., & Nante, N. (2013). Patients' evaluation of hospital foodservice quality in Italy: What do patients really value? *Public health nutrition, 16*(4), 730-737.

Ministry of Health. (2015). *Eating and Activity Guidelines for New Zealand Adults*. Wellington, New Zealand. Retrieved from https://www.health.govt.nz/system/files/documents/publications/eating-activity-guidelines-for-new-zealand-adults-oct15_0.pdf

Ministry of Health. (2017). Annual Data Explorer 2016/17: New Zealand Health Survey. Retrieved from https://www.health.govt.nz/publication/annual-update-key-results-2016-17-new-zealand-health-survey

Monson, J. R. (2008). Constipation: Etiology, evaluation, and management. *Diseases of the Colon & Rectum, 51*(3), 365-365.

Mowe, M., & Bohmer, T. (2002). Reduced appetite. A predictor for undernutrition in aged people. *Journal of Nutrition, Health & Aging, 6*(1), 81-83.

Naber, T. H., Schermer, T., de Bree, A., Nusteling, K., Eggink, L., Kruimel, J. W., . . . Katan, M. B. (1997). Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications. *The American Journal of Clinical Nutrition, 66*(5), 1232-1239.

Naithani, S., Thomas, J. E., Whelan, K., Morgan, M., & Gulliford, M. C. (2009). Experiences of food access in hospital. A new questionnaire measure. *Clinical Nutrition, 28*(6), 625-630. doi:10.1016/j.clnu.2009.04.020

Naithani, S., Whelan, K., Thomas, J., Gulliford, M. C., & Morgan, M. (2008). Hospital inpatients' experiences of access to food: A qualitative interview and observational study. *Health Expectations, 11*(3), 294-303. doi:10.1111/j.1369-7625.2008.00495.x

Norman, G. (2010). Likert scales, levels of measurement and the “laws” of statistics. *Advances in Health Sciences Education, 15*(5), 625-632. doi:10.1007/s10459-010-9222-y

Norman, K., Pichard, C., Lochs, H., & Pirlich, M. (2008). Prognostic impact of disease-related malnutrition. *Clinical Nutrition, 27*(1), 5-15. doi:10.1016/j.clnu.2007.10.007

O'Brien, B., & Naber, S. (1992). Nausea and vomiting during pregnancy: Effects on the quality of women's lives. *Birth, 19*(3), 138-143.

Pablo, A. M. R., Izaga, M. A., & Alday, L. A. (2003). Assessment of nutritional status on hospital admission: Nutritional scores. *European Journal Of Clinical Nutrition, 57*, 824. doi:10.1038/sj.ejcn.1601616

Planas, M., Audivert, S., Pérez-Portabella, C., Burgos, R., Puiggrós, C., Casanelles, J. M., & Rosselló, J. (2004). Nutritional status among adult patients admitted to an university-affiliated hospital in Spain at the time of genoma. *Clinical Nutrition, 23*(5), 1016-1024. doi:10.1016/j.clnu.2004.01.003

Reglier-Poupet, H., Parain, C., Beauvais, R., Descamps, P., Gillet, H., Le Peron, J. Y., . . . Ferroni, A. (2005). Evaluation of the quality of hospital food from the kitchen to the patient. *Journal of Hospital Infection, 59*(2), 131-137. doi:10.1016/j.jhin.2004.07.023

Reid, E. (2001). Factors affecting how patients sleep in the hospital environment. *British Journal of Nursing, 10*(14), 912-915.

Reissman, P., Teoh, T. A., Cohen, S. M., Weiss, E. G., Nogueras, J. J., & Wexner, S. D. (1995). Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial. *Annals of Surgery, 222*(1), 73-77.

Robinson, G., Goldstein, M., & Levine, G. M. (1987). Impact of nutritional status on DRG length of stay. *Journal of Parenteral and Enteral Nutrition, 11*(1), 49-51. doi:10.1177/014860718701100149

Schoeller, D. A. (1990). How accurate is self-reported dietary energy intake? *Nutrition Reviews, 48*(10), 373-379. doi:10.1111/j.1753-4887.1990.tb02882.x

Schoeller, D. A. (1995). Limitations in the assessment of dietary energy intake by self-report. *Metabolism, 44*, 18-22. doi:10.1016/0026-0495(95)90204-X

Schütz, P., Bally, M., Stanga, Z. G., & Keller, U. (2014). Loss of appetite in acutely ill medical inpatients: Physiological response or therapeutic target? *Swiss medical weekly, 144*, w13957.

Simmons, S. F., Lam, H. Y., Rao, G., & Schnelle, J. F. (2003). Family members' preferences for nutrition interventions to improve nursing home residents' oral food and fluid intake. *Journal of the American Geriatrics Society, 51*(1), 69-74. doi:10.1034/j.1601-5215.2002.51012.x

Smith, A. G. (2012). Nutrition support: Appropriate use of sip feeds. *Nursing & Residential Care, 14*(11), 584-588.

Stanga, Z., Zurflüh, Y., Roselli, M., Sterchi, A. B., Tanner, B., & Knecht, G. (2003). Hospital food: A survey of patients' perceptions. *Clinical Nutrition, 22*(3), 241-246. doi:10.1016/S0261-5614(02)00205-4

Statistics New Zealand. (2013, 29th January 2015). 2013 Census – Major ethnic groups in New Zealand. Retrieved from http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/infographic-culture-identity.aspx

Stone, P., Richardson, A., Ream, E., Smith, A. G., Kerr, D. J., & Kearney, N. (2000). Cancer-related fatigue: Inevitable, unimportant and untreatable? Results of a multi-centre patient survey. *Annals of Oncology, 11*(8), 971-975.

Vahabzadeh, D. (2017). *Food intake, plate waste and its association with malnutrition in hospitalized patients*.

Vaimoso, H. (2015). Mealtimes take priority on wards. *Healthlines: News, views and information from Waitemata District Health Board,* 14.

Van Duyn, M. A. S., & Pivonka, E. (2000). Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: Selected literature. *Journal of the American Dietetic Association, 100*(12), 1511-1521. doi:10.1016/S0002-8223(00)00420-X

Waitemata District Health Board. (2016). Bringing food into hospital. Retrieved 27th January 2018 from http://www.waitematadhb.govt.nz/patients-visitors/staying-in-hospital/food-in-hospital/bringing-food/

Ward, N. (2003). Nutrition support to patients undergoing gastrointestinal surgery. *Nutrition Journal, 2*(1), 18. doi:10.1186/1475-2891-2-18

Watters, C. A., Sorensen, J., Fiala, A., & Wismer, W. (2003). Exploring patient satisfaction with foodservice through focus groups and meal rounds. *Journal of the American Dietetic Association, 103*(10), 1347-1349.

Windsor, J. A., Knight, G. S., & Hill, G. L. (1988). Wound healing response in surgical patients: Recent food intake is more important than nutritional status. *British Journal of Surgery, 75*(2), 135-137. doi:10.1002/bjs.1800750215

Xia, C., & McCutcheon, H. (2006). Mealtimes in hospital - Who does what? *Journal of Clinical Nursing, 15*(10), 1221-1227. doi:10.1111/j.1365-2702.2006.01425.x

Young, A. M., Mudge, A. M., Banks, M. D., Ross, L. J., & Daniels, L. (2013). Encouraging, assisting and time to EAT: Improved nutritional intake for older medical patients receiving Protected Mealtimes and/or additional nursing feeding assistance. *Clinical Nutrition, 32*(4), 543-549. doi:10.1016/j.clnu.2012.11.009

Zhu, L., Huang, D., Shi, L., Liang, L., Xu, T., Chang, M., . . . Fang, X. (2015). Intestinal symptoms and psychological factors jointly affect quality of life of patients with irritable bowel syndrome with diarrhea. *Health and Quality of Life Outcomes, 13*(1). doi:10.1186/s12955-015-0243-3

Chapter 4. Conclusions and Recommendations

4.1 Overview and conclusions

While in hospital many patients do not eat all of the food they have been provided with, resulting in a suboptimal food intake, which ultimately contributes to many undesirable health outcomes. There are numerous types of barriers patients can encounter during their admission. These have been investigated using a survey, which was designed and validated in the UK (Naithani, Thomas, Whelan, Morgan, & Gulliford, 2009). This survey was later termed the Patient Mealtime and Nutrition Care Survey (PMNCS) which was further tested and adapted for use in Canada (Keller et al., 2015). The aim of this study was to investigate the barriers to surgical patients' oral intake in an acute hospital setting in New Zealand (NZ), using the PMNCS. To our knowledge, this is the first study that has specifically investigated barriers to food intake in a NZ hospital setting. The barriers that affected patients in countries around the world, would not necessarily be the same as the barriers experienced in NZ, due to the differences in culture, foodservice and health care systems (Keller et al., 2015).

This gap in the research helped formulate the objectives of the study, of which the first was to conduct a pilot study to test the usability of the validated PMNCS and to identify the additional barriers to surgical patients' oral intake in the NZ setting. To do this, a sample of surgical in-patients (n=100) were recruited to participate and complete the PMNCS in a pilot study. Data were analysed to find the most prevalent barriers in the NZ hospital setting, and to identify additional barriers.

The second objective was to adapt the PMNCS to include the most relevant barriers to oral intake in the NZ setting. In order to meet this objective, changes were made to the survey based on the results from the pilot study, patient feedback and the data collection experience. A total of 16 changes were made to create the NZ-PMNCS; open-ended questions with answer boxes were added to the survey where patients commonly made verbal and written comments during the pilot study. Additional questions in a Likert scale format were also added or reworded to better suit the survey's use in the NZ setting.

The third objective was to use the NZ-PMNCS paired with patient meal observations in a feasibility study to identify the most prevalent barriers in the NZ setting, and to compare with findings from meal observations. To do this, a sample of surgical in-patients (n=65) completed the NZ-PMNCS. From this sample, 60 patients also had a one-off meal observation completed during either breakfast, lunch or dinner. The most prevalent barrier, identified by surgical patients, was food brought in to the hospital for them by visitors. Visitors often bring food because they care; and care is based on many social and cultural reasons. Furthermore, patients often request items to be brought in while in hospital care, although this should ideally be the exception and not standard practise. This indicated that the meal service may not be providing the foods that patients desire. The second most prevalent barrier identified was a

loss of appetite affecting the amount of food consumed. Although there are many methods to stimulate appetite, not all are feasible within the hospital setting. This has highlighted the need for monitoring systems, such as observation charts and food records, that help to identify a loss of appetite and its subsequent impact on food intake.

The final objective was to identify significant associations between barriers with patient, care and hospital characteristics to establish which barriers are most likely to impact surgical patients' oral intake during their hospital admission. The NZ-PMNCS highlighted that short stay patients reported significantly less issues with difficulty cutting up their food compared to long stay patients; less issues with pain affecting food intake and fewer issues with food quality (taste and temperature). It is known that long stay patients often become dissatisfied with food quality, likely because they become bored with the menu over time. However, assistance should be provided for those who need help and pain management should be considered by health care professionals.

Investigations within barrier domains highlighted many significant findings which included younger patients who experienced more barriers within the hunger domain. Long stay patients experienced more barriers from the food quality and illness domains. General surgical patients experienced more barriers within the illness domain; additionally, patients located on a general surgical ward experienced less hunger barriers and more barriers from the illness domain. Patients who had one diet code during the previous 7 days of admission experienced more barriers from the hunger domain and less barriers from the illness domain; and patients currently on a standard diet code also experienced less barriers from the illness domain. Patients with a low self-reported food intake experienced more barriers from the food quality domain and more barriers from the illness domain; however, patients with a low observed food intake reported more barriers from the choice domain. Additionally, patients who reported abnormal bowel motions experienced more barriers within the illness domain.

Finally, results from the NZ-PMNCS and meal observations were compared, revealing that patients who consumed ≤½ of their meal felt they did not have enough information to make appropriate menu choices. Providing more detailed information about menu choices may support patients in making their selections, and as a consequence, they may eat more of their meals. These patients further reported that consumption of their prescribed nutritional supplements affected their food intake. It can be speculated that patients are consuming their supplements before food, which will likely reduce their appetite for their hospital meal, which results in a poor food intake and more plate waste. The NZ-PMNCS was found to be feasible and practical to use in the NZ hospital setting, and would be appropriate to use in future research within NZ. These findings can help provide the evidence to make realistic and accurate changes to hospital and foodservice practices in order to benefit patients.

4.2 Strengths

Conducting a pilot study was a major strength for this research project, as it was an essential step to test the PMNCS in a NZ setting (Hassan, Schattner, & Mazza, 2006). The pilot study facilitated the testing of the feasibility of the project, participant recruitment strategies, PMNCS and data handling (Hassan et al., 2006). Problems and difficulties were identified and rectified before conducting the final study, which enabled the researcher to familiarise them self with the hospital environment, study protocol and appropriate recruitment strategies.

The sample size for both the pilot study and final study are another strength for this research project. For pilot studies, it is thought that a sample which is 10% of the sample involved in the final study is a suitable guideline to minimise the chance of unforeseeable problems arising in the final study (Hertzog, 2008; Viechtbauer et al., 2015). The sample size (n=100) in this pilot study well exceeded the guideline and allowed for thoroughly testing feasibility through a wide variety of responses in the NZ setting. For descriptive research, the sample should be at least 10-20% of the population and for correlational research at least 30 subjects are required, additionally allowing the central limit theorem to be applied when conducting statistics (Hill, 1998; Norman, 2010). The sample size for the final study (n=60) fulfilled all the suggested criteria, allowing scope for participant drop-out. The data for both the pilot study and the final study was collected by one researcher, which also eliminated any inter-rater discrepancies. A unique addition to this study, in contrast to other studies, was the meal observations to further explore the barriers to oral intake. By conducting the survey paired with a meal observation, it provided a holistic and comprehensive insight into the types of barriers most likely to affect those with a low intake and assisted in confirming the findings from the NZ-PMNCS. It also allowed for a case-study analysis to occur with patients who had a poor oral intake during their meal observation. Meal observations additionally provided an opportunity to contrast patients self-reported measures with actual measures.

4.3 Limitations

Like all study designs, cross-sectional studies have limitations, as they can only provide an overview of the issues patients experienced at a certain point in time. This snapshot may not be a true representation of all of the food related barriers patients can experience. Cross-sectional studies are also limiting as they cannot determine causality or directionality. There is also the potential of social desirability bias influencing patient responses, especially if they were assisted by the researcher when completing the survey.

Hospitals are a dynamic environment focused on patient care rather than research outcomes. Negotiating the needs of the patient and supporting other health care professionals was a constant juggle during data collection. The Charge Nurse Managers made efforts to minimise participant burden for patients who were unwell, which reduced the number of patients who could participate in the study. It is likely these patients who were excluded may have different

food related experiences while in hospital. Having a high burden is a limitation as it also reduces the chance that the study will be replicated nationally or internationally.

This research additionally lacked diversity within the samples. Most patients in the pilot and feasibility studies were female and had a primary ethnicity of NZ European. Unfortunately, this was unavoidable due to the cross section of the patients on the surgical wards at the time of data collection and is likely due to the patient profile at North Shore Hospital. A greater diversity is however required to better understand the needs of all patients within the NZ population.

While the data reflects the food related barriers surgical patients face at North Shore Hospital, it may not truly represent the experiences of the wider hospital population including patients from different specialties. The study setting at North Shore Hospital, Waitemata District Health Board (WDHB), is deemed above average in many respects as the population has the fourth highest income amongst DHB's, the region's life expectancy is 85.1 years (2.4 years higher than the national average) and hospital services have the lowest mortality rate in the country (Waitemata District Health Board, 2015). This is a limitation as it is unlikely to represent barriers experienced in hospitals around NZ.

Limitations also surround the use of self-reported variables, as patients can often over-report, under-report or misclassify their answers. Assessing plate waste was an attempt to obtain a better understanding of a patient's true intake, using photographs of meal trays before and after a patient consumed their meal. However further limitations arose as the proportion of each meal component consumed was visually estimated to the nearest 10%, which is not an entirely accurate measure of oral intake. Having a one-off meal observation (either breakfast, lunch or dinner) is also limiting as it only captures what a patient consumed at one moment in time, and it may have been influenced by a number of factors (hospital activities, menu choices or the effects of illness).

4.4 Recommendations for practice

- The Protected Mealtime Policy that has been implemented at North Shore Hospital could be reviewed in order to assess compliance, as disruptions during mealtimes were observed.
- Consider supplying some or more of the foods patients requested to be brought in from visitors, to ensure the hospital menu is providing the foods that patients desire e.g. fresh fruit.
- Develop a monitoring system which identifies if patients have a loss of appetite and additionally records their oral intake, so that the impact of a loss of appetite can be quantified.

- Consider the investigation of further food provisions for hungry patients, including younger individuals or those on an orthopaedic ward, to ensure their requirements are met.
- Ensure symptoms are adequately managed, such as pain, constipation or diarrhoea, to lessen their impact on oral intake.
- Consider the benefits of ward based meal preparations or flexible serving times, such as Steamplicity, to ensure food is served when the patient is present and ready to eat. Additionally, this can further improve aspects of food quality e.g. temperature.
- Supplement usage could be reviewed, specifically regarding patient instructions and delivery times. Patients should be aware of when best to consume the supplement, to reduce the likelihood of the supplement taking priority over the food they have been provided with. Additionally, changes to practice around delivery of supplements could be altered, so that patients receive supplements early in the morning and late at night, to minimise their impact on food intake at main meal times.
- Consider the use of packaging which is easier to open for surgical patients, particularly paying attention to lids on milk, juice, ice cream and yoghurt containers.
- Review the delivery of information to patients with both spoken and paper menus. As patients have reported that a lack of information is provided, the use additional pictorial methods could be considered.
- The red tray system, which highlights to health care workers that a patient will need mealtime assistance, is endorsed. Implementing this system on surgical wards may result in fewer patients experiencing barriers from the eating difficulties domain.

4.5 Recommendations for future research

- Aim to identify the food related barriers that the most vulnerable (sick) patients in hospital experience. A mixed method approach could be used, alongside the NZ-PMNCS, to reduce participant burden. For example, short interviews or a focus group post-admission could work well for patients who are too unwell to participate in hospital.
- Obtain a sample with a greater diversity (ethnicities and gender). Equal numbers of patients from both genders should be used. Efforts should also be made to over-represent those of Māori, Pacific and Asian ethnicities. Interpreters, trained research assistants from a range of ethnicities or translated surveys could be utilised.
- Aim to include other specialties aside from surgical patients, such as general medicine, cardiology, older people's health, respiratory, cancer and haematology. This would provide an overview of the food related barriers all patients experience while in hospital.
- A multi-centre study involving hospitals from around NZ could be conducted in order to better understand food related barriers that are occurring on a national scale in a diverse demographic environment.

- Improved accuracy of oral intake from the plate waste assessment that was used in this project would be recommended for future studies. The use of a weighed food record would provide greater accuracy when calculating the amount of food consumed by each patient.
- Include more than one meal observation for each patient spread across more than one type of main meal in order to eliminate factors that can influence a one-off meal observation.

References

Hassan, Z. A., Schattner, P., & Mazza, D. (2006). Doing A Pilot Study: Why Is It Essential? *Malaysian Family Physician, 1*(2-3), 70-73.

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health, 31*(2), 180-191. doi:10.1002/nur.20247

Hill, R. (1998). What sample size is "enough" in internet survey research. *Interpersonal Computing and Technology: An electronic journal for the 21st century, 6*(3-4), 1-12.

Keller, H., Allard, J., Vesnaver, E., Laporte, M., Gramlich, L., Bernier, P., . . . Payette, H. (2015). Barriers to food intake in acute care hospitals: A report of the Canadian Malnutrition Task Force. *Journal of Human Nutrition and Dietetics, 28*(6), 546-557. doi:10.1111/jhn.12314

Naithani, S., Thomas, J. E., Whelan, K., Morgan, M., & Gulliford, M. C. (2009). Experiences of food access in hospital. A new questionnaire measure. *Clinical Nutrition, 28*(6), 625-630. doi:10.1016/j.clnu.2009.04.020

Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education, 15*(5), 625-632. doi:10.1007/s10459-010-9222-y

Viechtbauer, W., Smits, L., Kotz, D., Budé, L., Spigt, M., Serroyen, J., & Crutzen, R. (2015). A simple formula for the calculation of sample size in pilot studies. *Journal of Clinical Epidemiology, 68*(11), 1375-1379. doi:10.1016/j.jclinepi.2015.04.014

Waitemata District Health Board. (2015). Population Health Profile. Retrieved from http://www.waitematadhb.govt.nz/assets/Documents/population-profile/WDHB2015PopulationHealthProfileWDHB.pdf

Appendix A. Supplementary Results

A.1 Pilot study results

Table A.1: *Summary of demographic information including patient, care and hospital characteristics for the pilot study*

	Total with characteristic N=100	**Median [25th, 75th percentile]**
Parameter	**%***	
Age		72 [57,81]
≥65 years	67.0	
<65 years	33.0	
Gender		
Female	63.0	
Male	37.0	
Primary Ethnicity		
New Zealand European	75.0	
European	9.0	
Māori	7.0	
Asian	3.0	
Pacific	2.0	
Australian	2.0	
US/ Canadian	1.0	
Middle Eastern	1.0	
Secondary Ethnicities[×]		
No secondary ethnicity	96.0	
New Zealand European	3.0	
Pacific	2.0	
Length of stay		4 [3,9]
≤5 days	61.0	
>5 days	39.0	
Type of surgery		
Orthopaedic	50.0	
Other[β]	23.0	
Lower gastrointestinal tract	13.0	
Neurological	12.0	
Upper gastrointestinal tract	2.0	
Diet code; current		
Standard[#]	65.0	
Composition modified[†]	24.0	
Texture modified[‡]	7.0	
Liquid diet[Ω]	3.0	
Nil by mouth	1.0	

*The data in this table represents both the number of patients and the percentage of patients with each characteristic; the sample size was 100.

[×]Patients can identify with more than one secondary ethnicity.

[β]Other surgical admissions included: biliary drainage, cholecystitis, abscesses, cellulitis, carcinoma, haemopneumothorax, tracheostomy, skin lacerations, skin ulcers, sepsis, pancreatitis and a ruptured ovary.

[#]Standard diet code is designed for patients who are nutritionally well and able to eat normally with no restrictions (a full adult diet)

[†]Composition modified diet codes included: High Energy High Protein, Enhanced Recovery After Surgery, Restricted Fibre, Vegetarian and Low Sodium.

‡Texture modified diet codes included: Soft Mechanical and Soft Dysphagic.
ΩLiquid diet codes included: Free Oral Fluids and Clear Oral Fluids.

Table A.2: *Prevalence of food related barriers, for the pilot study, within food intake barrier domains*

	Total number affected N=100
Barriers to food intake reported by patients×	**%***
Organizational	
Did not always want food that has been ordered	66.0
Did not get help when needed (restricted to patients who needed help)‡	56.5
Did not receive ordered food	50.0
When meals missed, not given hospital food by staff (restricted to patients who missed meals)†	48.1
Interrupted by the hospital staff	41.0
Missed meals due to avoiding food for tests	36.0
Missed meals due to not being available when they were served	35.0
Disturbed by activities, noises or unpleasant smells	29.0
Choice	
Not enough information provided to choose the right food	40.0
Meals not served at times that suit patient	15.0
Not being able to choose preferred foods	13.0
Do not understand how to complete the menu selections	2.0
Hunger	
Visitors bring in food because patient is hungry	42.0
Become hungry as the time between meals is too long	17.0
Felt hungry but could not ask staff for food	14.0
Felt hungry but no food was available from the hospital	14.0
Eating difficulties	
Difficulty opening packets/ unwrapping food	49.0
In an uncomfortable position to eat	44.0
Difficulty reaching food	28.0
Difficulty cutting up food	28.0
Difficulty feeding self	15.0
Needed help to eat meals	8.0
Not enough time to eat all the food	0.0
Quality/satisfaction with food; dissatisfied with:	
Temperature of food	29.0
Taste	23.0
Appearance	20.0
Portion size	19.0
Smell	16.0
Effects of illness on food intake	
Loss of appetite	71.0
Tired	41.0
Sickness	39.0
Pain	33.0
Depressed	18.0
Worried	17.0
Chewing or swallowing difficulties	15.0
Breathing difficulties	10.0

×Based on the number of patients who reported experiencing the barrier at least once during their admission.

*The data in this table represents both the number of patients and the percentage of patients who reported the barrier; the sample size was 100.
‡Sub-question; patients who answered 'did not need any help' were excluded (N=23).
†Sub-question; patients who answered 'did not miss a meal' were excluded (N=54).

Table A.3: *Prevalence of patient opinions for the pilot study*

	Number of patients N=100
Patient opinions	**%***
Rated portion size	
Alright	74.0
Too large	15.0
Too small	11.0
Rated temperature of food	
Alright	72.0
Too cold	28.0
Too hot	0.0

*The data in this table represents both the number of patients and the percentage of patients with each opinion; the sample size was 100.

A.2 Feasibility study results

Table A.4: *Proportion of meal components consumed by patients*

	Number of patients who received meal component n (%)	Mean proportion of meal component consumed	Range of meal component consumed
Breakfast meal components	**N=20**	**%**	**minimum %, maximum %**
Milk	20 (100)	67	0, 100
Yoghurt	17 (85)	71	0, 100
Toast	14 (70)	71	0, 100
Juice	12 (60)	69	0, 100
Cereal	10 (50)	74	0, 100
Porridge	9 (45)	72	0, 100
Fruit	8 (40)	75	0, 100
Nutritional supplement	4 (20)	75	0, 100
Lunch meal components	**N=20**	**%**	**minimum %, maximum %**
Bread	13 (65)	66	0, 100
Soup	12 (60)	45	0, 100
Hot main	10 (50)	76	0, 100
Sandwich/ filled roll	9 (45)	50	0, 100
Side salad	6 (30)	53	0, 100
Dessert	4 (20)	35	0, 100
Nutritional supplement	2 (10)	100	100, 100
Salad	1 (5)	90	90, 90
Cheese and crackers	1 (5)	0	0, 0
Yoghurt	1 (5)	100	100, 100
Dinner meal components	**N=20**	**%**	**minimum %, maximum %**
Hot main	20 (100)	70	0, 100
Carbohydrate	19 (95)	68	0, 100
Vegetables	16 (80)	79	10, 100
Jelly	12 (60)	70	0, 100
Ice cream	11 (55)	73	0, 100
Main dessert	7 (35)	69	10, 100
Soup	2 (10)	95	90, 100
Nutritional supplement	2 (10)	0	0, 0

*Mean proportion of meal component consumed indicates the mean amount of each food consumed based on the number of patients who received the item.

Table A.5: *Case-by-case analysis for the seven patients who proportionally consumed between none to ¼ of the delivered food during the meal observation*

Patient code	Meal	Meal components received	Proportion of meal components consumed (%)	Mean proportion of meal consumed (%)	Observation/s	Food intake barrier domains	All patients Mean barrier score[x] ± SD	Individual patient barrier score
60041	Breakfast	Porridge	0	10	Visitor present	Organisational	2.34 ± 1.74	2
		Toast	50			Choice	0.62 ± 0.76	2
		Milk	0		Consumed 'non-hospital' food (snack food or addition to hospital meal)	Hunger	1.22 ± 0.80	1
		Juice	0			Eating difficulties	1.28 ± 1.31	2
		Yoghurt	0			Food quality	0.83 ± 1.14	1
					Nausea and/or vomiting throughout meal	Illness	4.38 ± 2.95	9
60058	Breakfast	Cereal	0	20	Sleeping throughout meal	Organisational	2.34 ± 1.74	5
		Toast	0			Choice	0.62 ± 0.76	3
		Milk	0			Hunger	1.22 ± 0.80	3
		Yoghurt	0			Eating difficulties	1.28 ± 1.31	0
		Fruit	100			Food quality	0.83 ± 1.14	4
						Illness	4.38 ± 2.95	1
60012	Lunch	Soup	0	0	Visitor present	Organisational	2.34 ± 1.74	3
		Bread	0			Choice	0.62 ± 0.76	1
		Sandwich	0		Consumed 'non-hospital' food (entire meal)	Hunger	1.22 ± 0.80	1
						Eating difficulties	1.28 ± 1.31	4
					Saving food for later	Food quality	0.83 ± 1.14	2
						Illness	4.38 ± 2.95	0
60018	Lunch	Soup	0	3	Consumed 'non-hospital' food (entire meal)	Organisational	2.34 ± 1.74	4
		Bread	0			Choice	0.62 ± 0.76	2
		Sandwich	10		Saving food for later	Hunger	1.22 ± 0.80	3
		Dessert	0			Eating difficulties	1.28 ± 1.31	3
						Food quality	0.83 ± 1.14	3
						Illness	4.38 ± 2.95	7
60022	Lunch	Soup	0	0	Visitor present	Organisational	2.34 ± 1.74	4
		Bread	0			Choice	0.62 ± 0.76	1
		Sandwich	0		Consumed 'non-hospital' food (entire meal)	Hunger	1.22 ± 0.80	1
						Eating difficulties	1.28 ± 1.31	4
						Food quality	0.83 ± 1.14	0
						Illness	4.38 ± 2.95	5
60033	Lunch	Hot main	0	0	Visitor present	Organisational	2.34 ± 1.74	4
		Soup	0			Choice	0.62 ± 0.76	1
		Bread	0		Medical care given	Hunger	1.22 ± 0.80	0
		Dessert	0			Eating difficulties	1.28 ± 1.31	1
					Sleeping throughout meal	Food quality	0.83 ± 1.14	1
						Illness	4.38 ± 2.95	9
60035	Dinner	Hot main	0	4	Nausea and/or vomiting throughout meal	Organisational	2.34 ± 1.74	0
		Vegetables	10			Choice	0.62 ± 0.76	0
		Carbohydrate	10			Hunger	1.22 ± 0.80	1
		Ice cream	0			Eating difficulties	1.28 ± 1.31	1
		Jelly	0			Food quality	0.83 ± 1.14	1
						Illness	4.38 ± 2.95	6

Table A.6: *Types of food brought into the hospital for patients*

	Number of patients* N=65
Types of food	**n (%)**
Fresh produce	
Fresh fruit	28 (43.1)
Homemade-type foods	
Salad	2 (3.1)
Quiche	1 (1.5)
Sandwich	1 (1.5)
Takeaway-type foods	
McDonalds	3 (4.6)
Kentucky Fried Chicken	3 (4.6)
Subway	2 (3.1)
Burger King	2 (3.1)
Pie	2 (3.1)
Pizza	1 (1.5)
Pita Pit	1 (1.5)
Snacks and convenience foods	
Baked items	11 (16.9)
Chocolate	6 (9.2)
Sweets	6 (9.2)
Chips	5 (7.7)
Crackers	4 (6.2)
Muesli bar	3 (4.6)
Nuts	2 (3.1)
Protein bar	1 (1.5)
Yoghurt	1 (1.5)
Ice cream	1 (1.5)
Fluids	
Coffee	6 (9.2)
Smoothie	3 (4.6)
Soup	3 (4.6)
Tea	2 (3.1)
Protein drink	1 (1.5)

*Based on the patient comments within the New Zealand Patient Mealtime and Nutrition Care Survey.

Appendix B. Research Approval

B.1 Massey University Human Ethics Committee (MUHEC) Review

Date: 20 December 2016

Dear Olivia Stone

Re: Ethics Notification - **SOA 16/66 - Barriers to oral intake in the acute hospital setting**

Thank you for the above application that was considered by the Massey University Human Ethics Committee: **Human Ethics Southern A Committee** at their meeting held on **Tuesday, 13 December, 2016**.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand **T** 06 350 5573; 06 350 5575 **F** 06 355 7973
E humanethics@massey.ac.nz **W** http://humanethics.massey.ac.nz

B.2 Health and Disability Ethics Committee (HDEC) Review

Health and Disability Ethics Committees
20 Aitken Street
Freyberg Building
PO Box 5013
Wellington

0800 4 ETHICS
hdecs@moh.govt.nz

Thursday, 20 October 2016

Miss Olivia Stone
[redacted]

Dear Miss Stone,

Study title:	Barriers to oral intake in the acute hospital setting

Thank you for emailing HDEC a completed scope of review form on 14 October 2016. The Secretariat has assessed the information provided in your form and supporting documents against the Standard Operating Procedures.

Your study will not require submission to HDEC, as on the basis of the information you have submitted, it does not appear to be within the scope of HDEC review. This scope is described in section three of the Standard Operating Procedures for Health and Disability Ethics Committees.

Your study meets the student-led research exemption criteria described below. Your study is an observational, cross sectional study that aims to investigate barriers to patient eating in an acute hospital setting.

For the avoidance of doubt a study conducted wholly or principally for the purposes of an educational qualification requires HDEC review only if it:

- is an intervention study, or
- is not conducted at or below a Master's level.

If you consider that our advice on your project being out of scope is in incorrect please contact us as soon as possible giving reasons for this.

This letter does not constitute ethical approval or endorsement for the activity described in your application, but may be used as evidence that HDEC review is not required for it.

Please note, your locality may have additional ethical review policies, please check with your locality. If your study involves a DHB, you must contact the DHB's research office before you begin. If your study involves a university or polytechnic, you must contact its institutional ethics committee before you begin.

Please don't hesitate to contact us for further information.

Yours sincerely,

Tom Kent
Advisor
Health and Disability Ethics Committees
hdecs@moh.govt.nz

B.3 Māori Research Committee Review

MASSEY UNIVERSITY

5th December 2016

Tena koutou e te Kōmiti,

Re: Ethics Application of Olivia Stone (SOA 16-66)

I have reviewed the application of Olivia Stone to your committee for ethics approval, and have noted the feedback from the committee as well.

Generally it seems that Olivia's research will provide some benefit for Māori. Olivia has considered the cultural implications and possible risk for Māori participants. Note however, that I can comment only on the cultural considerations but not on the clinical considerations. For that reason, I would suggest that if Olivia has further need of a cultural advisor, she seeks one at the DHB who more clearly understands the intersection of cultural and clinical practice.

Given Māori are a diverse grouping, it would nevertheless be pertinent to assess whether there are any cultural factors which would create barriers. For example, is the context and environment of the hospital conducive to expressing a karakia before eating? It may be relevant to include questions which relate to such cultural factors in the questionnaire. However I realise that use of the Canadian Malnutrition Task Force questionnaire which has been tested and validated may preclude inclusion of a question relating to cultural factors. And with regard to a Māori dissemination strategy – I suggest a presentation to the Māori research arm of the DHB who may then be able to disseminate further, any useful information for Māori, or they may have suggestions as to how Olivia can disseminate it further.

Mauri ora,

Dr Lily George, Senior Research Officer
Office of AVC Māori & Pasifika, Massey University.

50 YEARS

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

He Kamaka Waiora
Waitematā and Auckland DHB
Level 2, 15 Shea Terrace,
Auckland 0740,
New Zealand
Private Bag: 93-503

09/12/2016

Olivia Stone
North Shore Hospital
Takapuna
Auckland

Re: Barriers to oral intake in the acute hospital setting

Thank you for providing the following documents the:

- Māori review form and consultation letter
- Background information sheet
- Research proposal
- Participant information and consent forms
- Massey ethics application

The study is seeking to identify barriers to oral intake in a hospital setting. The study is student based and involves 160 participants, 24 of who are predicted to be Maori. There are two phases to the study – phase one is identifying barriers to oral intake and phase two is to develop and test a barriers to oral intake assessment tool.

I note you have consulted with Maori at Massey University and considered the advice given. Please thank the reviewer and let her know we tautoko her comments. The investigator intends to recruit 24 Maori participants and is familiar with tikanga best practice within the District Health Board.

Comments:

- You will need Maori cultural contact details øn the participant information and consent forms (see below)

If you require Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324

- Investigators commonly aim to over represent Maori in their studies to make sure the DHB is gathering information that improves health gains for Maori. Dr Sue Crengle recommends 50% Maori 50% other.
- Please let the Maori Research Committee know how many Māori were part of the study and what their thoughts were about barriers to oral intake.

On behalf of the Waitematā and Auckland District Health Boards Māori Research Committee the study has been approved.

Heoi ano

H.A Wihongi

Dr Helen Wihongi
Research Advisor – Māori
Waitematā and Auckland DHB
Level 2, 15 Shea Terrace, Auckland 0740,
New Zealand
Private Bag: 93-503
p: +64 9 486 8920 ext. 3204
m: + 64 21 0203 1167
email helen.wihongi@waitematadhb.govt.nz

B.4 Awhina Research and Knowledge Centre Locality Approval

WDHB Approval of Research

Waitemata District Health Board
Best Care for Everyone

RM13592 Barriers to oral intake in the acute hospital setting

WDHB Contact: Charlotte Moor

External CI: Olivia Stone, Massey University

Department: Food Services
Project Type: Observational research
Duration: 14/11/2016 - 1/10/2017

Title Abbreviation:
External Reference:

Description: Research question: What are the barriers to patients eating?
Aim: To investigate the barriers to patient eating in an acute hospital setting in New Zealand.
This study is a single-centre cross-sectional study, which will take place in New Zealand in the acute hospital setting (North Shore Hospital, WDHB). Specifically on surgical wards; 4, 7, 8 and 9. It will be broken down into two phases in order to obtain the desired information and meet the objectives. Phase 1 will require a questionnaire to be obtained and/or developed to suit the study (see attached). This questionnaire will primarily focus on identifying the barriers to oral intake. Results from this questionnaire will be quantitative. Phase 2 will require a questionnaire to be developed from a combination of the findings from Phase 1 and self-reported food intake tools used in previous studies. This questionnaire will primarily focus on the most relevant barriers to oral intake in order to profile the barriers that are most likely to effect oral intake. Results from this questionnaire will also be quantitative.

Locality Review

The undersigned agree to the following:

- The study protocol and methodology has merit.
- The local lead investigator is suitably qualified, experienced, registered and indemnified.
- Resources, facilities and staff are available to conduct this study, including access to interpreters if requested.
- Cultural consultations have occurred or will be undertaken as appropriate.
- Appropriate confidentiality provisions have been planned for.
- Appropriate arrangements are in place to notify other relevant local health or social care staff about the study, and for making available any extra support that might be required by participants.
- Conducting this study will have no adverse effect on the provision of publicly funded healthcare.
- There is a stated intent that the results of this study will be disseminated and where practical and appropriate the findings of the study will be translated into evidence based care.

Awhina Research & Knowledge can assist in the determination of ethics approval requirements, budgets, contracts, funding applications and statistical consultations. Enquires to research@waitematadhb.govt.nz

Dept/Org	Role	Name (Print Clearly)	Signature	Date
Surgical & Ambulatory Services	*General Manager*	*Michelle Sutherland*		18/11/16
Food Services	*Manager*	*Roslyn Norrie - approved prior to registration as per email 28/09/2016*		16/11/16
Ward 4 (General Surgery)	*Charge Nurse Manager*	*Susan Johnston*		16/11/16
Ward 7 Orthopaedic Acute	*Charge Nurse Manager*	*Roslyn Bell*	R. Bell	16/11/16

WDHB Approval of Research

Waitemata District Health Board
Best Care for Everyone

Ward 8 (General Surgery)	*Charge Nurse Manager*	*Frances Scheirlinck*		14 / 11 / 16
Ward 9 Orthopaedic	*Charge Nurse Manager*	*Suzanne Huskinson*		7 / 12 / 16.
ALLIED>Dietitians	*Clinical Lead*	*Teresa Stanbrook*		16 / 11 / 16.

Please return completed form to Awhina Research & Knowledge Centre
Alternatively, emails received from approvers are acceptable as electronic sign-off.

WDHB Clinical Support Services - Sign-off

Waitemata District Health Board
Best Care for Everyone

RM13592 Barriers to oral intake in the acute hospital setting

WDHB Contact			External CI: Olivia Moor, Massey University
Type:	Observational research	**Department:**	Food Services
Multi-site?	Single site (WDHB only)	**Project Duration:**	14/11/2016 - 1/10/2017

Project Description

Research question: What are the barriers to patients eating?
Aim: To investigate the barriers to patient eating in an acute hospital setting in New Zealand.
This study is a single-centre cross-sectional study, which will take place in New Zealand in the acute hospital setting (North Shore Hospital, WDHB). Specifically on surgical wards; 4, 7, 8 and 9. It will be broken down into two phases in order to obtain the desired information and meet the objectives. Phase 1 will require a questionnaire to be obtained and/or developed to suit the study (see attached). This questionnaire will primarily focus on identifying the barriers to oral intake. Results from this questionnaire will be quantitative. Phase 2 will require a questionnaire to be developed from a combination of the findings from Phase 1 and self-reported food intake tools used in previous studies. This questionnaire will primarily focus on the most relevant barriers to oral intake in order to profile the barriers that are most likely to effect oral intake. Results from this questionnaire will also be quantitative.

CROSS OUT ANY SERVICES NOT REQUIRED FOR THIS STUDY

Declaration: **This research has been discussed with the undersigned managers and an agreed level of resource has been negotiated. Conducting this study will not impact publically funded healthcare.**

Clinical Support Service Add or cross out as applicable	Name & Role Print clearly	Signature	Date Signed
Clinical Records	Jasmin O'Sullivan		/ /
Health Information Group	*Contact Andrew Cave*	A H. Cave	31 / 11 / 16
			/ /
			/ /

Please return completed form to Awhina Research & Knowledge Centre
Alternatively, emails received from approvers are acceptable as electronic sign-off.

Hi Charlotte

Thank you for your reply.

I believe your email below contain sufficient information for us to approve this study and would like to confirm that this study will have no requirements from CRD as the information will be obtained whilst the patient is in the hospital.

Therefore, on behalf of my Team Leader, Samantha Johnson please accept this email as sign-off from Clinical Records.

Thank you very much.

Kind regards

Jasmin O'Sullivan | Clinical Records
Health Information Group | Waitemata DHB

North Shore Hospital

Private Bag 93503, Takapuna, Auckland 0740
p: 09 486 8920 x3341 | f: 09 488 4622 int. 3822

www.waitematadhb.govt.nz

Office hours 10am to 2pm Mon - Fri

Waitemata
District Health Board
Best Care for Everyone

Appendix C. Additional Materials

C.1 Participant Information Sheet: Pilot Study

Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

School of Food and Nutrition I Massey University I Private Bag 102 904 I Auckland 0745 I New Zealand

What stops you from eating your meals while in hospital?

INFORMATION SHEET
(PART 1)

My study
There are a lot of reasons why you may not eat your meals while in hospital. I am doing a study to find out what these reasons are. The study is taking place on surgical wards at North Shore Hospital. I am currently studying to become a Dietitian; this research project is part of what I need to do in order to become a Dietitian. The study is being done alongside the foodservice provider for the hospital, Medirest- Compass Group.

My study aims to highlight specific barriers that stop you from eating your hospital meals. Other ways to explain barriers are hurdles, obstructions or stumbling blocks. What I find will help the foodservice meet the needs of patients. There are two parts to my study and I am asking you to be involved in the first part.

The first part is to find out what the barriers are that stop you from eating your meal.
We would like to ask you to participate in our study, please read the information below to learn more about the study.

Who are we looking for?
Patients on the surgical wards at North Shore Hospital, Waitemata District Health Board (WDHB), will be invited to be part of the study.

Anyone can participate if they:

- Have been in hospital care for at least 48 hours.
- Have an anticipated length of stay for at least the next 24 hours.
- Can speak English well.
- Are aged 16 years or older.
- Have consumed at least one hospital meal during current hospital admission.

Unfortunately, you cannot take part if:

- Are under the age of 16 years.
- Have been Nil by Mouth (NBM) for the entire hospital stay.

We aim to include 100 people in the first part of the study.
Being part of this study will not cause any discomforts or have any added risks and will only utilise a small amount of your time to complete the questionnaire.

If you require help to complete this questionnaire, this can be organised - either the researcher or a trained research assistant will be able to support you.

Project Procedures

- Participants will be asked to complete a patient survey about their mealtime experiences.
- Some personal information will be obtained from a questionnaire, the use of patient notes and the meal ordering system.
- The survey and questionnaire will take about 10-15 minutes of your time to complete, with an extra 10 minutes given to read the information sheet and sign the consent form.

Patient Code: _____

Data Management
The researchers will use the information from this study only for the purpose for which it has been collected. Results of this project may be published or presented at conferences. No individual will be able to be identified. At the end of this study the list of participants and their unique study code will be disposed of. Any raw data on which the results of the project depend will be retained in secure storage for 5 years, after which it will be disposed. The supervisors, Rozanne Kruger and Deirdre Johnston will be responsible for the final disposal of the data.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular question as completion and return of the questionnaire implies consent;
- Withdraw from the study immediately;
- Ask any questions about the study at any time during participation;
- Be given access to a summary of the project findings when it is concluded.

The researcher has no conflicts of interest to report.

Project Contacts

Olivia Stone (Researcher)
[redacted]

Rozanne Kruger (Massey University Supervisor)
Ph: 09 414 0800 ext 43661
Email: R.Kruger@massey.ac.nz

Laura Mash (Foodservice Supervisor)
[redacted]

Deirdre Johnston (Massey University Supervisor)
Ph: 09 414 0800 ext 43026
Email: D.M.Johnston1@massey.ac.nz

Charlotte Moor (Foodservice Supervisor)
[redacted]

You are welcome to contact any of the above researchers/supervisors should you have any questions or concerns.

If you require Māori cultural support, talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 16/66. If you have any concerns about the conduct of this research, please contact Mr Jeremy Hubbard, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63487, email humanethicsoutha@massey.ac.nz.

C.2 Participant Information Sheet: Feasibility Study

Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

COMPASS
GROUP

School of Food and Nutrition I Massey University I Private Bag 102 904 I Auckland 0745 I New Zealand

What stops you from eating your meals while in hospital?

INFORMATION SHEET
(PART 2)

My study
There are a lot of reasons why you may not eat your meals while in hospital. I am doing a study to find out what these reasons are. The study is taking place on surgical wards at North Shore Hospital. I am currently studying to become a Dietitian; this research project is part of what I need to do in order to become a Dietitian. The study is being done alongside the foodservice provider for the hospital, Medirest- Compass Group.

My study aims to highlight specific barriers that stop you from eating your hospital meals. Other ways to explain barriers are hurdles, obstructions or stumbling blocks. What I find will help the foodservice meet the needs of patients. There are two parts to my study and I am asking you to be involved in the second part

The second part is to find out what barriers have the biggest impact on the amount of food you eat.
We would like to ask you to participate in our study, please read the information below to learn more about the study.

Who are we looking for?
Patients on the surgical wards at North Shore Hospital, Waitemata District Health Board (WDHB), will be invited to be part of the study.

Anyone can participate if they:
- Have been in hospital care for at least 48 hours.
- Have an anticipated length of stay for at least the next 24 hours.
- Can speak English well.
- Are aged 16 years or older.
- Will be consuming one hospital meal during the next 24 hours.

Unfortunately, you cannot take part if:
- Are under the age of 16 years.

We aim to include 60 people in the second part of the study.
Being part of this study will not cause any discomforts or have any added risks and will only utilise a small amount of your time to complete the questionnaire.

If you require help to complete this questionnaire, this can be organised - either the researcher or a trained research assistant will be able to support you.

Project Procedures
- Participants will be asked to complete a patient survey about their mealtime experiences.
- Some personal information will be obtained from a questionnaire, the use of patient notes and the meal ordering system.
- A photograph assessment of plate waste will occur to observe the amount of food consumed.
- The survey and questionnaire will take about 10-15 minutes of your time complete, with an extra 10 minutes given to read the information sheet and sign the consent form.

Patient Code: _____

Data Management
The researchers will use the information from this study only for the purpose for which it has been collected. Results of this project may be published or presented at conferences. No individual will be able to be identified. At the end of this study the list of participants and their unique study code will be disposed of. Any raw data on which the results of the project depend will be retained in secure storage for 5 years, after which it will be disposed. The supervisors, Rozanne Kruger and Deirdre Johnston will be responsible for the final disposal of the data.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular question as completion and return of the questionnaire implies consent;
- Withdraw from the study immediately;
- Ask any questions about the study at any time during participation;
- Be given access to a summary of the project findings when it is concluded.

The researcher has no conflicts of interest to report.

Project Contacts

Olivia Stone (Researcher)
[redacted]

Rozanne Kruger (Massey University Supervisor)
Ph: 09 414 0800 ext 43661
Email: R.Kruger@massey.ac.nz

Laura Mash (Foodservice Supervisor)
[redacted]

Deirdre Johnston (Massey University Supervisor)
Ph: 09 414 0800 ext 43026
Email: D.M.Johnston1@massey.ac.nz

Charlotte Moor (Foodservice Supervisor)
[redacted]

You are welcome to contact any of the above researchers/supervisors should you have any questions or concerns.

If you require Māori cultural support, talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 16/66. If you have any concerns about the conduct of this research, please contact Mr Jeremy Hubbard, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63487, email humanethicsoutha@massey.ac.nz.

C.3 Participant Consent Form: Pilot Study

Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

COMPASS
GROUP

School of Food and Nutrition I Massey University I Private Bag 102 904 I Auckland 0745 I New Zealand

What stops you from eating your meals while in hospital?

PARTICIPANT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

- I agree to participate in this study under the conditions set out in the Information Sheet.
- I agree to allow access to the information provided in my patient notes and in the meal ordering system.

If you require Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

Signature:		**Date:**	
Full Name - printed			

If you would like to receive a summary of the project findings after the conclusion of the research, please leave either your email address or postal address below.

Email address	
OR	
Postal address	

C.4 Participant Consent Form: Feasibility Study

Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

COMPASS
GROUP

School of Food and Nutrition I Massey University I Private Bag 102 904 I Auckland 0745 I New Zealand

What stops you from eating your meals while in hospital?

PARTICIPANT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

- I agree to participate in this study under the conditions set out in the Information Sheet.
- I agree to allow access to the information provided in my patient notes and in the meal ordering system.
- I agree to allow photographs of my meal to be taken as an assessment of plate waste.

If you require Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

Full Name (printed):		**Date:**	

Signature:	

If you would like to receive a summary of the project findings after the conclusion of the research, please leave either your email address or postal address below.

Email address	

OR

Postal address	

C.5 Participant Background Information Sheet: Pilot Study

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Patient Code: _____

Background Information Sheet
[Completed by the participant]

1. **Gender:**

	Male		Female

2. **Date of Birth:** _____/_____/_____ (DD/MM/YYYY)

3. **Which ethnicity do you most identify with? (tick only one box)**

	New Zealand European		Pacific
	Māori		Asian
	Other (please specify):		

4. **Do you identify with any other ethnicities? (you may tick more than one box)**

	New Zealand European		Pacific
	Māori		Asian
	Other (please specify):		

FOR OFFICE USE ONLY
[Completed by the researcher/ trained research assistant]

Current diet code (select as many as required):

	Standard		Clear Oral Fluids
	High Energy High Protein		Free Oral Fluids
	Vegetarian		Soft Mechanical
	Vegan		Soft Dysphagic
	ERAS		Minced and Moist
	Halal		Smooth Puree 1
	Restricted Fibre		Smooth Puree 3
	Nil By Mouth (NBM)		
	Other (please specify):		

Patient Code: _____

Date of admission: _____/_____/_____ (DD/MM/YYYY)

Current date: _____/_____/_____ (DD/MM/YYYY)

Type of surgery: _____

Ward:

	Ward 4
	Ward 7

	Ward 8
	Ward 9

C.6 Participant Background Information Sheet: Feasibility Study

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Patient Code: _____

Background Information Sheet
[Completed by the participant]

1. **Gender:**

	Male		Female

2. **Date of Birth:** _____/_____/_____ (DD/MM/YYYY)

3. **Which ethnicity do you most identify with? (tick only one box)**

	New Zealand European		Pacific
	Māori		Asian
	Other (please specify):		

4. **Do you identify with any other ethnicities? (you may tick more than one box)**

	New Zealand European		Pacific
	Māori		Asian
	Other (please specify):		

Patient Code: _____

[Completed by the researcher/ trained research assistant]

Date of admission: _____/_____/_____ (DD/MM/YYYY)

Current date: _____/_____/_____ (DD/MM/YYYY)

Length of stay: _____

Type of surgery: _____

Surgery category:

	Orthopedic surgery		Upper GI surgery
	Neurosurgery		Lower GI surgery
	Other		

Ward:

	Ward 4		Ward 8
	Ward 7		Ward 9

Stage of admission:

	Pre-operation		Post-operation
			_____days post-operation

Diet codes (previous 7 days of patients admission):

Meal code	**Day ____**	**Day ____**	**Day ____**	**Day ____**	**Day ____**	**Day ____**	**Day ____**
Standard							
High Energy High Protein							
Vegetarian							
Vegan							
ERAS							
Halal							
Restricted Fibre							
Low Sodium							
Nil By Mouth (NBM)							
Clear Oral Fluids							
Free Oral Fluids							
Mildly Thick Fluids							
Soft Mechanical							
Soft Dysphagic							
Minced and Moist							
Smooth Puree 1							
Smooth Puree 3							
Other (please specify):							

Patient Code: _____

Size of meal:

	Small		Medium		Large

MST score:

	0		1		2+		Not completed

Had a dietitian visit during admission?

	Yes		No

Protected meal time on ward?

	Yes		No

Red tray?

	Yes		No

<u>Meal Observation</u>
If on a red tray, did they receive assistance?

	Yes		No		Not observed

Comments:

If on a ward with a protected meal time, was their meal interrupted?

	Yes		No		Not observed

Comments:

Did they eat food 'other non-hospital' food instead of their hospital meal?

	Yes		No		Not observed

Comments:

C.7 Patient Mealtime and Nutrition Care Survey (PMNCS)

Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

COMPASS GROUP

Patient Mealtime and Nutrition Care Survey

We want to find out your perspective on the nutrition care and the food you received while in hospital. Please tick the answer that applies to you. Please tick only ONE ANSWER per statement.

How much do you agree or disagree with the following statements:	Agree strongly	Agree	Disagree	Disagree strongly
I understand how to complete the menu selections.				
I have been able to choose foods that I like or prefer.				
Choosing the right food is difficult because there isn't enough information provided.				
Meals are served at times that suit me.				

Since you came into hospital, how often did these experiences apply to you?	Every meal	Some meals, not every meal	A few meals	Never happened
When the food arrives, I always want what I've ordered.				
I did not receive the food that I ordered.				
When I was eating I was disturbed. For example, by activities, noises or unpleasant smells.				
My mealtimes were interrupted by the hospital staff wanting to speak to me or give me treatment.				

The Canadian Malnutrition Task Force adapted this questionnaire, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

Patient Code: _____

Since you came into hospital, how often did these experiences apply to you?	Every meal	Some meals, not every meal	A few meals	Never happened	
I missed my meals because I was not available when they were served.					
I missed meals because I had to avoid food for tests.					
When I missed my meals, I was given hospital food by staff.					Didn't miss a meal ☐
When I needed help, I got the help I needed to eat my meals.					I didn't need any help ☐

Since you came into hospital, how often did these experiences apply to you?	Every day	Some days, not every day	A few days	Never happened
My visitors bring in food for me because I am hungry.				
I get hungry because the time between meals is too long.				
I felt hungry but I could not ask staff for food.				
I felt hungry and wanted something to eat but no food was available from the hospital.				

The Canadian Malnutrition Task Force adapted this questionnaire, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

Patient Code: _____

Have any of the following made it difficult to eat your meals?	Every meal	Some meals	A few meals	Never happened
Being in an uncomfortable position to eat				
Difficulty reaching my food				
Difficulty cutting up my food				
Difficultly opening packets / unwrapping food				
Difficulty feeding myself				
Not enough time to eat all the food that I wanted to eat				
I need help to eat my meals				

In general how satisfied are you with the quality of hospital food?	Extremely satisfied	Satisfied	Dissatisfied	Extremely dissatisfied
Taste				
Appearance				
Smell				
Portion size				
Temperature of food				
Rate portion size	Too small ☐	Alright ☐	Too big ☐	
Rate temperature of food	Too cold ☐	Alright ☐	Too hot ☐	

Effects of illness and treatment

How often have any of the following affected the amount of food you've eaten during mealtimes?	Every meal	Some meals, not every meal	A few meals	Never happened
Loss of appetite / didn't feel like eating				
Sickness				
Pain				
Tired				
Worry				
Depressed				
Breathing difficulties				
Chewing or swallowing difficulties				

The Canadian Malnutrition Task Force adapted this questionnaire, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

C.8 New Zealand Patient Mealtime and Nutrition Care Survey (NZ-PMNCS)

1 Patient Code: _____

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

COMPASS GROUP

Patient Mealtime and Nutrition Care Survey

We want to find out your perspective on the nutrition care and the food you received while in hospital. Please tick the answer that applies to you. Please tick only ONE ANSWER per statement.

How much do you agree or disagree with the following statements:	Agree strongly	Agree	Disagree	Disagree strongly
I understand how to complete the menu selections.				
I have been able to choose foods that I like or prefer.				
Choosing the right food is difficult because there isn't enough information provided.				
Please explain or tell me more about why it was difficult:				
Meals are served at times that suit me.				

Since you came into hospital, how often did these experiences apply to you?	Every meal	Some meals, not every meal (more often than not)	A few meals (hardly ever)	Never happened
When the food arrives, I always want what I've ordered.				
I did not receive the food that I ordered.				
When I was eating I was disturbed. For example, by activities, noises or unpleasant smells.				
My mealtimes were interrupted by the hospital staff wanting to speak to me or give me treatment.				
Comments:				

This has been modified from the Canadian Malnutrition Task Force questionnaire which was adapted, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

Patient Code: _____

Since you came into hospital, how often did these experiences apply to you?	Every meal	Some meals, not every meal (more often than not)	A few meals (hardly ever)	Never happened	
I missed my meals because I was not available when they were served.					
I missed meals because I had to avoid food for tests.					
When I missed my meals, I was given hospital food by staff.					Didn't miss a meal ☐
If you weren't provided with food, what did you do?	I had nothing to eat ☐	I had to buy food ☐	A visitor bought me food ☐	I didn't want any food ☐	Didn't miss a meal ☐
When I needed help, I got the help I needed to eat my meals.					I didn't need any help ☐

Since you came into hospital, how often did these experiences apply to you?	Every day	Some days, not every day (more often than not)	A few days (hardly ever)	Never happened
My visitors bring in food for me.				
Why do your visitors bring in food?				
I get hungry because the time between meals is too long.				
I felt hungry but I could not ask staff for food.				
I felt hungry and wanted something to eat but no food was available from the hospital.				

This has been modified from the Canadian Malnutrition Task Force questionnaire which was adapted, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

Patient Code: _____

Have any of the following made it difficult to eat your meals?	Every meal	Some meals (more often than not)	A few meals (hardly ever)	Never happened
Being in an uncomfortable position to eat				
Difficulty reaching my food				
Difficulty cutting up my food				
Difficultly opening packets / unwrapping food				
Difficulty feeding myself				
Not enough time to eat all the food that I wanted to eat				
I need help to eat my meals				
Comments:				

In general how satisfied are you with the quality of hospital food?	Extremely satisfied	Satisfied	Dissatisfied	Extremely dissatisfied
Taste				
Appearance				
Smell				
Portion size				
Temperature of food				
Rate portion size	Too small ☐	Alright ☐	Too big ☐	
Rate temperature of the hot food	Too cold ☐	Alright ☐	Too hot ☐	
Rate temperature of the cold food	Too hot ☐	Alright ☐	Too cold ☐	
How could these problems be overcome for you?				

This has been modified from the Canadian Malnutrition Task Force questionnaire which was adapted, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.

Patient Code: _____

Effects of illness and treatment

How often have any of the following affected the amount of food you've eaten during mealtimes?	Every meal	Some meals, not every meal (more often than not)	A few meals (hardly ever)	Never happened
Loss of appetite / didn't feel like eating				
Sickness				
Nausea				
Vomiting				
Pain				
Tired				
Worry				
Depressed				
Breathing difficulties				
Chewing or swallowing difficulties				
Medication				
Prescribed nutritional supplements e.g. Fortisip, Ensure, Calogen, Beneprotein, Polycal, Duocal or Diasip.				
My bowel motions have affected my appetite				
Since I came into hospital, my bowel motions have been mostly:	Diarrhoea ☐	Normal ☐	Constipated ☐	

Rate your current intake of the food on your hospital tray:	None ☐	¼ ☐	½ ☐	¾ ☐	All ☐

This has been modified from the Canadian Malnutrition Task Force questionnaire which was adapted, with permission, from the original by Naithani et al, Clinical Nutrition 2009;28:625-630.