Dining Environments in Long Term Care: Prevalence of Features and Construct Validity of Two Measures

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Background: Previous research suggests that the physical and psychosocial environments can improve outcomes for residents living in long term care (LTC). However, research has inconsistently implemented interventions that target these environments resulting in the inability to compare results across studies. These inconsistencies are due to a lack of standardized measures that quantify these environments reliably and validly. Thus, instruments that address this gap would result in dependable claims of mealtime experience summarizations and consistent evaluations. Additionally, prior to this study, there has not been an examination of the differences in prevalence of physical and psychosocial dining environments across Canada. At this point it is unclear whether consistency exists nationally with regard to environmental characteristics and delivery of care and it is unknown what areas require further improvements to meet industry standards.

Purposes: 1) Assess the construct validity of the dining environment audit protocol (DEAP), **2)** assess the construct validity of the Mealtime Scan (MTS), **3)** examine the construct validity of the mealtime relational care checklist (M-RCC) and **4)** demonstrate the prevalence of key features of these instruments and differences where they exist, among provinces included in this data set.

Methods and Findings: This thesis is a secondary data analysis of the Making Most of Mealtimes (M3) study, which is a cross sectional Canadian study conducted in Alberta, Manitoba, New Brunswick and Ontario. This study collected data on the multilevel determinants of food intake in 32 LTC homes, which included 639 residents and 82 dining rooms. Resident energy and protein intake estimated from three weighed and estimated food intake records were proxies for intake. Energy intake per kilogram body weight and protein intake per kilogram body weight variables were created as outcomes for these analyses, and gender, age and cognitive performance score (CPS) were used as covariates in cluster regression stratified by dementia care and general care units. Other constructs compared to measures included: nutritional status, CPS, and dining room level constructs and staff perceptions of person centered care. Features and characteristics of instruments are described and analyzed to determine their association with key summary scales of instruments. Finally,

comparisons across provinces were made to determine differences in prevalence of instrument variables. The key methods and findings for analysis of each measure will be discussed.

1) Cluster regression analysis determined that the needs of residents in dementia care and general care units differed. Further, energy and protein intake was minimally influenced by the physical characteristics of the dining room as assessed by the DEAP. Through regression analysis ($p<0.05$) it was found that the DEAP homelikeness summary scale was positively associated with a view of the garden, clock and posted menu. Functionality summary scale was positively associated with number of chairs and lighting, while negatively associated with furniture with rounded edges and clutter. The construct validity of the homelikeness and functionality scales of the DEAP was determined through correlations ($p<0.05$). The functionality scale was positively associated ($p<0.05$) with the MTS physical scale, the dining room M-RCC, the resident M-RCC and the Mini Nutritional Assessment- Short Form (MNA-SF). Homelikeness was positively associated ($p<0.05$) with the staff person directed care (PDC) score and the Cognitive Performance Scale (CPS), while negatively associated with energy and protein intake. Further, the homelikeness and functionality scales were associated with one another. These associations determined that the DEAP summary scales are construct valid. Few physical characteristics of the dining room as assessed by the DEAP differed ($p<0.01$) across Alberta, Manitoba. New Brunswick and Ontario.

2) Energy and protein intake was minimally influenced by the physical and psychosocial characteristics of the dining room as assessed by the MTS. Regression analysis revealed that the MTS physical summary scale was positively associated with music availability and the dining room M-RCC ratio, while negatively associated with number of staff passing food and number of residents. The social environment scale was positively associated with social noise, number of residents requiring assistance and the M-RCC ratio. The person centered care (PCC) summary scale was positively associated with adequate lighting, excess noise and the dining room M-RCC ratio. Construct validity of the scales was examined using correlations ($p<0.05$). The three MTS summary scales were positively associated. The physical scale was also positively associated ($p<0.05$) with the DEAP functionality scale, the

resident and dining room M-RCC and the MNA-SF. The social scale was positively associated ($p<0.05$) with the dining room M-RCC, the MNA-SF and CPS score. The PCC scale was positively associated ($p<0.05$) with the dining room and resident M-RCC, the MNA-SF and CPS score. These associations determined that the MTS summary scales are construct valid. Physical and psychosocial environments as assessed by the MTS minimally differed ($p<0.01$) across Alberta, Manitoba, New Brunswick and Ontario.

3) Correlations were computed to determine the construct validity of the resident level M-RCC ratio. The resident M-RCC was positively associated ($p<0.05$) with the DEAP functionality scale, the dining room M-RCC, the MTS PCC summary scale, and the MNA-SF score and negatively associated ($p<0.05$) with protein intake and CPS score. These associations determined that the resident M-RCC is construct valid. RCC and PCC practices as assessed by the resident M-RCC differed ($p<0.01$) across the provinces of Alberta, Manitoba, New Brunswick and Ontario.

Conclusion: In conclusion, the physical and psychosocial environments as assessed by the MTS and DEAP minimally explained the variance of energy and protein intake in both dementia care and general care units, but summary scales were associated with nutritional status. The DEAP, MTS and M-RCC exhibit validity through the significant associations between the summary scales and the individual variables of each instrument. Additionally, the construct validity of these instruments was supported through the significant correlations with other instruments collected in M3. The physical and psychosocial components of the dining environment can be improved in Alberta, Manitoba, New Brunswick and Ontario to promote consistency on a national level. This secondary analysis of the M3 dataset suggests that the DEAP, MTS and M-RCC are construct valid standardized instruments that may be used to quantify the physical and psychosocial environments. Prior to this study, construct valid instruments did not exist, thus this analysis offers a basis for future research. Prevalence estimates identify areas where practices can be improved further to promote the physical and psychosocial environments.

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List of Abbreviations

AB: Alberta

CPS: Cognitive Performance Scale

DEAP: Dining Environment Audit Protocol

DRS: Depression Rating Scale

ICC: Intraclass Correlation

LTC: Long Term Care

M3: Making the Most of Mealtimes

MB: Manitoba

MNA-SF: Mini Nutritional Assessment- Short Form

MTS: Mealtime Scan

M-RCC: Mealtime-Relational Care Checklist

NB: New Brunswick

ON: Ontario

PCC: Person Centered Care

PDC: Person Directed Care

RCC: Relational Centered Care

Chapter 1
Introduction

Poor food intake in long-term care (LTC) facilities is a well-known problem in Canada and elsewhere (1–5). Poor food, and energy and protein intake specifically, has multiple consequences, therefore this problem needs not only to be addressed, but also prevented to enhance the health and quality of life of Canadian LTC residents (2,6–17). It is hypothesized that the mealtime environment, both physical and psychosocial, can influence food intake, yet our understanding of this association is poor (15,18). In providing the opportunity to bring forth evidence that outlines components of the dining room that influences energy and protein intake, policies can be implemented across LTC residences in Canada, allowing for current and future LTC residents to thrive in their environment. This thesis identified the specific dining room level physical and psychosocial characteristics that potentially have the capability to enhance or hinder energy and protein intake in LTC.

In addition, many components of the mealtime environment have been studied in the LTC setting; however, research has failed to observe and analyze multiple components simultaneously as they co-exist in the dining room. Our understanding of the prevalence of various components believed to be supportive or negative towards functionality and homelikeness of dining spaces is unknown, or how this may vary by regions with different policies for design. A second purpose of this thesis was to characterize dining rooms across four different regions of Canada.

Numerous studies have been conducted assessing the physical environment of LTC dining (19–38); however, these studies utilize immensely different instruments or indicators to describe the mealtime environment. Standardized instruments to assess physical and psychosocial characteristics are needed so that there is consistency among research studies that evaluate the mealtime environments, allowing for efficient comparisons and evaluations. Using a standardized instrument will result in further growth in knowledge surrounding environmental determinants of food intake, malnutrition, and quality of life, allowing researchers and policy makers to promote the strongest influencers into dining rooms. To further work on standardized instruments, this analysis examined the construct validity of the

Mealtime Scan (MTS), the Dining Environment Audit Protocol (DEAP) and the Mealtime Relational Care Checklist (M-RCC). The DEAP and MTS have been deemed as reliable tools (39,40) and have been created to assess multiple components of the physical and psychosocial mealtime environments. The ultimate goal of this thesis is to demonstrate the construct validity of these tools, thus filling this current knowledge gap.

All objectives were examined as a secondary data analysis of the Making Most of Mealtimes (M3) dataset. This dataset is the first study that attempts to measure multilevel determinants that influence resident food intake in LTC homes, including the physical and psychosocial environments. Due to the high quality of this dataset that resulted from assessing a vast amount of variables that exist at each of the government, home, staff and resident levels, this dataset allowed for these analyses to be performed in a rigorous manner.

Chapter 2
Background

2.1 Overview: Older Adults and Malnutrition in Long Term Care

In Canada, the proportion of older adults in the overall population has continued to expand dramatically (41) and the Canadian senior population will continue to expand until the year 2036, when all baby boomers (those born between the years of 1946 to 1965) reach the age of 65, making up approximately 25% of the total Canadian population (41–44). Currently there are 352,205 seniors over the age of 65 living in special care facilities, including nursing homes, chronic care hospitals and long term care (LTC) homes; this is 7.1% of the senior population (45). It has been estimated that by the year 2047, 637,721 beds will be needed in LTC facilities, with an estimated 10,535 bed increase per year (46). As the senior population grows resulting in an increasing demand on LTC facilities, this will result in economic burden which includes heightened health care costs due to aging, estimated to increase 20% between the years 2000 and 2030 (44,47). For example, in Canada, 24.5% of LTC residents are currently taken to an emergency department annually (48). As the baby boomers get older, LTC facilities will become residences for an increasing number of older adults requiring diverse care needs (49). Part of these health care needs and additional costs could be due to malnutrition. Although no estimates exist for Canada, the cost of malnutrition in the UK is estimated to be responsible for approximately eleven billion dollars (7 British pounds) due to medical complications (50), with half of this cost attributed to hospital care and half to community care, including LTC (51). Effective and efficient ways to treat and prevent malnutrition are necessary to enhance the quality of life of LTC residents as additional seniors join this segment of the population.

Malnutrition is defined as consuming inadequate energy and/or micro and/or macronutrients in order to meet the body's needs, with this eventually leading to a functional deficit such as impaired wound healing (52). In Canada and other developed countries, malnutrition is a condition that is common among the older adults residing in LTC facilities (11,53). Currently in Canada it is estimated that between 47-62% of LTC residents are at risk

for malnutrition, with more than half of all residents having experienced malnutrition while in LTC (9). Evidence has shown that malnutrition leads to an increased risk of falls, medical complications and death (54,55), however malnutrition is often not recognized by staff working in LTC facilities, and as a result is often left untreated (16,56–59). A lack of a reliable measures to evaluate nutritional status in older adults also impacts the ability to readily diagnosis malnutrition in LTC (7,13,56,59), resulting in an immense gap in knowledge.

As individuals age, body composition changes reducing total body protein and increasing risk of malnutrition (60,61). Seniors have a reduced energy requirement which makes it increasingly difficult to consume adequate macro/micronutrients while maintaining body weight; the current protein intake requirements is set at a low 0.8 grams/kilogram of body weight (60,62,63). Physiologic changes make it increasingly difficult for the body to efficiently absorb nutrients increasing malnutrition risk, for example protein turnover is reduced by 20% by age 70, and hormonal changes, such as a reduction in ghrelin secretion, create challenges to promote appetite stimulation (60,64). Declines in food intake are common and may result in inadequate energy and protein consumption creating a reduction of total body fat and muscle mass which results in malnutrition (62). Additionally, cognitive decline increases risk for malnutrition as individuals are more prone to have eating challenges (62), reducing overall food intake. Age-related changes, such as a decline in senses such as taste and smell and reduced physical activity levels, further potentiate the problem (61,65). When elderly individuals lose weight it is difficult for them to re-gain weight (61), therefore it is important that seniors consume adequate energy and protein to reduce this risk of malnutrition.

Malnutrition, especially in LTC, is primarily a result of low food intake rather than excess metabolic need (10,12,66,67); thus, it is necessary to explore the factors that are associated with an increase in food consumption so that malnutrition can be prevented and treated (6). Keller demonstrated that behavioural, environmental and disease-related factors all influence undernutrition of older adults living in LTC (14). Furthermore, the Making Most of Mealtime (M3) conceptual model contends that three domains influence overall food

intake in LTC residents; meal quality, meal access and mealtime experience. Each of these domains is influenced by multilevel determinants including the resident, home, staff and system levels (15). It is therefore important that interventions with the goal of improving food intake in LTC facilities target more than one of these domains, and potentially at multiple levels.

2.2 Theoretical Basis: What is the Mealtime Environment in LTC?

Mealtimes are complex systems and there are multiple components that contribute to the overall mealtime environment (68). The Five Aspects of Meal model was created to allow for the categorization of the numerous factors that contribute to eating, including the room itself, social interactions, food products, management control system and overall dining atmosphere (made up by the first four aspects) (68). It is thereby possible that modifying the overall dining atmosphere can improve food intake, resulting in the prevention of malnutrition. Gustafsson et al. (2006) adopted this model in the restaurant setting and concluded that a positive dining atmosphere is associated with the Five Aspects of Meal model components and is a valuable tool in aiding the creation of the overall dining experience (69).

To understand how these five aspects relate to the LTC mealtime environment, one study conducted interviews with residents to understand the main issues that were important to them (70). All of the aspects of the Five Aspects of Meal model were identified and outlined by the residents as core components of a quality mealtime experience, supporting the use of this model to understand the dining environment in the LTC setting (70). For example, the residents expressed that the meal itself was important to the mealtime experience, identifying food presentation, portion size, food choice and décor as important factors. Further, the residents emphasized the necessity of being in an atmosphere that promotes social interactions and comfort, as the social aspect of the dining environment contributes to the residents' overall well-being. While the senior population is diverse, there are common themes that residents identified as important factors that contribute to an overall positive dining environment (70). It is important to understand, and accommodate to, the

residents' perceptions of the mealtime experience as it has the potential to promote energy intake in LTC and reduce the proportion of residents at risk, or suffering from, malnutrition.

The Mealtimes as Active Processes in LTC is a substantive theory that identifies mealtimes in this context as a process; the central component of mealtimes are the residents and the mealtime is made up of individual activities such as arriving, eating and waiting, which can contribute to resident outcomes such as food intake (71). This theory identified that there are many influences on the mealtime process, which interact at multiple levels and are impacted by both internal and external factors. The internal factors include resident attributes, while the external factors include multiple activities such as direct caregiving, administrative activities and government or policy driven activities. These internal and external factors affect the residents' activities, which impact the mealtime process influencing food intake. Food itself was explicitly excluded from this model to further delve into the process and influences on providing and eating food in LTC. As with the Five Aspects of the Meal, Mealtimes as Active Processes in LTC emphasizes that the overall mealtime experience is an important influencer of food intake; therefore, it is important to explore which specific factors of the mealtime experience, and more specifically the physical and psychosocial environment, directly and significantly influence food consumption so that both feasible and cost effective interventions can be implemented in LTC facilities.

Henkusens et al. conducted qualitative interviews and discovered that residents who recently transitioned into a LTC home found it difficult to become accustomed to mealtimes, as dining in LTC was much more structured than what was traditionally experienced at home (72). This resulted in feelings of discomfort and lack of belonging (72). The residents felt that staff members often interacted with residents impersonally, focusing only on the tasks that needed to be completed. Additionally, residents were placed at dining tables with other residents whom they had few commonalities with and those who may have had different cognitive abilities compared to themselves. Eating with strangers may result in forced and awkward conversation; however, it is important to provide residents with the chance to have meaningful interactions as resident-to-resident social interaction at mealtimes can create the opportunity for social relationships to develop, resulting in feelings of acceptance and

understanding (72). When residents interacted with one another, it was also found that they often spoke of home to help them feel connected to a place of familiarity while residing in a foreign environment. When thinking of home, residents may begin to miss the mealtime roles that they were once responsible for; allowing residents to rekindle that role in a redefined way may help with this transition. For example, having residents participate in cooking activities can allow them to maintain their past identity in a meaningful way. In fostering new relationships with staff, residents and the physical space, adjusting to the more structured mealtime routine and feeling a sense of belonging in the LTC home, residents can begin to feel that they are home and accept the LTC environment as their new home. This work further clarifies that an institutional physical environment negatively affects the mealtime experience of residents, while social and psychological connections are hoped for, but often lost opportunities with the 'systemizing' of the mealtime routine (72).

2.1.1 The Physical Mealtime Environment in LTC

The care environment, as it exists in LTC, is made up of many components including the physical environment, the psychological environment and the social environment (73). With regard to the physical environment, it is common for Canadian LTC homes to consist of a rushed dining environment, resulting in a busy and noisy atmosphere (23,73) . However, relatively little research has been conducted on the physical environment in relation to food intake. One Canadian study demonstrated that rushed dining environments resulted in resident frustration and agitation, emphasizing a demand for flexible dining environments that accommodate residents' needs. This study further suggested that flexible dining environments will promote a more positive dining experience for residents (73). Another consequence of inflexible dining areas is staff failing to provide residents with the assistance that they require during mealtimes. One study has shown that this results in a decrease in food intake as residents are not receiving adequate attention to their care needs (74). By providing residents with a flexible dining area that values and supports resident needs, dining environments can become more homelike resulting in a more enjoyable mealtime experience.

Some of the characteristics of a more homelike dining environments include: wall coverings, pictures, homelike décor, homelike furniture, open-dining (i.e., coming to the

meal on their own schedule rather than the home's), small in size and access to natural light (75). Research has found that a more homelike environment is an important component to reducing behavioural disturbances and improving resident quality of life (76). Additionally, homelike environments have been associated with the social environment and person centered care (PCC) practices as enhanced physical environments support meaningful interactions (77), encourage resident directed conversation (78) and promote PCC (79,80). Furthermore, homelike dining environments have been found to encourage social engagement through the promotion of developing relationships between staff and residents, which enhances familiarity (26). As well, accessible kitchens can assist in stimulating appetite through food aromas that are familiar and comforting (26,78). Supportive physical environments, including the promotion of homelikeness, enhance feelings of control and resident autonomy (26), while institutional environments promote environmental press, as they contain features that provide residents with negative stimulation (81). For example, inadequate lighting that produces glare in the dining room created spatial disorientation and reduced feelings of safety and security (78). While it is important to implement homelike environments in LTC dining rooms, it has also been noted that interventions that address culture change (e.g. person centered care philosophies) through staff training need to also be conducted to influence resident outcomes (26).

2.1.2 Person Centered Care, Social Models of Care and the Psychosocial Mealtime Environment in LTC

PCC is an important component of the psychosocial environment and has been defined as "the individuals' values and preferences are elicited and, once expressed, guide all aspects of their health care, supporting their realistic health and life goals (AGS Expert Panel on Person Centered Care, 2016, p. 16)" (82). PCC was developed by Kitwood to help care providers move away from the institutional and medical models of care and towards the concept of personhood (83) to support residents with dementia. PCC and the concept of personhood emphasizes the need for individuals to be cared for as a person, with individual preferences and perspectives, and provides a sense of place that values their social being (83). Brooker (2004) has furthered the work of Kitwood and has identified valuing the

person, individualizing treatment, empathizing and creating a positive social environment as the four elements that contribute to PCC in LTC (84). In Canadian LTC, residents are often not given the opportunity to express preferences and staff fail to empathize with resident's feelings surrounding mealtimes (85). Staff are a critical component to the mealtime experience, therefore training is needed to promote attitudes that are beneficial to LTC residents to promote PCC behaviours (85). PCC as it applies to mealtimes is made up of four components: providing choices and preferences, supporting independence, showing respect and promoting social interaction (85). Providing choices and preferences considers the individuality of residents with respect to when, where, what, and with whom one eats. Supporting independence considers the fact that most residents in LTC need some degree of assistance during mealtimes; however, assistance should be given while maintaining the resident's feelings of independence, as this is essential for preserving resident dignity. Showing respect involves empathizing with residents and observing the mealtime experience from their perspective. The Five Aspects of Meal model supports the need for PCC in LTC as social interactions and the room itself contain components that support PCC, such as noise and interactions with staff (68,85). Further, PCC supports the social and psychological dining experience, providing residents with the opportunity to develop relationships and thrive in the LTC environment (72).

A social model of care uses a holistic approach, identifying that there are more components than just the physical and health focused aspects of care, providing residents with a level of care, stimulation and interaction that goes beyond PCC (86,87). Sweden, a leader in the social care model within LTC (86), has been found to also emphasize person focused care, where each staff member is responsible for the many aspects of care and living for fewer residents (86). In contrast, Canada tends to focus on task completion in institutional dining environments, where staff members are responsible for a few aspects of care for many residents (86,87). The social model of care is supported by assigning fewer residents per staff member, which has been shown to be tied to higher levels of respect and individualized care from staff members (86).

Adopting a social model of care includes relational dining, family style dining, and promoting the engagement of the residents at mealtimes by staff (87). Relational dining is a term which refers to a pleasurable and sociable dining that results from caring for residents, staff and informal care partners as 'family' (87). Relational dining is the ultimate goal of a proactive physical and psychosocial environment that promotes relationship building and builds on the foundation of PCC (87). The transformation towards relational dining consists of staff encouraging residents to eat through the initiation of friendly conversation, adopting an open-dining philosophy, creating a friendly atmosphere that is welcoming for family members and maintaining social connections between staff and residents (87). Ducak et al. identified key physical and organizational supports to relational dining: 1) physical renovations to allow for sufficient space, but more intimate dining areas, 2) creating a flexible dining area with food available 24 hours, 3) implementing décor and homelike materials similar to those in household kitchens, and 4) providing a fully equipped kitchen (fridge, stove, dishwasher) for family members and residents to use anytime of the day. By increasing the flexibility of mealtimes, resident autonomy and the mealtime experience was enhanced (87). While LTC homes should strive to adopt PCC practices, these practices are not always enough for LTC residents, especially those experiencing dementia. Relational dining which is consistent with a social model of care suggests providing residents with the opportunity to engage psychologically and socially, which cannot be achieved using PCC practices alone.

Although PCC is an important component to integrate into mealtimes, it does not focus on the multidirectional relationships that can result into relational centered care (RCC) as promoted in relational dining (87,88). Implementing PCC is necessary as it provides LTC homes with the first step to move away from the traditional, medical model of care and allows stakeholders and staff to envision resident centered care; however, PCC must then evolve into RCC to provide residents with psychological and social engagement, specifically meaningful engagement that is possible (87,88). It is crucial that LTC homes implement the RCC practices as there are limitations to implementing PCC practices. For example, organizational structures create difficulties in implementing PCC practices as PCC requires

collaborative efforts between all staff members, rather than the traditional hierarchy (88). Additionally, the current LTC system focuses on the completion of tasks and quantifiable outcomes rather than resident well-being that results, and the health care system places constraints on funding and regulations (88). RCC recognizes these limitations and places emphasis on the residents and utilizing their skills and abilities to mitigate the shift from PCC to RCC and observes LTC homes as a component of the wider community that has valuable resources, including family, that support residents and encourage meaningful relationships (88).

An example of relational dining would be considering tablemate placement. Promoting social interactions in LTC means promoting tablemate selection as an opportunity to develop relationships (89). Resident seating arrangements should be thought through carefully to promote resident-to-resident interactions (85). Additionally, flexible dining rooms in LTC can create supportive environments for social interactions of residents thus providing an opportunity for the autonomy of the residents to be enhanced. Flexible spaces have been shown to improve the overall mealtime experience (26,87). The concepts of PCC, RCC and relational dining are consistent with the Five Aspects of the Meal and Mealtimes as Active Processes in LTC, as an improved overall mealtime experience has the potential to influence food intake through the physical and psychosocial environment (68,71). Relational dining identifies adjustments that need to be made regarding multiple aspects of the physical and psychosocial environments which exist at multiple levels to create supportive environments for LTC residents. For example, relational dining identifies changes at the dining, staff, unit and home levels which is similar to those outlined by the Fives Aspects of Meal and Mealtimes as Active Processes in LTC models.

2.1.3 Special Considerations in the Mealtime Environment for Persons with Dementia

Cognitively impaired residents have unique needs due to the distinct determinants of food intake that are apparent at the early, mid and late stages of dementia, putting these residents at a greater risk of poor food intake and malnutrition (90). For example, common deterrents to food intake at early stage dementia include picky eating, changes in taste and depression (90). These determinants extend into agitation, aggression and relocation trauma

when in mid stage dementia, and eventually into loss of communication, refusal to eat and lack of recognition of food which are common in late stage dementia (90). With 57% of seniors living in residential care facilities having some form of dementia (91), special attention is needed in the mealtime environment to minimize the 'environmental press' that commonly occurs in institutional settings (92) which can further impair food intake.

Environmental press is a term which refers to outside stimuli, such as staff attitudes, policy and procedures, and characteristics of the physical setting, which can overwhelm LTC residents; it is an unsupportive environment that fails to coincide with and does not support residents' with diminished capabilities (93,94). Evans, Crogan and Shultz (2004) adopted the environmental press theory for dining, and described that as the abilities of residents diminished, the mealtime environment must further support the residents (92). Strategies need to be developed and implemented in the mealtime setting to accommodate these influences on food intake for all dementia stages, emphasizing the importance of the psychosocial environment (90). For example, valuing resident individual preferences and facilitating resident relationships can provide persons living with dementia the resources that they need to adapt to the LTC environment (90,92). Decreasing environmental press can also be achieved through the implementation of PCC practices, resulting in an increase in support of residents living with dementia, potentially influencing malnutrition (85,90,92).

There are two additional models, specific to the physical environments that further explain the experiences of persons with dementia. The Model of Place identifies people with dementia, social context, organizational context and the physical setting as four subsystems that contribute to "therapeutic dimensions of environment as experience (Weisman, 1997, p. 326)" (95,96). These subsystems interact and the multiple factors within the social and organizational contexts influence experiences and quality of life of persons with dementia (81). The Progressively Lowered Stress Threshold model identifies the reduced stress threshold for persons with dementia, making it difficult for them to process the environment (97,98). To counteract the lowered stress threshold, negative environmental stimuli should be reduced, while positive stimulation is enhanced to provide supportive environments for persons living with dementia (81). For example, excess noise, a negative stimulus, when

minimized could increase social interactions while reducing agitation, disruptive behaviours and wandering (77,99–101). These models aid in explaining how persons with dementia interact with their physical environment and how these interactions mould their experiences during mealtimes.

The Life Nourishment Theory identifies being connected, honouring identity and adapting to an evolving life as important concepts and goals that make mealtimes meaningful for persons living with dementia (102). Being connected promotes the idea that family and residents can maintain levels of companionship and alleviate stress by eating together. It is hypothesized that this will preserve their dignity and potentially improve food intake. Specific strategies that can be adopted in the LTC setting to promote social connection include facilitating a calm environment, reducing group sizes to minimize stress levels and including the residents in mealtime tasks so that they can participate and feel connection beyond socializing (102). Including residents in mealtime tasks also allows them to feel a sense of accomplishment and maintain and develop connections with individuals whom they are performing these tasks with. Honouring identity in this theory also emphasizes the importance of choice as well as participating in mealtime roles. These physical and psychosocial environment strategies, if adopted, could allow for persons living with dementia to better cope in the LTC environment and could promote higher quality mealtime experiences.

An example of an intervention that adopted some of these physical and psychosocial strategies was the Eat Right study, which changed their menu to what the residents wanted and used select menus and buffet-style dining to ensure that residents' preferences were honoured (78). This intervention resulted in an increase in body weight, not due to an increase in food intake, rather due to residents eating more food that had greater nutritional value. This intervention showed the importance of allowing for cognitively impaired residents to participate in the decision making process to improve the quality of the mealtime experience (103). Thus, the physical and psychosocial components of the mealtime environment appear to be important to consider when implementing interventions in LTC due to their potential direct influence on resident outcomes.

2.3 What do we know about the mealtime environment and food intake in LTC?

Institutional-style dining rooms, as seen in many LTC homes in Canada, have been found to lack responsive capabilities in regard to food intake (104,105). For example, these environments are unable to be flexible with seating and tablemate choice, have large dining rooms that can be overwhelming for residents, and lack homelike ambiance within dining spaces. It is therefore critical that steps be taken to make dining rooms more homelike to optimize the mealtime experience. However, this research is limited to a small sample of homes and inadequate description or comparison of the prevalence of physical and psychosocial characteristics across homes and unit types (105). Further work defining features and those that are linked to patient outcomes, such as food intake are needed, as well as identifying the components of the dining environments that homes should improve upon.

Evidence has shown that the smaller the dining room and the fewer persons in the dining room, the less institutional the atmosphere (104). When the dining atmosphere is less institutional-like and more homelike, there are fewer incidents of expressive behaviours among residents with dementia and social interactions are more likely to occur (104). To make the dining room more homelike, one study implemented an intervention that included replacing the square dining tables with round tables, removing the television, playing relaxing music and removing medication administration during mealtime. This intervention resulted in higher calorie intake among the residents who were in the homelike versus the institutional-like dining room (27). Yet, while this study compared specific components of the physical environments between units, very few aspects were evaluated (noise and lighting) and only one home was used limiting the generalizability of these results (27). Furthermore, institutional-like dining environments are associated with a fast-paced atmosphere resulting in expressive behaviours from the residents due to stimulation overload (106). All of these areas and more (such as lighting, glare, aroma etc.) have the potential to influence intake although relatively little research has been done to associate these factors with food consumption to determine those aspects that are relevant and worthy of modification or improvement.

Reducing environmental press in LTC dining rooms and enhancing positive stimulation may reduce expressions during mealtimes, especially for residents with dementia (81). Environmental press is often associated with negative behaviours such as pacing, anxiety and agitation which impedes optimal food intake (81). As discussed, characteristics of the dining room, such as homelikeness, that improve positive stimulation may enhance resident outcomes that promote food intake (27,104,107,108) as residents are better able to process their environment, especially for those with dementia (81). The dining environment is complex with multiple components interacting with one another, as an enhanced physical environment can provide opportunities for social engagement and allow staff to care for residents in a person centered manner (26,78). For example, RCC and the social environment are closely related as the implementation of RCC requires meaningful social interactions between staff and residents (87,88) which may be hindered by task focused care (77). Additionally, promoting resident centered culture change in LTC would result in the promotion of homelikeness as these concepts emphasize addressing the needs of residents (26,78,81,87). It is hypothesized that this should encourage resident food intake as resident care, food and environmental preferences are addressed providing a place of comfort and familiarity to enhance resident satisfaction and improve the mealtime experience (15). Yet, research is lacking in this area. Familiarity has been associated with improved resident enjoyment and subsequently resulted in weight gain (26); it can be hypothesized that familiarity decreases resident anxiety and encourages positive mealtime behaviours (78). Improving resident experiences surrounding mealtimes should be a priority in LTC as this may result in increasing resident intake; however, in order to do so physical characteristics, the social experience and care practices must be examined together, something not considered in prior research. .

Studies have also examined psychosocial quality of the mealtime environment (92,103,109,110). Crogan (2009) and Evans (2003) have studied the resident experience in LTC, concluding that personal preference of the residents within the mealtime environment was not being honoured. Residents identified preference, along with courteous staff, good service, being able to choose their environment and getting enough food, as contributing to a

quality dining experience (109,110). A lack of autonomy, ensuing from ignoring resident food preferences was associated with lower prealbumin levels, a potential marker of malnutrition (109). Generally, it was found that if the mealtime environment supported food intake, overall quality of life, as measured by the Quality of Life- Alzheimer's Disease scale (111) was enhanced.

It is apparent from this limited review that many physical and psychosocial factors in the mealtime environment could influence food intake. Yet there is a lack of studies that examine characteristics of physical and psychosocial dining environments; thus we have only a limited understanding of which determinants have a strong potential for support and improvement of food intake.

2.1.4 Mealtime Environment Interventions

As seen in the scoping review conducted by Vucea et al. (2014), many interventions have altered various aspects of the mealtime environment (33). A variety of outcome variables were used when evaluating these interventions such as patient satisfaction, food intake, body weight and agitation (33). Unfortunately, many of the studies discussed in this paper failed to consider the multilevel determinants of food intake, thereby resulting in incomplete understandings of the complex mealtime experience. Complex interventions that examine multilevel determinants are valuable in LTC, resulting in strategies that can be implemented that are feasible and sustaining; an example of such an intervention is the Eden alternative. The Eden alternative is a household model that promotes homelikeness as well as a philosophy of PCC and RCC. However, such interventions with their multiple, inter-related components can be difficult to assess. Some of these interventions will be discussed in depth in this section to demonstrate the challenges in assessing the mealtime environment.

Physical features

Research suggests that allowing residents to have control over their environment benefits their overall well-being by maintaining their independence, preventing frailty and enhancing their overall quality of life (26). In conducting a critical literature review it was found that supporting functional abilities, maximizing orientation, providing a sense of safety and security, creating familiarity, providing optimal sensory stimulation and opportunities for

social interaction and supporting privacy and personal control are all important components of the physical dining environment (22). It is contended that by achieving these aspects of the physical dining environment, the mealtime experience of the residents will be improved, as a supportive and flexible dining environment helps to mediate cognitive impairments and functional disability (22). While it is important for these aspects of the physical dining environment to be present in LTC dining rooms, the intervention process in implementing a supportive dining environment is inconsistent due to a lack of high quality research that utilizes a standardized instrument to measure relevant physical features (112).

Many studies have been conducted which assess the LTC physical environment, utilizing different methods resulting in diverse outcome variables (33). This has resulted in studies that claim to have altered the physical environment, such as making it more homelike, however, the aspects of the environment that were altered are inconsistent across studies. For example, one study chose to alter the environment using the smell of baking bread (113), while others played music during mealtimes (24,25,28,29,31). Two studies changed many aspects of the physical environment by changing the tableware, implementing cloth napkins and expanding staff roles (20) and changing the décor (plants on tables, background music, tableware), adjusting meal service and between-meal periods, altering the organization of assistance and standardizing program monitoring (34). It is evident that there are divergent ways to alter the physical environment of LTC dining rooms but there currently is no reliable way to assess these features and their potential impacts on the mealtime experience.

As a result, diverse outcome variables are used to evaluate the effectiveness of these interventions and most do not consider the immediate outcome of how the features that have been changed result in a change in ambiance. For example, one study found that the physical environment is an important factor of the mealtime experience as it can increase patient satisfaction, however a standardized instrument was not used to measure the degree of homelikeness before or after the renovation (20). Similarly, creating a more homelike dining environment has been associated with improved social ambiance in the dining room, leading to an increase in the residents' body weight as mean daily energy intake increased; however, homelikeness in this study was also not evaluated making it unclear if this was truly achieved

(34). Playing music in the dining room and removing excess noise was found to reduce agitation among dementia patients, increase calorie intake and increase the amount of time that residents stayed seated at their table (24,25,28,29,31). In these studies, the only component of the dining room that was altered was music; however, the environment as a whole must be evaluated to identify potential confounders. A common method to measure noise is utilizing a decibel meter (25,27). While a decibel meter will give an accurate measurement of noise level, it fails to differentiate negative noises, such as the scraping of plates, from positive noises, such as residents interacting with one another.

Social environment

A few studies have focused on the social environment as a means of improving food intake. Specifically, the frequency of interactions between residents and care providers, altering the physical environment and atmosphere to promote social engagement (e.g. seating arrangements), and adjusting nursing staff activities (e.g. sitting with residents during the meals) are strategies that are commonly used (34–37). However, a lack of detail on the changes implemented makes it difficult to understand how these strategies improved the social environment. Perceived improvements in the social environment of the dining room was found to increase food intake (35), energy and protein intake (36,37) as well as increased body weight in the elderly population (34). Yet, two of these studies failed to evaluate the social environment itself, resulting in unclear conclusions as to why these ultimate outcomes were achieved (34,36). The other two studies used a coding system when observing resident interactions and counted the number of times that each type of interaction occurred (35,37). Unfortunately, the coding and counting failed to describe the social environment changes as a whole; a simple count on the number of interactions does not demonstrate the quality of the interaction. Furthermore, these studies were single group studies that lacked a control group, introducing bias through the act of being observed by the researchers. Thus, it is questionable as to what was actually changed in these social environments and if these changes resulted in the outcomes.

Homelike models of care

The Eden alternative has been espoused as a household model that reduces environmental press by emphasizing PCC (112). By abandoning the institutional model, the Eden alternative provides LTC residents with a high quality physical and psychosocial environment, promoting resident autonomy and well-being (112). Studies have found that the Eden alternative results in reduced infection rates (114), increased sociability (112), and reduced feelings of helplessness (115). The Eden Alternative appears to be consistent with Mealtimes as Active Processes in LTC which emphasizes residents as the central component of mealtimes; thus accommodating to their needs is paramount to improving food intake (71). Research has consistently demonstrated that a PCC approach has many beneficial outcomes for residents (28,72,85,116), thus tailoring the physical and psychosocial environments is worth striving for in Canadian LTC homes. One study implemented the Eden alternative into one household and one traditional unit, concluding that the Eden alternative is associated with the maintenance of body weight by improving and supporting energy consumption of residents in LTC (117). While this study supports the use of the Eden alternative in LTC, it did not have a control group, had a small sample size, and did not measure food intake. Further, the researchers claimed to have a household environment; however, without an assessment of the environmental characteristics, the influential aspects of that environment on food intake cannot be determined. It is important when evaluating the impact of the Eden alternative on food intake that researchers utilize a standardized instrument to fully assess the physical and psychosocial environment (112).

While each of the physical, psychosocial and person centered components of the mealtime environment are important, it is critical that all these components of the dining environment be addressed to improve outcomes (26). The physical and psychosocial components of the dining environment influence each other as alteration in one of these environments can aide in the improvement of another. For example, Campo and Chaudhury identify homelike environments and group congregations in the dining room as creating opportunities for social interactions (77). Physical characteristics of the dining room, such as the use of adjustable tables, may also improve the social environment as they permit

residents to move closer to the table allowing them to easier interact with tablemates (78). Additionally, PCC practices can be encouraged in enhanced dining environments as staff feel a greater ability to provide residents with personal preferences and encourage teamwork, thus reducing feelings of being rushed and stress (78). It is therefore critical that all of these environments be examined, emphasizing the need for instruments that allow researchers and stakeholders to evaluate these components of the dining environment to improve mealtimes for staff and residents.

2.4 How do we measure the mealtime environment?

Part of the reason for the poor understanding of the mealtime environment is the lack of instruments that accurately evaluate diverse dining features in the LTC setting. PCC, relational dining and the Eden alternative all have the potential to benefit residents in LTC; however, the lack of a standardized instrument to assess what physical and psychosocial aspects of these approaches influence resident outcomes has resulted in low quality research that fails to translate fully into practice. Further, studies that aim to evaluate specific aspects of the mealtime environment, such as implementing a homelike environment, are not able to accurately do so due to a lack of a scale that allows them to compare homelikeness levels across dining rooms. A standardized scale would allow for control and treatment groups to be reliably compared and would allow for valid comparisons across various LTC homes. Without this standardized instrument, researchers cannot fully understand the complex mealtime environment.

The Mealtime Scan (MTS) is an instrument used to quantify the overall dining atmosphere by breaking down dining room observations into the physical environment, the social environment and relational/person directed care practices. Studies have shown that all three of these dimensions are associated with improved energy intake in the mealtime environment among older adults living in LTC (9,24,25,28,29,31,34,36–38,113,118–120). The specific aspects of the physical environment include: the number of individuals in the dining area, food aroma, décor, contrast, music and excess noise. The social environment includes: social sound, resident-to-resident interactions, resident-to-staff interactions and staff-to-staff interactions and those focused on PCC (inclusion in conversation, needs being

readily met, respectfully addressing the resident, meal preferences and eating assistance behaviours) are captured on an embedded Mealtime Relational Care Checklist (M-RCC). Other relational/person directed care aspects include: assigned seating, use of restraints, and medications being provided during meal times. In using this instrument, the mealtime experience dimensions that can influence food intake can be measured in a way that makes it available for research. The inter-rater reliability of the MTS was determined revealing that the key summative scales and the M-RCC checklist had good to very good inter-rater reliability (ICC 0.65-0.85 p-value<0.001) (40).

The Dining Environment Assessment Protocol (DEAP) is used to systematically assess the physical features of the dining environment. The DEAP instrument was created on the basis that LTC residents require supportive and flexible dining environments as they allow residents to maintain levels of autonomy and functional ability. The main concepts of DEAP are: adequate space in the dining room with elderly friendly components that have been shown to support food intake, features of the dining room that support functional ability, safety and security and social interaction (e.g. table arrangement). Two summative scales on overall homelikeness and functionality are used to rate the physical space. The DEAP inter-rater reliability for these two summative scales was good (ICC 0.68- 0.7 p-value= 0.04-0.67)(39). It is anticipated that aspects of the DEAP should be correlated with MTS, thus demonstrating their construct validity. Although content validity and reliability of the MTS and DEAP have been shown, further work to determine construct validity is required.

2.5 Making the Most of Mealtimes (M3) Study

The Making Most of Mealtimes (M3) framework was created to outline the complexity of LTC mealtimes by identifying the three domains that influence food intake: meal quality, meal access and mealtime experience (15). Meal quality includes sensory appeal of the food itself, nutrient density, variety, food presentation and food safety. Meal access includes capacity to eat, chewing and swallowing capabilities, taste and smell of the food, food availability and food texture. Mealtime experience, which is the focus of this study, includes social interactions, ambiance, meal pace, appetite and desire to eat.

Additionally, these domains include factors at the levels of government (e.g. food budget allocations), home (e.g. physical dining environment) and resident (e.g. functional dependence) (15). It is important to consider these multilevel determinants when implementing interventions that address these domains, to determine those that are mores influential for food intake.

The M3 study was conducted with the purpose of determining food intake, malnutrition prevalence and to detect independent and inter-related multilevel determinants of food intake among LTC residents in Canada. This was a cross-sectional study, which began in October of 2014. It is a multi-site study as they collected data from eight homes in each of the provinces of New Brunswick, Ontario, Manitoba and Alberta. LTC homes were purposively sampled so that diversity within resident and home characteristics could be promoted (e.g. cultural emphasis); profit and non-profit homes were recruited. Within homes, eligible residents were randomly sampled. Eligible homes had to have been in operation for at least six months, had a minimum of fifty residents, and agreed to allow researchers to recruit residents and staff for data collection as well as have management complete a questionnaire on the home operations (17). Within each home up to four neighbourhoods were recruited, and if available a dementia care unit was included.

The eligibility criteria for the residents participating were that they must be at least 65 years of age, require at least 2 hours each day of nursing care, had resided in the home for at least one month at the time of recruitment, were not at the end of life or unstable (recent admission or transition from acute care), and they or a substitute decision maker, provided consent for their participation. Those who spoke English, French (for New Brunswick) and/or Cantonese (for Alberta and Ontario) were eligible. Cognitive ability was not part of the eligibility criteria, thereby individuals with dementia were also recruited. Each resident's age, gender and cognition were noted for all potentially eligible residents, to determine if those who eventually participated were representative of other residents living in the home. Eligible staff were staff from nursing, recreation or dietary that were regular part-time or full-time employees.

Data collection was performed at the provincial, home, unit, staff and resident levels. This secondary data analysis used data from the following instruments: the Dining Environment Assessment Protocol (26), the Meal Time Scan (17,40), the staff Person Directed Care questionnaire (121), the Mealtime Relational Care Checklist (M-RCC) (17), the Resident Food and Food Service Satisfaction scale (122), selected items from the InterRAI LTC (123), individual energy and protein intake and nutritional status (using MNA-SF; 122) of residents. The M3 study expands understandings surrounding resident food intake.

2.6 Summary

Malnutrition, a preventable and treatable condition, is a prevalent problem in Canadian LTC facilities threatening the quality of life of residents and heightening health care costs. The mealtime environment needs to be examined to identify factors that promote food intake, thus reducing malnutrition rates. The Five Aspects of Meal model and Mealtimes as Active Processes in LTC theory support this research by emphasizing that environmental factors do influence food intake. By creating an environment that supports the opportunity to implement a social model of care with PCC behaviours performed by staff, the overall well-being of residents can be enhanced; this is especially important for residents with dementia as they are at an increased risk of malnutrition revealing an imminent need for the development of effective strategies to prevent malnutrition in LTC. Improving food intake is an important issue in Canadian LTC homes; however to date, there have not been any studies that considered the multilevel determinants of food intake. The M3 data was explicitly collected to address these issues and was used for secondary analysis as it included instruments that empirically assess the mealtime environment by conceptualizing complex concepts such as homelikeness and PCC. These tools require further validation testing. In using the M3 dataset to examine the construct validity of these instruments, dining environments may be evaluated accurately to promote feasible interventions. In doing so, environments that support food intake in the Canadian LTC setting can be implemented, reducing malnutrition in LTC and optimizing the quality of life of our LTC residents.

Chapter 3
Research Questions

There is a mounting evidence-base that supports the view that the mealtime dining environment has an influence on food intake, nutritional health and well-being of older adults living in residences. Due to a lack of standardized instruments that assess the mealtime environment in LTC, it is increasingly difficult to consistently assess the physical and psychosocial environments. It is imperative that this thesis examine the construct validity of two recently developed measures that may fill this gap. This thesis will examine the relation of the components of these measures to food intake using energy intake as a proxy for amount of food consumed and protein as a proxy for diet quality. In identifying the features that have a significant association with resident's energy intake, LTC homes and policy makers can utilize this research as evidence to implement strategies that may improve food intake. These results can be used to plan intervention studies, which experimentally change these factors, confirming their importance for predicting food intake. Additionally, this thesis will evaluate the prevalence of physical and psychosocial characteristics for homes used in the M3 study to identify areas in which LTC homes in Canada may need to improve. Furthermore, this thesis will also determine the construct validity of the M-RCC component of the MTS, the MTS and the DEAP to give current and future researchers greater confidence in the utility of these instruments for measuring key physical and psychosocial features of the mealtime environment. In employing these tools for research purposes, it will create a consistent measure of the mealtime physical and psychosocial environments, allowing for accurate comparisons across and within studies and expanding this area of research and intervention development.

To address these gaps in knowledge, the following research questions were answered in this thesis:

1 a) What are the individual features and scales of the physical environment in LTC, as assessed by DEAP, which predict resident energy and protein intake in adjusted models?

H0: The individual features and scales of the physical environment, as assessed by the DEAP, do not predict resident energy and protein intake

Ha: The individual features and scales of the physical environment, as assessed by the DEAP, do predict energy and protein intake

b) What components of the mealtime physical space are independently associated with ratings on DEAP for homelikeness and functionality?

c) Does the DEAP summary scales of homelikeness and functionality exhibit construct validity as determined through associations with resident energy and protein intake as well as other constructs?

H0: The DEAP homelikeness and functionality scales are not significantly associated with the constructs.

Ha: The DEAP homelikeness and functionality scales are significantly associated with the constructs.

d) What is the overall prevalence and differences of DEAP variables among provinces?

2 a) What are the individual features and scales of the physical and psychosocial environments in LTC, as assessed by MTS, which predict resident energy and protein intake in adjusted models?

H0: The individual features and scales of the physical and psychosocial environments, as assessed by the MTS, do not predict resident energy and protein intake

Ha: The individual features and scales of the physical and psychosocial environments, as assessed by the MTS, do predict energy and protein intake

b) What components of the mealtime physical and psychosocial environments are independently associated with summative ratings for physical, social and PCC scales on the MTS?

c) Do these summary scales on MTS exhibit construct validity as determined through associations with resident energy and protein intake as well as other constructs?

H0: The MTS is not significantly associated with the constructs.

Ha: The MTS is significantly associated with the constructs.

d) What is the overall prevalence and differences of MTS variables among provinces?

3 a) Does the M-RCC checklist exhibit construct validity?

H0: The M-RCC is not significantly associated with the constructs.

Ha: The M-RCC is significantly associated with the constructs.

b) What is the overall prevalence and differences of M-RCC variables among provinces?

Chapter 4

Construct Validity and Prevalence of Features of the Dining Environment Audit Protocol

4.1 Introduction

Malnutrition is a prevalent problem in Canadian LTC homes that is both treatable and preventable (9,11,30,53). Research has demonstrated that the physical environment has an important impact on the dining experience of long term care (LTC) residents, allowing them to thrive in their environment by increasing social interaction (104), reducing agitation (106), increasing energy intake (19,27,34,38,105) and improving nutritional status (19). Yet our understanding is limited, as until recently, there was no face valid, reliable instrument that could be used to specifically assess the physical features of dining spaces. A recently developed tool, based on design components for dementia care (124), has been tested for inter-rater reliability (39). The main concepts that the Dining Environment Audit Protocol (DEAP) assesses are: adequate space in the dining room, with elderly friendly components that are believed to support food intake; and specific features of the dining room that are believed to support functional ability, safety and security, and social interaction (124). Two scales on DEAP summarize these aspects into functionality and homelikeness scores.

Environmental press is an important concept when considering physical spaces such as dining rooms. Lawton defines environmental press as environmental forces that conflict with the needs of individuals evoking a typically negative response (93). Individuals become more vulnerable to the effects of environmental press if their competence is reduced. Competence, in this context, refers to cognitive capacity and physiological changes that are a result of aging; for example, increased sensitivity to noise and light (81). Institutional LTC environments increase environmental press due to the presence of characteristics such as large dining rooms, increased group sizes and excess noise that stress the individual (81). On the other hand, promoting small scale, familiar and functional dining environments can provide positive stimulation (75,81,125). For persons with dementia, glare and poor lighting may result in increased difficulty to process the physical environment resulting in agitation

and a reduced sense of independence (78,81). Further, Chaudhury et al. found that homelike dining environments were more comfortable, inviting and less institutional, promoting familiarity which can result in the facilitation of positive mealtime behaviour and reduced anxiety (78). DEAP has been designed to capture features that may increase environmental press, and can act as an assessment for making modifications to dining rooms.

A key concept assessed by DEAP is homelikeness, based on features such as décor and adequate space in the dining room. Unfortunately many Canadian LTC homes retain institutional features (78) such as inaccessible kitchens and lack of access to food or beverages between meals. More homelike dining rooms are associated with a greater amount of social interactions (104), higher calorie intake (27) and fewer distressed residents living with dementia, that can result from stimulation overload (106). Adjusting the lighting of the dining room also contributes to functionality as older adults are increasingly sensitive to glare and require increased lighting to see due to changes in the eye (126). Adequate lighting is important in the dining room to accommodate these changes during mealtimes; sufficient lighting has been shown to be beneficial to nutrition outcomes (19), and quality of life (127).

Functionality is another key concept assessed by DEAP. Functionality includes safety and security, such as the dining room being an appropriate size with short pathways for food delivery that contain no clutter. Research has found that by providing a path that is safe for residents to access the kitchen, enhances their feelings of autonomy and inclusion (26). One study concluded that staff supervision in the dining area and the presence of noninstitutional features (for example removing the presence of restraints) were associated with increased energy and fluid intake (105). However, this study did not define what was observed in terms of "noninstitutional features" and a simple counting of features was used to assess the degree of institutionalization of each environment (105). Due to the lack of detail of characterizing institutional environments, which would have been aided with a standardized measurement, it would be difficult for a researcher to replicate this study. Furthermore, this study only included a crude dichotomized variable (consuming less than seventy five percent of the meal) to describe food intake, potentially resulting in imprecise and invalid conclusions (105).

The potential for social interactions is also assessed by the DEAP tool by rating the space depending on the variety of seating arrangements, such as a mix of large and small tables. Small intimate spaces are important for social interaction. One study invited six residents to eat their meals in a small dining room and found that a more intimate environment, which included homelike décor and a less institutional atmosphere, promoted social interactions, satisfaction and ultimately enhanced quality of life and food intake (30). Yet, these observations were subjectively determined and the features of the space were not objectively rated. The researcher for this study claimed to have created a homelike dining environment; however, there was no assessment on how homelike the environment was nor what a homelike environment should consist of. Providing residents with homelike dining features such as implementing an open kitchen concept, providing adequate lighting, reducing dining room clutter and decorating the dining room with homelike furniture and finishings has been found to support independence and autonomy, to create familiarity and enjoyment and to provide a place for social experience (26) and is related to higher food intake and enhanced overall quality of life (21,27,30,34). Yet, poor measurement to date of these features limits internal and external validity.

Keller et al. (2014) created the Making Most of Mealtimes (M3) conceptual model which identifies that mealtime experience, meal quality and meal access are inter-related domains that influence food intake (15). The mealtime experience includes the physical environment, consisting of aspects such as ambiance. These three domains are influenced by factors at the levels of government (e.g. food budget allocations), home (e.g. physical dining environment) and resident (e.g. functional dependence) (15). The M3 concept suggests that aspects of a physical environment measure, like the DEAP tool, should be associated with food intake and nutritional status. It is thereby critical that the mealtime experience as evaluated by DEAP including adequate space, functional ability, safety, security, social interaction and homelikeness be evaluated to determine the physical aspects that have a strong potential to influence food intake. Knowledge of the features that support food intake could lead to redesign and changes in décor to promote well-being of residents.

While the DEAP tool has not been tested for construct validity, this tool has demonstrated inter-observer reliability (39). The homelikeness and functionality summary scales received good intraclass correlation coefficient values of 0.68 and 0.70, respectively (39). The DEAP tool appears to be promising as the operationalization of the homelikeness concept specific to LTC dining rooms is heavily supported by scientific evidence (19,22,26,27,30,34,104–106,117,127). It is important that the elements of the DEAP tool and the concept of homelikeness are understood with regard to how it is related to other constructs, including other measures of the mealtime physical and psychosocial environment. High quality research is needed to support the use of the DEAP tool, as well as evaluate each component of the instrument, allowing research to move forward in a systematic way, using a strong basis to inform the decision-making process. Further, research on the mealtime experience would benefit from use of a standardized instrument to evaluate the physical dining environment empirically, accounting for all components simultaneously and individually assessing their prevalence and independent association with food intake and other meaningful constructs. The purposes of this study were to: 1) determine what individual characteristics of the physical dining environments in LTC, as assessed by DEAP, predict resident energy and protein intake in adjusted models, 2) determine those features associated with the functional and homelikeness summative scales on DEAP when adjusted for other variables included on the tool, 3) assess the construct validity of the homelikeness and functionality summary scales by determining their association with resident intake and nutritional status as well as other constructs, and 4) demonstrate the overall prevalence and differences in prevalence of DEAP variables among provinces.

4.2 Methodology

4.2.1 Sample and Participants

This is a secondary data analysis of the M3 study, which was a multisite, cross sectional study that collected data from 32 LTC homes in four Canadian provinces: Alberta, Manitoba, New Brunswick and Ontario (17). Data collection occurred at the resident, dining room, home and government levels. However, this secondary data analysis focused primarily

on the resident and dining room levels, specifically the physical components of the LTC dining rooms and how they relate to resident energy and protein intake and nutritional status.

Eight LTC homes were purposively recruited in each of the four provinces. Homes that were considered for inclusion had: 1) been operating for at least 6 months, 2) a minimum of 50 residents that met the resident eligibility criteria, 3) agreed to participate in the data collection and provided their full cooperation for all procedures. For- profit and not-for-profit homes were recruited and homes with special characteristics were chosen to promote sample diversity (e.g. culturally based homes) (17). Within each home, data was collected on one to four randomly selected care units; 82 dining rooms were assessed during data collection.

The eligibility criteria for resident participation included: 1) residing on the units selected, 2) being over the age of 65, 3) requiring a minimum of two hours each day of nursing care, 4) residing in the home for at least one month, and 4) they, or a substitute decision maker, provided informed consent to participate. Resident exclusion criteria included: 1) residing in the home for less than one month, 2) medically unstable at the time of recruitment (e.g. recent hospital transition), 3) short term admission at the time of recruitment, 4) requiring tube feeding, 5) deemed by home staff to be at the end of life, and/or 6) having an advanced directive that excluded them from research. Eligible residents were randomly sampled from the units that were selected, with twenty residents having been recruited from each home; these residents were representative of the study units (17). A total of 640 residents were recruited for data collection; the final sample was 639 as one participant withdrew consent. Eligible staff were staff from nursing, recreation or dietary that were regular part-time or full-time employees. A minimum of 10 employees working on the chosen units were recruited for data collection at this level (17).

4.2.2 Data Collection and Measures

An assessment of the physical environment was conducted using the Dining Environment Audit Protocol (DEAP) in each dining area by a trained provincial coordinator. This assessment was performed once at the beginning of data collection for the home, when the dining room was empty. The DEAP recorded information on the unit and the dining space, specifically: unit type (dementia care unit or general care unit); number of tables;

number of chairs; number of stools or chairs for staff; number of entry ways and exits; percentage of residents with a clear view of the outside garden/green space; use of adjustable tables; contrast between floor/table/dishes; rounded edges of furniture; presence of a posted menu; detergents/non-edibles secured; stove and other dangerous items secured; presence of a television and/or clock; dining room open between meals; adjacent family kitchen with residential appliances, private family dining area; short distance from most bedrooms and visible from bedrooms; accessible washroom near dining room for residents; accessible beverage services; and accessible main kitchen/servery. Data was also collected on the functionality of the space, including lighting intensity, glare and respecting and responding to resident's opinions on the physical environment (e.g., light, noise, temperature). Each of these items are categorized as zero, one or two, where zero indicates low functional ability, and two represents high functional ability for each variable. Further safety and security information was subjectively assessed by categorizing the space on the size of the dining room, length of pathways for meal delivery, presence of obstacles/clutter, the ability of staff to view all residents and use of restraints. Ratings for size, pathway and obstacles/clutter were one, two or three and were summed to create a scale from one to nine, where a higher score indicates a more functional dining space. Social potential of the space was noted by the presence of a mixture of seating arrangements, which were categorized as zero, one or two, which signify one option, a few options and multiple options of seating arrangements. A total score for features could be tallied from all of these components (max 56). Once all of these features were recorded, the assessor rated the space overall on two separate scales, homelikeness and functionality of the environment, where the range was 1(low) to 8 (high) (see Appendix E) (26). Four provincial coordinators were trained to complete all measures, including the DEAP, during an intensive three-day in-person training. For DEAP, in-depth review of each item on the assessment was completed. Assessors then observed four dining spaces to practice; results were qualitatively compared and clarification provided where required to promote consistency among provincial raters (17).

A variety of standardized measures were used to assess construct validity. The Mealtime- Relational Care Checklist (M-RCC) assesses relational and person centered care

(R/PCC) behaviours exhibited by staff during mealtimes with individual residents. This checklist includes a variety of positive and negative staff-resident interactions (see Appendix A). Each interaction was given a score of either 0 (absent) or 1 (present); the positive and negative actions were summed and a positive:negative ratio was created. At the resident level, this checklist was performed three times per resident across three non-consecutive days with one observation for breakfast, lunch and dinner. The mean ratio across the three observations was created and used for analysis. The M-RCC has demonstrated inter-rater reliability (40).

The staff reported person-directed care (PDC) instrument was developed to assess perceived care practices by classifying them into: personhood, comfort care, autonomy, knowing the person and support for relationships (121). By utilizing Likert scales, this questionnaire quantifies the extent to which staff report performing PCC behaviours. The staff PDC questionnaire is self-reported and has demonstrated face validity and conceptually distinct constructs (Cronbach's alpha 0.86-0.91) (121). The staff PDC is given a maximum score out of 100. Some examples of items include: the number of residents that the staff member knows their preferred music; the number of residents that staff are able to have personal conversations with; and the number of residents that decide where they want to eat.

The Mealtime Scan (MTS) is an instrument which assesses the physical and psychosocial environments (40) as a meal is being completed. The MTS includes three summary scales (1=low to 8=high) to assess the physical, social and person centered environments (see Appendix F) and includes an M-RCC checklist; however, this checklist is collected at the unit level rather than the resident level. The MTS has been deemed a reliable tool with good intraclass correlations (0.65-0.85) for the three summary scales (40). This data was collected in each dining area by the trained provincial coordinator and/or research assistants. This instrument was performed 4-6 times in each unit's dining room (n=82) with observations at breakfast, lunch and dinner; the mean of M-RCC, person centered, social and physical environment summary scales from these observations was used in analyses.

The Resident Food and Foodservice Satisfaction survey (122) is an instrument that is completed in an interview with residents and consists of 21 questions. There are three

components to the questionnaire: aspects of food, aspects of food service and quality of life (see Appendix B). Each question is asked with responses from 1 (less than half the time) to three (most of the time). This instrument was only conducted in-person with residents that had adequate cognition to complete. This survey is has a total score out of 63.

The interRAI Long Term Care Form is a standardized checklist which assesses the health, mental and quality of life of LTC residents (128). Trained provincial coordinators collected this data by interviewing staff members that are familiar with the resident's current care and behaviour (17). The items from the interRAI Long Term Care Form that were used in this analysis were the Cognitive Performance Scale (CPS; maximum score of 6) (see Appendix G) and the Depression Rating Scale (DRS; maximum score of 33) (123,128,129) (see Appendix C).

Malnutrition risk was measured using the Mini Nutritional Assessment- Short Form (MNA-SF) which was collected from each participant in the M3 study. This tool was completed by gathering information from resident charts, the residents themselves or from care providers who were familiar with the resident. Information was collected on food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and body mass index (see Appendix D). These responses were summed to create a total score out of 14, where a higher score indicates better nutritional status. The MNA-SF has been deemed as a valid and reliable instrument in assessing nutritional risk (130,131).

Food intake measurements for each resident were performed on three non-consecutive days, including one weekend day, throughout four weeks. Food intake data was gathered by weighing the items on main plates before and after meals, with fluid and side dish consumption and snacks estimated. The detailed process for collecting food and fluid intake data can be found in the Making Most of Mealtimes protocol (17). Home recipes were gathered and assembled in a program called Food Processor (version 10.14.1) and a nutrient analysis was used to estimate intake for the day for each resident based on the portion of all food and fluid consumed. Estimated average energy and protein intake variables for each resident was created by averaging each of three daily energy and protein intake values. Energy is a proxy for the amount of food consumed, while protein for the quality of food

consumed. Ethics clearance was provided by review boards from the Universities of Waterloo, Alberta, and Manitoba and Université de Moncton. Where required, ethics approval at individual nursing homes was also completed. Informed written consent was provided by residents or in the event of cognitive impairment, their alternative decision maker. Staff provided informed consent for completion of their questionnaire (17).

4.2.3 Data Analysis

Descriptive and regression analyses were stratified by dementia care and general care units, as it was hypothesized that physical features of these environments or the extent of environmental press might be different. To determine statistical significance by unit type of key descriptives, student t-tests were computed using a p-value of 0.01. There were a total of 184 residents in dementia care units; those with less than six meals of food intake data and those with missing CPS were excluded, leaving a total of 180 for this analysis. In the dementia care units, none of the dining rooms had an unsecured stove, thus analyses could not be performed on this DEAP variable. There were a total of 455 residents in general care units, four were removed for having less than six days of food intake data, five were missing body weight data and three were missing CPS, thus were not included, leaving a total of 443 for this analysis.

Each individual feature and subscale of the DEAP was summarized descriptively as frequency or mean and analyzed, using hierarchical regression analysis to determine its association with energy and protein intake (kilocalorie per kilogram body weight (kcal/kg); grams of protein per kilogram of body weight (g/kg)). These outcome variables were created by taking the average energy and protein intake variables and dividing by the resident's body weight. Gender, age and CPS were used as covariates as these variables were anticipated to strongly predict energy and protein intake. Bivariate analyses using cluster regression, adjusting for age, gender and CPS score, were performed for each DEAP variable stratified by dementia and general care units; a p-value<0.25 was used as an indicator for inclusion of the variable in the multivariate model used to predict energy and protein intake in each of the unit types. The multivariate model was built using backwards elimination and a final p-value of 0.05 was used to determine the variables to be retained. Multicollinearity was assessed for

each final model; however none of the correlations were greater than 0.5 indicating that multicollinearity was not present.

The regression procedure was also used to determine those DEAP variables which predicted the homelikeness and functionality summative scales when adjusted for other variables in this tool. First, a bivariate analysis was performed between homelikeness and each variable from the DEAP; those that had a p-value<0.25 were included in the multivariate model. Next a multivariate model of all variables found to have potential association was built and backwards elimination was performed using a p-value of 0.05 to determine order for removal and retention of variables. The final model was achieved when all variables had a p-value of 0.05 or lower. The same method was used for the functionality scale. When the multivariate model for functional ability was conducted, the variable that represented "respecting and responding to resident's opinions" was found to interact with the variable "residents are able to see the dining area from their bedroom". Both of these variables were eliminated from the multivariate model as the first could not be reliably assessed in an empty dining room while the second had only three dining rooms with this feature. The adjusted R-squared was noted at each step of the multivariate model to understand how each variable was affecting the overall model. Further, collinearity tests were performed using the tolerance values and cooks d to gather information on the existing relationships between each of the variables that remained in the final model. Due to tolerance values being >0.2 in all models, it was determined that multicollinearity was not present. Upon conducting cooks d, outliers were detected and removed; however, this did not alter the interpretation of the model, therefore supporting their inclusion.

The construct validity of the summary scales of homelikeness and functionality from the DEAP were assessed by contrasting with resident energy and protein intake, nutritional risk as measured with MNA-SF as well as several other scales in the data set. Descriptive statistics were computed for each of the instruments that the scales were compared to, dining room level M-RCC, MTS summary scales, staff PDC, resident Food and Food Service Satisfaction survey, resident DRS, nutritional risk, CPS score and resident level M-RCC. Since the DEAP was collected at the unit level, when performing correlations to resident

level instruments the median was used for instruments that had a high level of variance (e.g. energy intake and resident level M-RCC ratio) and the mean was used for those that had little variability. A Spearman rho correlation was computed for each instrument with the homelikeness and functionality scales, and a $p<0.05$ was used to indicate statistical significance. To determine the association between CPS and the homelikeness and functionality scale, the CPS score was dichotomized into none to mild cognitive impairment (scores 0-2) and moderate to severe cognitive impairment (3-6). Using a Student t-test, it was determined if homelikeness and functionality varied by cognitive status.

Chi squared tests were computed to determine if the provinces were statistically different from one another with respect to individual characteristics captured with DEAP. If the Chi squared test was significant ($p<0.01$), a Fisher's test was performed to address potential non-independence between variables. For continuous variables, such as the homelikeness and functionality scales, analysis of variance was computed and Tukey's tests were conducted to determine significant differences among the four provinces. All analyses were performed using SAS University (version 9.4).

4.3 Results

4.3.1 Determinants of Energy and Protein Intake in Dementia Care Units

Table 4.1 provides resident characteristics and demonstrates significant differences between dementia and general care units. Average age of residents in dementia care units was 85.92±8.20 years of age, approximately 28% were male and the average CPS score was 3.69±1.45. Residents in dementia care units had more cognitive impairment than those living in general care units. DEAP variable scores were summed resulting in an average total score for dementia care units of 33.07 (out of 56). Residents that lived in dementia care units had an average intake of 1675.78 calories (standard deviation (SD) = 418.27), average protein intake of 62.90g (SD= 18.71), with an average of 26.98 kcal/kg (SD= 7.62) and 1.02g of protein/kg (SD= 0.35); these values were significantly higher than residents living in general care units.

While the DEAP total score and summative scales were not significantly different across unit types (Table 4.1), the DEAP ease of pathway total score was significantly different with dementia care units having a higher score (μ= 7.29(SD= 1.46)) than general care units (μ= 6.28(SD=1.55)). In dementia care units, the total score for the components of the general physical space of the dining room (eg. accessible washroom, private family dining area, percentage of residents with a view of the garden) was 11.88(SD= 2.38), supporting functional ability (eg. lighting, glare) was 3.08(SD= 0.83), safety and security (eg. ease of pathway total, restraint use) was 8.92(SD= 1.84) and social interactions was 0.71(SD= 0.69). None of these component scores of DEAP were significantly different across unit types.

Table 4.2 provides the bivariate associations between DEAP variables and energy and protein intake adjusted for age, gender and CPS using cluster regression for those residing in dementia care units. Seven of 35 variables were sufficiently associated ($p<0.25$) with energy and protein intake and included in initial full regression models. There was a relatively low prevalence of multiple seating arrangements where only 12.50% of dining rooms had multiple options. Variables that suggest reduced risks in the dining had relatively high prevalences; 100% of dining rooms had a stove secured and 95.83% of dining rooms had detergents/non-edibles secured.

The multivariate model for energy intake (kcal/kg body weight) is found in table 4.3. CPS score (β=1.03, p=0.01) and site within province (p=0.02) were significant predictors of energy intake in dementia care units. This initial model had an R^2 value of 0.23 and adjusted R^2 value of 0.12. Adjusting for these covariates, an accessible main kitchen/servery (β = -3.69, p=0.02) and presence of a television (β= -6.40, p=<0.01) were negatively associated with energy intake, while a posted menu (β= 4.50, p=0.03) and number of exits (β=4.41, p=0.03) were positively associated ($p<0.05$) with energy intake; site was no longer significant, as this variance was now explained by these DEAP variables. Yet, the final model R^2 values were no different from the base model.

The multivariate model for protein intake (protein g/kg body weight) is found in table 4.4. CPS score (β= 0.05, p=<0.0001) and site within province (p=<0.0001) were significant

predictors of protein intake in dementia care units. This initial model had an R^2 value of 0.35 and adjusted R^2 of 0.26. Adjusting for these covariates, obstacles/clutter (β(some)= 0.19, β(several)= -0.25, p=<0.0001), accessible main kitchen/servery (β= -0.23, p=<0.01), and television (β= -0.06, p=0.01) were negatively associated (p<0.05) with protein intake, while view of the garden (β (25-49%)= 0.54, β(50-74%)= 0.20, β(75%+)= 0.11, p= <0.0001) was positively associated (p<0.05) with protein intake. CPS score and site within province remained significant (p<0.05). The final model R^2 values were not different from the base model.

4.3.2 Determinants of Energy and Protein Intake in General Care Units

Table 4.1 provides resident characteristics and demonstrates significant differences between dementia and general care units as note above. Average age of residents in general care units was 87.12±7.65 years, approximately 33% of residents were male and the average CPS score was 2.53±1.80, which was significantly lower than dementia care units. Further, the average total DEAP score in general care units was 32.75 (out of 56). Residents who lived in general care units had an average kilocalorie intake of 1537.85 (SD= 396.30), average protein intake of 56.86g (SD= 17.21), average kilocalorie per body weight of 23.56 (SD= 7.86) and average grams of protein per body weight of 0.87 (SD= 0.34); these mean intakes were significantly lower than those living in dementia care units. Means of DEAP ease of pathway, general physical space of the dining room, safety and security (eg. ease of pathway total, restraint use) and social interactions scores can be found in table 4.1.

As seen in table 4.5, bivariate analysis using cluster regression identifies the variables associated with energy and protein intake in general care units, when adjusting for age, gender and CPS score. Fourteen of 35 variables were associated with energy intake while 11 of 35 were sufficiently associated (p<0.25) with protein intake and included in initial full regression models. There was a relatively low prevalence of minimal glare (18.97%) and multiple seating arrangement options (6.90%), while presence of a clock (87.93%) and posted menu (70.69%) had a relatively high prevalence.

The multivariate model for energy intake (kcal/kg body weight) is found in table 4.6. Site within province (p=0.01) was a significant predictor of energy intake in general care

units. This initial model had an R^2 value of 0.13 and adjusted R^2 value is 0.05. Adjusting for these covariates, television (β= -3.17, p=<0.01), obstacles/clutter (β (some) = -3.48, β (several) = -1.26, p=0.01) and private family dining area (β= -4.24, p=<0.01) were negatively associated (p<0.05) with energy intake; site within province was no longer significant, while province became significant (p=0.01). This final model has an R^2 of 0.15 and adjusted R^2 of 0.07.

Table 4.7 shows the multivariate model for protein intake (protein g/kg) for residents in general care units. Site within province (p=<0.0001) was a significant predictor of protein intake. This initial model had an R^2 of 0.20 and an adjusted R^2 of 0.13. Adjusting for these covariates, television (β= -0.19, p=0.02) and private family dining area (p=0.01, β= -0.09) were negatively associated (p<0.05) with protein intake; site within province (p=<0.01) remained significant and CPS score became significant (β= 0.02, p=0.04). This final model had an R^2 of 0.21 and an adjusted R^2 of 0.14.

4.3.3 DEAP Variables Associated with Homelikeness and Functionality Ratings

Table 4.8 identifies which DEAP variables were associated with the homelikeness and functionality summary scales at p<0.25. Table 4.9 provides the multivariate model for homelikeness. At the bivariate level, the majority of the variables associated with homelikeness did convey the anticipated direction; however, it was surprising that bedrooms being a short distance from the dining room was negatively associated with homelikeness and number of chairs was positively associated with homelikeness. At the multivariate level, all variables significantly associated (p<0.05) with homelikeness were associated in the expected direction and were characteristics of the dining environment that conceptually enhance homelikeness, demonstrating the importance of conducting multivariate statistics. A view of the garden (β (25-49%) = -1.98, β (50-74%) = 0.88, β (75 %+) = 0.29, p<0.01), presence of a clock (β= 0.90, p= 0.01) and a posted menu (β= 1.09, p= <0.01) were positively associated (p<0.05) with this score. The R^2 value of the final model was 0.35 and the adjusted R^2 squared was 0.32, indicating that these three variables explained a good deal of the variance in this summary scale, but not all of the variance was explained by these DEAP variables.

Table 4.10 demonstrates the multivariate model for functionality. At the bivariate level, the majority of associations were in the expected direction; however, surprisingly, a size of dining being homelike and main kitchen/ servery were negatively associated with functionality. At the multivariate level, it was expected that adequate lighting (β (reasonable) = 0.85, β (plenty) = 1.32, p=0.01) and the excess obstacles and clutter (β (some) =-0.92, β (several) = -2.06, p<0.01) would be positively and negatively associated with functionality respectively. However, unexpectedly, the number of chairs (β= 0.03, p=0.03), was positively associated with functionality and furniture with rounded edges (β= -0.42, p=0.03) was negatively associated with functionality. These associations were surprising as a smaller dining room with less people was expected to enhance functionality, and the increased safety associated with furniture with rounded edges suggests that this characteristics of the dining environment would also enhance functionality. The R^2 for this model was 0.46 and the adjusted R^2 was 0.42 indicating that these variables explained much of the variance for functionality; however, not all the variance of this score was explained by these DEAP variables.

4.3.4 Construct Validity of the DEAP Homelikeness and Functionality Summary Scales

Table 4.11 consists of the descriptive statistics for each of the measures and their association with the DEAP summary scales. The DEAP homelikeness scale was positively associated with the DEAP functionality scale (ρ=0.26, p=0.02), the staff PDC scale (ρ=0.49, p=<0.0001), but was negatively associated with resident energy (ρ= -0.23, p=0.04), and protein intake (ρ= -0.23, p=0.04) and CPS (t (634) = 2.60, p=0.01). The functionality scale was positively associated with: dining room level M-RCC positive:negative ratio (ρ= 0.23, p=0.04); MTS physical rating (ρ= 0.52, p=<0.0001); the resident level M-RCC positive:negative ratio (ρ=0.23, p=0.04) and nutritional status (ρ= 0.26, p=0.02).

4.3.5 Prevalence of DEAP Variables and Differences among Alberta, Manitoba, New Brunswick and Ontario

Table 4.12 presents the prevalence of the DEAP variables and how this varied among provinces (see table 4.13 for all frequencies). Of the 32 homes in this study, 10 were for-

profit and 22 were not-for-profit (17), with New Brunswick including the most number of not-for-profit homes (87.50%) and Alberta including the highest number of for profit homes (50%) in the M3 study. The mean home age was 31.22 and on average Ontario had the newest homes (25.88 years), while Manitoba had the oldest homes (35.38 years) in the M3 sample. Ontario had the highest score for respecting/responding to resident opinions with respect to dining room temperature, noise and lighting (100% responded "yes") and was significantly different from Manitoba and New Brunswick, but not significantly different from Alberta (χ^2 (3, 70) = 21.67, p<0.0001). The presence of adjustable tables was lowest in Alberta (present in 13.04% of dining rooms) and was significantly different from New Brunswick and Ontario, but not Manitoba (χ^2 (3, 82) = 10.29, p=0.01). The presence of rounded edges of furniture was lowest in New Brunswick (present in 5.88% of dining rooms) and was significantly different from all other provinces (χ^2 (3, 80) = 27.22, p<0.0001). Having the dining room open between meals was less likely to occur in Ontario (38.89% responded "yes"), and Ontario was significantly different from Alberta and Manitoba, but not New Brunswick (χ^2 (3, 82) = 24.92, p<0.0001). The presence of a private family dining area was less common in Manitoba (9.09% had a private family dining area), and this province was significantly different from Alberta and Ontario but not New Brunswick (χ^2 (3, 82) = 14.58, p<0.01). The use of restraints was lowest in Alberta (13.04% used restraints), and was significantly different from Manitoba and New Brunswick, but not significantly different from Ontario (χ^2 (3, 73) = 28.32, p<0.0001). The number of stools in the dining area was lowest in New Brunswick (μ=0.84(SD= 1.77)), and this province was significantly different from Alberta, but not from Manitoba and Ontario (F (3, 82) = 3.79, p=0.01). Number of exits in the dining room was lowest in Ontario (μ= 1.78 (SD= 0.65)), which was significantly different from Manitoba and New Brunswick but not Alberta (F (3, 82) = 6.64, p=<0.01).

4.4 Discussion

The findings of this study suggest that the needs of residents in dementia care units differ from those in general care units. As anticipated, residents in these units had more (p<0.01) cognitive impairment (higher CPS score) but also consumed more energy and protein than residents in general care units; thus it was important to stratify analyses by these

different units (table 4.1). Cognitive status was significantly and positively associated with resident energy and protein intake, but only in dementia care units. Prior research has shown that the environmental needs of dementia care residents are unique (14,22,27,29,33,75,78,81), which align with the findings of this study. In this study, the dementia care units (33.07) received a slightly higher but insignificantly different DEAP total score than the general care units (32.75) and is consistent with prior type of unit comparisons (19). The only significant DEAP component to be different by unit was the ease of pathway total score, which includes the absence of obstacles/clutter, pathway lengths and dining room size, which was significantly higher in dementia care units (μ=7.29(SD=1.46)). Interestingly, CPS score was positively associated with a lower homelikeness rating indicating that those with higher cognitive impairment ate in dining rooms which were rated lower in homelikeness on this scale (table 4.11).

In this study, few physical environment features were associated with energy and protein intake, and the variance explained by these features was modest in comparison to gender, age and CPS. In dementia care units, having a posted menu and more exits in the dining room were positively associated with energy intake (table 4.3). Displaying the menu where residents can see it is a recommended LTC practice (132) to provide residents with choice and autonomy, positively stimulating residents at mealtimes (81). The number of exits may be positively associated with energy as increasing access enhances functionality (table 4.8). Functionality refers to adequate contrast, accessibility, lighting arrangements and features (Appendix E), which has been shown to support nutritional intake (19,75) and in this study was also associated with nutritional status (table 4.11). A view of the garden was positively associated with protein intake (table 4.4), supporting recommendations and previous findings as natural lighting can regulate circadian rhythms (125,133) and has been found to increase appetite, and decrease loneliness and anxiety (134). Further, outdoor environments enhance positive stimulation resulting in reminiscence, reduced stress and can promote social interactions (135). Obstacles/clutter was found to be negatively associated with protein intake (table 4.4) in dementia care units, which may be due to the strong association between reduced obstacles/clutter and increased functionality. A greater amount

of obstacles/clutter in the dining room may overstimulate residents (81) resulting in low protein intake. In both unit types, the presence of an accessible main kitchen/servery was negatively associated with energy and protein intake; although not significant in general care units at the multivariate level. Contradictory to these findings, Hung et al. support the use of an accessible main kitchen/servery to enhance homelikeness, familiarity and comfort (26). Yet in this study, table 4.8 shows that an accessible main kitchen/servery was negatively associated with both homelikeness and functionality, which may explain the negative association with energy and protein. The influence of an accessible main kitchen/servery should be further explored, specifically assessing the use of these areas during mealtimes and influence on food intake while accounting for home level policy which may impact their use. Other features of these dining rooms appear to be more influential for the subjective ratings of homelikeness and functionality.

In general care units, obstacles/clutter was significantly and negatively associated with energy intake (table 4.6), consistent with the association seen with protein intake in dementia care units. While this finding was for general care units, it can be interpreted in a similar fashion as obstacles/clutter is associated with the overall summary scale for functionality (table 4.8), and suggests that this feature not only results in over stimulation for residents with cognitive impairment (81), but is negative for all residents. A private family dining area was negatively associated with both energy and protein intake at the multivariate level for general care units. Presence of such a dining area, although making the area feel more homelike, was not necessarily used at mealtimes on a routine basis, thus the use of these spaces should also be further explored. Data on where residents were seated during their meal when food intake was measured was not ascertained to confirm this contention.

In both dementia care and general care units, the presence of a television in dining rooms was negatively associated with energy and protein intake (table 4.3). A television in the dining room may result in excess noise (136), resulting in negative sensory stimulation (81), increased environmental press and stimuli in LTC dining rooms (93,98). Increasing environmental press in dementia care units results in the further inability of residents to process the environment (93), leading to the onset of distress, exhibited as agitation (100),

which may discourage residents from eating (27). This finding suggests that a television should not be in the dining room in dementia care or general care units due to the significant impact it has on residents.

In both unit types the DEAP variables minimally explained the variance in energy and protein intake suggesting that these aspects of the physical environment have little overall influence on intake. Yet, nutritional status was found to be associated with functionality of the dining rooms (table 4.11). Studies that did result in associations between energy intake and the physical environment did not use standardized measures to assess the physical environment (19,34,38,105), used an overall percentage of food consumed which was not rigorously measured (105) and had small sample sizes (19,34,38). These studies may have unreliably associated the physical environment to resident energy and protein intake. Of greater importance to food intake are individual characteristics (137), including age, gender and CPS score modeled here. Perhaps the characteristics of the physical environment assessed by the DEAP influence the quality of life of residents rather than intake, which has not yet been examined.

In this study, the DEAP homelikeness scale was negatively associated ($p<0.05$) with energy and protein intake, but not with nutritional status (table 4.11). This finding opposes the current literature as studies have found that enhancing the dining environment to be more homelike is associated with increased food intake (78,104,105). Despite this negative result, it is still recommended that LTC units continue to promote homelike environments as it is hypothesized that such environments may be associated with quality of life (76). Additionally, future research should explore these associations while accounting for additional confounders of intake, which may potentially aide in explaining these negative associations. As mentioned, there is little and inconsistent research regarding what characteristics promote homelikeness. Multivariate models suggest three variables predicted homelikeness ratings: view of the garden, having a clock in the dining room, and a posted menu. In this study, 58.54% of dining rooms had a garden view that 75% or more residents had visual access to (see table 4.8), indicating that Canadian LTC homes are prioritizing this aspect. A clock in the dining room was common in these Canadian homes, being present in

84.15% of dining rooms (table 4.8). Prior research suggests that agitation is reduced with the presence of a clock and signage (107). Two-thirds of dining rooms had a menu posted in the dining area (see table 4.9). Few studies examined the effects of having a menu posted; however, it is a recommended practice in Ontario (132) and improves awareness and orientation (26). When compared to other constructs, the homelikeness summary scale was associated with the staff PDC, suggesting that as homelikeness increases, the more staff feel they are able to execute PCC practices. Additionally, Chaudhury et al. found that changes to the physical environment increased quality personal support and enhanced teamwork among staff, making mealtimes more enjoyable (78). In this study, staff may have felt more capable to care for residents in a relational way when in a homelike environment (22). This finding could also suggest home level differences; homes with dining rooms that are more homelike may also have a philosophy of person centered care and hire and train staff in this philosophy. Homelikeness was not associated with other PCC measures while functionality was. Conversely, homelikeness was associated ($p=0.01$) with CPS score; those with none to mild impairment were in dining rooms with a higher homelikeness scores than those with moderate to severe cognitive impairment (table 4.11). This may be a result of specific characteristics in the dining room that cannot be implemented in a dementia care units due to safety concerns. An example of this is dining rooms that do not secure dangerous items, such as a stove, increase overall homelikeness significantly at the bivariate level ($p=0.01$); however, in this study dementia care units always had dangerous items secured (table 4.2). Functionality was rated higher than homelikeness on average, and the potential difference in variance with respect to homelikeness ratings may partially explain the lack of association with other PCC measures. While these findings suggest that the homelike summary scale of the DEAP is construct valid, a lower R^2 for the homelikeness model as compared to the functionality model, also suggests that more of the variance in this scale was unexplained by DEAP variables. This may indicate that this summary scale may be prone to greater subjectivity.

Functionality was positively associated with nutritional status ($p=0.02$, table 4.11), underlining the importance of implementing characteristics in the dining room that promote

functionality. The Quality Nutrition Outcomes Long Term Care model proposes that nutritional status is an intermediate outcome of overall quality of life (138,139). While the correlation between functionality and nutritional status was weak, future research should further investigate the associations between homelikeness and functionality with overall quality of life. In multivariate analyses, the number of chairs was positively associated with functionality, which may be due to a reduction in the number of wheelchairs, improving residents' ability to navigate the dining room. Supporting this hypothesis, one study found that transferring residents into a dining room chair reduced the presence of wheelchairs in the dining room, improving resident dignity and dining experience (140). The presence of furniture with rounded edges was associated with reduced functionality in the dining room which is contradictory to recommendations, as furniture with rounded edges is believed to improve the safety of the dining area (124,141). In this study, functionality may have been reduced by rounded edged furniture due to more challenges arranging round tables or reduction in space due to rounded edges. Obstacles and clutter in the dining room was negatively associated with functionality and has been identified as a cause of overstimulation of LTC residents (142,143). Clutter creates challenges when navigating the dining room and reduces feelings of autonomy and control (26). Adequate lighting was also associated with the functional physical environment as proper lighting can encourage residents to be more mobile (143), reduces glare which can and consequently decrease pain and discomfort (125). Adequate lighting has been used in conjunction with other environmental interventions to improve nutritional health, food and fluid intake (27,34) and improve functional independence (19). Implementing these characteristics into LTC dining rooms may reduce overstimulation by decreasing existing environmental press, allowing residents to better process the physical environment to improve autonomy. This study also demonstrated that a functional dining environment was positively associated with the resident and dining room level M-RCC positive:negative ratio, suggesting that a greater level of functionality in the dining area promotes observed R/PCC practices that occur between staff and residents. For example, more space in the dining room has been found to allow staff to sit with the residents they are assisting (78). Further, improving functionality may allow staff members to work

together efficiently, improving PCC as staff do not feel rushed and can navigate the dining room more efficiently (78,106). An important finding in this study is that the functional environment, which evaluates the physical dining space, was positively associated ($p<0.0001$) with the dining room physical scale on the MTS. This finding is significant because it demonstrates that these measures, which are evaluating the same concept, are producing similar results. These results suggest that the functionality scale on DEAP is construct valid.

The bivariate analysis (table 4.8) demonstrates the large amount of overlap that exists between the characteristics that improve homelikeness and functionality. Many of these characteristics are supported in the literature especially lighting, colour contrasts and accessible beverage services during meals (19,27,34,118). Interestingly, functionality and homelikeness are both negatively associated with visually accessible dining rooms from resident bedrooms; however, this may be due to the very small number of dining rooms that did have visual accessibility. These findings suggest that homelikeness and functionality are closely related, which is supported by the significant positive correlation found ($\rho=0.26$, $p=0.02$).

In this study, few of the DEAP components differed among provinces suggesting that LTC dining room physical attributes are relatively similar in these provinces. Adjustable tables were relatively common in Manitoba, New Brunswick and Ontario (present in roughly fifty percent of dining rooms), while only present in 13.04% of dining rooms in Alberta. This may be attributed to differences in funding or potentially perceived importance of this accessible feature. The use of restraints was lowest in Alberta with a prevalence of 13.04%, which was similar to Ontario (16.67%). Alarmingly, New Brunswick and Manitoba had significantly higher levels of reported restraint use, with a prevalence of 73.68% and 78.95%, respectively, based on reports of staff when completing the DEAP. The Canadian Institute for Health Information did not have restraint use data for New Brunswick and Manitoba to corroborate this finding; Alberta (6.9%) and Ontario (6.0%) reported restraint use was lower than the Canadian average (7.4%) (144). This question required asking staff about restraints as the DEAP is completed when the dining room is empty, potentially leading to differences

in prevalence (39). Manitoba had the lowest prevalence (27.27%) of respecting/responding to resident opinions about room temperature, noise etc.; however, this finding is also potentially unreliable as this variable was sometimes reported as unknown as it is not an observable characteristic of the physical environment. Manitoba also had the lowest prevalence of a private family dining area (9.02%), significantly lower than Alberta (52.17%) and Ontario (55.56%). In New Brunswick dining rooms, only 5.88% had round edged furniture, which was significantly different from Alberta (47.83%), Manitoba (81.22%) and Ontario (77.78%). New Brunswick also had the lowest number of stools in the dining area. As with lack of adjustable tables, this may be a funding issue. Dining rooms in Ontario had the lowest prevalence of being open between meals (38.89%), while over 70% of dining rooms in the other provinces remained open between meals. On average, Ontario also had the lowest number of exits. High prevalence (table 4.8) and scores on key features (e.g. high proportion of residents can see the outside; pathways; supervision capacity of environment; contrast; secured dangerous items; clock; dining room open between meals) suggests that some physical environment interventions in LTC have been implemented consistently across provinces. Yet, further improvements in lighting, glare, size of dining rooms, ability to view the dining room from bedrooms, obstacles/clutter, mix of seating arrangements, and removal of televisions is still required.

4.4.1 Strengths and Limitations

This analysis cannot be considered representative of all long term care homes and residents in Canada or worldwide. Since data was only collected from Alberta, Manitoba, Ontario and New Brunswick, it is questionable as to whether this sample is representative of the LTC population within Canada. Homes within each province were purposively sampled, rather than randomly selected; M3 attained diversity by including homes that had a high proportion of residents with cultural minorities, private and corporate, for-profit, not-for-profit, faith-based, rural and urban. While these limitations may introduce bias into the sample and specifically influence prevalence estimates, it is also important to consider that residents and units within each home were randomly selected and that interpretation of associations identified to determine construct validity is likely to be unaffected.

Food intake assessment always has limitations. In this study, energy and protein intake variables were calculated using Food Processor. While food composition software is cost effective compared to chemical analysis, there are limitations associated with this method which include: variability in food composition, variability in energy conversion factors, accuracy of nutrient values, converting units and household measures into weight, assigning weight factors and errors in the nutrient analysis program based on the contents of the recipe (145–147). Clear protocols were used in the M3 study to promote consistency in nutrient analysis (17). As well, DEAP was not collected at specific meals where food intake was consumed, but rather when the room was empty, during the month that data collection occurred at each home. There is the potential that the physical environment was altered and could have influenced food intake post DEAP assessment, yet the majority of items on DEAP are not readily changed (e.g. institutional furniture, pathways).

All of the measures used for construct validation had their limitations. The completion of the interRAI LTCF instrument required a single staff member to be interviewed by the project coordinator for each resident participant, which could introduce bias for CPS and DRS scales used in this analysis. A systematic review questioned the validity of a variety of PDC measures (148). This review stated that construct validity and internal consistency of the PDC measure used in M3 was good; however, test-retest reliability has not been demonstrated and it was unclear if the two dimensions (PDC and person centered environment) should be interpreted autonomously (148). Additionally, the staff PDC is completed through self-reporting and may be open to bias. As well, the number of staff participants in each home varied between ten and twenty, potentially skewing the results due to the unequal sample sizes for each home. The Food and Food Service Satisfaction questionnaire also had minimal development and testing (122) and was only completed by a sub-sample of the M3 participants with adequate cognition. Further, completion of these tools by staff and residents potentially introduced bias, while the DEAP measures were based on systematic observation. Thus, it is not surprising that associations between DEAP summary scales and these construct measures were for the most part, modest.

Higher associations were seen with researcher observed constructs (e.g. M-RCC, MTS physical summary scale).

A significant issue of bias was due to the use of different assessors in the M3 study who completed DEAP. The use of different assessors may potentially skew results due to potential subjectivity when utilizing the summary scales and making judgements on the physical space. This would potentially weaken the correlations between the DEAP summary scales and the variety of instruments used, and could bias the prevalence estimates across the provinces resulting in potentially spurious differences. Yet, differences across provinces were minimal for the majority of DEAP characteristics. Cluster regression when computing associations with energy and protein intake was used to account for province differences. Using the same individuals to assess all instruments in all of the provinces would overcome this issue; however, this would be extremely time consuming and expensive. The M3 study reduced the risk of this limitation by extensively training research assistants, although it is still important to note that this form of data collection potentially increased risk of measurement error

Finally quality of life was not measured in the M3 study which may have had higher associations with DEAP variables than resident energy and protein intake (99,124,125,134–136,141). Qualitative data was not collected, which is valuable in gaining an inside perspective of the residents' experience in LTC through interviews with residents, staff and family to better understand the resident mealtime experience. Such data could have further validated the DEAP measures. Future work should include multi-methods to further characterize and understand the dining environment from these perspectives.

4.5 Conclusion

This study contributes to the prevention and treatment of malnutrition in Canadian LTC homes by outlining the physical characteristics of dining rooms that are positively and negatively associated with food intake and nutritional status. Further, the literature has consistently illustrated the benefits to implementing homelike and functional dining spaces. This study shows what characteristics of the environment contribute to improving homelikeness and functionality, allowing researchers and stakeholders to implement these

physical changes into LTC dining rooms with confidence. This study also supports the use of the DEAP instrument to quantify homelikeness and functionality as it has demonstrated construct validity; however, the DEAP tool should only be used by trained researchers due to its potential subjectivity. Further, this study demonstrates that the four Canadian provinces of Alberta, Manitoba, New Brunswick and Ontario have relatively similar physical characteristics. Prevalence estimates of key features can be used to advocate for improvements in LTC, especially for those demonstrated to be associated with food intake and homelikeness and functionality.

Table 4.1. Characteristics of Residents and Units in Dementia Care (n=180, n=24) and General Care Units (n=443, n=58)

	Dementia Care Unit Mean (SD)	General Unit Mean (SD)
Resident Characteristics		
Age (years)	85.92 (8.20)	87.12 (7.65)
CPS Score	3.69 (1.45)[a]	2.53 (1.80)[b]
Calorie intake (kcal)	1675.78 (418.27)[a]	1537.85 (396.50)[b]
Kcal/kg body weight	26.98 (7.62)[a]	23.56 (7.86)[b]
Protein intake (g)	62.90 (18.71)[a]	56.86 (17.21)[b]
Protein g/kg body weight	1.02 (0.35)[a]	0.87 (0.34)[b]
Unit Characteristics		
DEAP Total Score (max 56)	33.07 (4.48)	32.75 (4.05)
DEAP Homelikeness Score	4.17 (1.27)	4.66 (1.45)
DEAP Functionality Score	5.17 (0.92)	5.34 (1.24)
DEAP Ease of Pathway Total Score (max 9)	7.29 (1.46)[a]	6.28 (1.55)[b]
DEAP Total Physical Components (max 21)	11.88 (2.38)	11.36 (2.00)
Supporting Functional Ability (max 5)	3.08 (0.83)	3.08 (0.86)
Safety and Security (max 12)	8.92 (1.84)	7.71 (2.03)
Social Interaction (max 2)	0.71 (0.69)	0.64 (0.61)

[ab] Values with different letter superscripts within resident variables indicate a significant difference at $p<0.01$, absent superscripts indicate no significant difference across unit types

Abbreviations: CPS= Cognitive Performance Scale; DEAP= Dining Environment Audit Protocol; kcal= kilocalorie; kg= kilogram; g= gram; SD= Standard Deviation

Table 4.2. DEAP Variables Associated with Resident Energy and Protein Intake Who Live in Dementia Care Units (n=180 residents in 24 dining rooms)

		Energy			Protein		
Variable	Unit %(n)	Mean kcal/kg (SD)	β	P-value	Mean g/kg (SD)	β	P-value
% of residents with a clear view of the garden							
≤24%	12.5(3)	28.55 (8.05)	---	0.79	1.01 (0.31)	---	0.02*
25-49%	4.17(1)	28.28 (6.69)	0.10		1.50 (0.37)	0.54	
50-74%	33.33 (8)	27.13 (7.14)	-1.89		0.99 (0.27)	-0.05	
75%+	50.00 (12)	26.07 (8.33)	-7.45		0.98 (0.37)	-0.33	
Lighting intensity							
Poor	4.17(1)	22.41 (4.86)	---	0.49	0.79 (0.22)	---	0.39
Reasonable	50.00 (12)	28.18 (8.04)	-1.07		1.09 (0.36)	-0.03	
Plenty	45.83 (11)	25.65 (6.80)	3.22		0.93 (0.30)	-0.12	
Glare							
Strong	12.50 (3)	25.18 (6.56)	---	0.64	0.89 (0.25)	---	0.37

Some	54.17 (13)	26.94 (7.49)	3.57		1.06 (0.36)	0.02	
Minimal	33.33 (8)	27.89 (8.27)	-0.27		0.99 (0.37)	-0.28	
Respecting/ responding to resident opinion on light, noise and temperature [a]							
No	45.00 (6)	27.40 (8.16)	---	0.77	1.05 (0.36)	---	0.51
Yes	55.00 (11)	25.81 (6.73)	-4.01		0.96 (0.33)	-0.27	
Size of dining room							
Institutional	8.33 (2)	27.93 (8.05)	---	0.75	1.04 (0.28)	---	0.86
Moderate	45.83 (11)	26.98 (7.39)	-3.28		1.03 (0.34)	-0.20	
Homelike	45.83 (11)	26.66 (7.97)	-7.69		0.99 (0.38)	-0.40	
Pathway length							
Long	0.00 (0)	0(0.00)	---	0.96	0(0.00)	---	0.80
Moderate	50.00 (12)	27.29 (7.59)	0.00		1.03 (0.34)	0.00	
Short	50.00 (12)	26.49 (8.23)	-4.41		0.99(0.36)	-0.19	
Obstacles/ clutter							

None	45.83 (11)	27.20 (7.68)	---	0.40	0.99 (0.32)	---	0.25*
Some	50.00 (12)	27.15 (7.64)	4.41		1.05 (0.36)	0.19	
Several	4.17 (1)	20.16 (2.59)	-3.09		0.57 (0.11)	-0.14	
Physical environment supporting supervision							
Low	4.17 (1)	28.41 (6.58)	---	0.93	0.97 (0.20)	---	0.86
Moderate	29.17 (7)	26.17 (7.35)	-1.89		0.99 (0.31)	-0.05	
Good	66.67 (16)	27.31 (7.87)	-6.30		1.04 (0.38)	-0.24	
# of seating arrangements							
One	41.67 (10)	28.21 (7.61)	---	0.76	1.10 (0.38)	---	0.58
Few	45.83 (11)	26.52 (7.65)	4.94		0.97 (0.31)	0.24	
Multiple	12.50 (3)	24.05 (6.83)	4.29		0.87 (0.31)	0.19	
Adjustable tables							
No	54.17 (13)	28.40 (7.66)	---	0.37	1.03 (0.32)	---	0.76
Yes	45.83 (11)	25.45 (7.31)	-5.22		1.00 (0.38)	-0.28	

Contrast between dish and table							
No	29.17 (7)	27.25 (8.21)	---	0.91	1.03 (0.35)	---	0.87
Yes	70.83 (17)	26.86 (7.38)	2.20		1.01 (0.35)	0.03	
Contrast between table and floor							
No	54.17 (13)	25.84 (7.26)	---	0.57	0.96 (0.32)	---	0.55
Yes	45.83 (11)	28.42 (7.86)	3.57		1.08 (0.38)	0.02	
Rounded edges of furniture							
No	37.50 (9)	28.16 (7.59)	---	0.76	1.04(0.33)	---	0.74
Yes	62.50 (15)	26.12 (7.56)	-1.89		1.00 (0.36)	-0.05	
Posted menu							
No	41.67 (10)	26.59 (7.47)	---	0.22*	0.97 (0.30)	---	0.16*
Yes	58.33 (14)	27.20 (7.73)	-1.89		1.04 (0.37)	-0.05	
Detergent/ non-edibles secured							
No	4.17 (1)	25.22 (8.33)	---	0.99	0.89 (0.28)	---	0.91

Yes	95.83 (23)	26.07 (7.59)	1.34		1.02 (0.35)	-0.04	
Stove and other dangerous items secured[b]							
No	0.00 (0)	0(0.00)	N/A	N/A	0(0.00)	N/A	N/A
Yes	100.0 (24)	26.98 (7.62)	N/A		1.02 (0.35)	N/A	
Servery							
No	41.67 (10)	25.71 (7.73)	---	0.11*	1.00 (0.37)	---	0.58
Yes	58.33 (14)	27.77 (7.47)	4.42		1.02 (0.33)	0.02	
Television							
No	54.17 (13)	28.66 (8.07)	---	0.03*	1.09 (0.38)	---	0.07*
Yes	45.83 (11)	24.97 (6.53)	-1.89		0.92 (0.28)	-0.05	
Clock							
No	25.00 (6)	26.39 (7.74)	---	0.99	1.06 (0.40)	---	0.22*
Yes	75.00 (18)	27.15 (7.80)	0.00		1.00 (0.34)	-0.54	
Dining room open between meals							
No	20.83 (5)	27.01 (6.91)	---	0.90	1.09 (0.35)	---	0.50

Yes	79.17 (19)	26.96 (7.90)	-0.10		0.99 (0.34)	-0.54	
Adjacent family kitchen							
No	70.83 (17)	26.95 (7.92)	---	0.85	1.01 (0.36)	---	0.92
Yes	29.17 (7)	27.04 (6.92)	4.41		1.02 (0.33)	0.19	
Short distance from most bedrooms							
No	66.67 (16)	25.89 (7.01)	---	0.26	0.97 (0.33)	---	0.36
Yes	33.33 (8)	29.49 (8.41)	-2.29		1.12 (0.37)	0.01	
Private family dining area							
No	54.17 (13)	26.82 (7.48)	---	0.86	1.03 (0.35)	---	0.60
Yes	45.83 (11)	27.16 (7.82)	1.85		1.00 (0.36)	0.05	
Accessible washrooms near dining room							
No	58.33 (14)	27.02 (7.39)	---	0.85	0.99 (0.32)	---	0.44
Yes	41.67 (10)	26.92 (7.94)	-4.41		1.05 (0.38)	-0.19	

Dining rooms visually accessible from most bedrooms							
No	95.83 (23)	27.01 (7.65)	---	0.40	1.02 (0.35)	---	0.57
Yes	4.17 (1)	24.34 (3.61)	-1.96		0.85 (0.21)	-0.17	
Accessible beverage service							
No	54.17 (13)	26.52 (7.68)	---	0.06*	1.03 (0.35)	---	0.73
Yes	45.83 (11)	27.64 (7.53)	1.89		0.99 (0.35)	0.05	
Accessible main kitchen/ servery							
No	70.83 (17)	27.55 (7.40)	---	0.11*	1.06 (0.37)	---	0.17*
Yes	29.17 (7)	25.73 (8.00)	-3.57		0.91 (0.30)	-0.02	
Use of restraints [c]							
No	54.55 (12)	28.17 (8.51)	---	0.43	1.07 (0.39)	---	0.42
Yes	45.45 (10)	25.88 (6.78)	0.18		0.98 (0.33)	0.10	
Continuous Variables							
Variables	Mean (SD)	Correlation	β	P-Value	Correlation	β	P-Value

	{Tertile Range}	with Energy			with Protein		
Ease of pathway total score	7.29 (1.46) {5,7,9}	0.01	-1.50	0.73	-0.05	-0.06	0.97
# of tables	7.58 (3.19) {2,7,16}	-0.23	-2.46	0.46	-0.31	-0.12	0.68
# of stools	2.17 (2.20) {0,2,8}	0.21	1.68	0.25*	0.01	0.09	0.56
# of chairs	14.46 (5.06) {5,14.5, 23}	-0.16	-0.98	0.50	-0.18	-0.04	0.34
# of exits	2.50 (0.98) {1,2.5, 4}	-0.01	4.41	0.05*	0.03	0.19	0.96
Overall Homelikeness	4.17 (1.27) {2,4,6}	-0.31	-1.69	0.53	-0.37	-0.03	0.02*
Overall Functionality	5.17 (0.92) {3,5,7}	0.12	-0.62	0.89	-0.04	-0.02	0.72

These bivariate analyses were adjusted for age, gender and cognitive performance score
Abbreviations: N= total number of units; SD= standard deviation; kcal= kilocalorie; g=gram; β= parameter esimtate
* indicate a p-value of <0.25
[a] n= 17 due to the removal of the "unknown" category
[b] None of the dementia care units had a stove that was unsecured therefore regression could not be performed on this variable
[c] n=22 due to the removal of the "unknown" category
There were 184 individuals in dementia care units; 2 were removed due to having less than 6 meals of food intake observations and 2 were excluded due to missing CPS score

Table 4.3. Multivariate Models for Energy Intake with DEAP Variables in Dementia Care Units (n=180 residents in 24 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-Value
Age	0.01	0.85	0.01	0.86
Gender[a]	-0.94	0.50	-0.99	0.49
CPS Score	1.03	0.01*	0.97	0.03*
Province		0.55		0.25
Site (within province)		0.02*		0.76
Accessible Kitchen[b]			-3.69	0.02*
TV[b]			-6.40	<0.0001*
Posted Menu[b]			4.50	0.03*
Number of Exits			4.41	0.03*
R Squared	0.23		0.23	
Adjusted R Squared	0.12		0.12	

Used backwards regression to determine final model using $p<0.05$
*****indicates a significant value of $p<0.05$
[a] Reference category= female
[b] Reference category= no

Table 4.4. Multivariate Models for Protein Intake with DEAP Variables in Dementia Care Units (n=180 residents in 24 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-value
Age	-0.00	0.56	-0.00	0.44
Gender[a]	0.00	0.99	0.01	0.91
CPS Score	0.05	0.00*	0.05	0.03*
Province		0.14		0.15
Site (within province)		<0.0001*		<0.0001*
Obstacles/Clutter			---	<0.0001*
Some vs. None			0.19	
Several vs. None			-0.25	
TV[b]			-0.06	0.01*
Accessible Kitchen[b]			-0.23	<0.0001*
View of Garden			---	<0.0001*
25-49% vs ≤24%			0.54	
50-74% vs ≤24%			0.20	
75%+ vs ≤24%			0.11	
R Squared	0.35		0.35	
Adjusted R Squared	0.26		0.26	

Used backwards regression to determine final model using $p<0.05$

*****indicates a significant value of $p<0.05$

[a] Reference category= female

[b] Reference category= no

Table 4.5. DEAP Variables Associated with Resident Energy and Protein Intake Who Live in General Care Units (n=443 residents in 58 dining rooms)

		Energy			Protein		
Variable	Unit %(n)	Mean kcal/kg (SD)	β	P-value	Mean g/kg (SD)	β	P-value
% of residents with a clear view of the garden							
≤24%	10.34(6)	24.47 (7.85)	---	0.44	0.89 (0.29)	---	0.73
25-49%	5.17(3)	23.45 (9.30)	-5.48		0.96 (0.53)	-0.18	
50-74%	22.41(13)	22.94 (6.75)	-2.59		0.85 (0.27)	0.00	
75%+	62.07(36)	23.78 (8.16)	-0.16		0.87 (0.35)	0.03	
Lighting intensity							
Poor	3.45(2)	22.36 (7.68)	---	0.09*	0.88 (0.32)	---	0.12*
Reasona-ble	46.55(27)	22.73 (6.32)	4.71		0.82 (0.26)	0.08	
Plenty	50.00(29)	24.30 (8.85)	4.74		0.92 (0.40)	0.09	
Glare							

Strong	10.34(6)	25.42 (6.56)	---	0.20*	0.88 (0.30)	---	0.51
Some	70.69(41)	23.00 (6.87)	-4.93		0.86 (0.31)	-0.09	
Minimal	18.97(11)	25.39(12.00)	-2.76		0.96 (0.54)	-0.05	
Respecting / responding to resident opinion on light, noise and tempera-ture [a]							
No	38.00(19)	22.52 (7.01)	---	0.25*	0.83 (0.30)	---	0.20*
Yes	62.00(31)	24.17 (8.55)	3.87		0.91 (0.38)	0.16	
Size of dining room							
Institutional	29.31(17)	23.17 (7.56)	---	0.71	0.88 (0.35)	---	0.68
Moderate	39.66(23)	24.22 (8.41)	0.45		0.89 (0.36)	0.08	
Homelike	31.03(18)	22.88 (7.15)	0.42		0.82 (0.28)	0.00	
Pathway length							

Long	25.86(17)	23.45 (8.02)	---	0.79	0.89 (0.38)	---	0.89
Moderate	44.83(26)	23.43 (8.11)	-1.28		0.86 (0.28)	-0.06	
Short	29.31(17)	23.99 (7.17)	2.36		0.87 (0.28)	0.10	
Obstacles/ clutter							
None	32.76(19)	25.01 (9.07)	---	0.05*	0.90 (0.39)	---	0.63
Some	56.90(33)	23.05 (7.32)	-4.52		0.86 (0.33)	-0.16	
Several	10.34(6)	22.22 (6.60)	-2.23		0.83 (0.30)	-0.05	
Physical environ-ment supporting supervision							
Low	12.07(7)	23.47 (8.02)	---	0.17*	0.87 (0.33)	---	0.88
Moderate	32.76(19)	22.54 (6.95)	-0.87		0.85(0.33)	-0.05	
Good	55.17(32)	24.35 (8.38)	-1.67		0.89 (0.36)	-0.06	
Mix seating arrange-ments							
One	43.10(25)	24.37(9.06)	---	0.15*	0.94(0.42)	---	0.07*

Few	50.00(29)	22.73 (6.87)	-1.01		0.82 (0.27)	-0.04	
Multiple	6.90(4)	24.7 (6.50)	-3.73		0.88 (0.22)	-0.07	
Adjustable tables							
No	62.07(36)	23.11 (8.28)	---	0.27	0.84 (0.35)	---	0.12*
Yes	37.93(22)	24.16 (7.26)	1.07		0.91 (0.32)	0.07	
Contrast between dish and table [b]							
No	33.33(19)	22.61 (7.12)	---	0.37	0.83 (0.28)	---	0.39
Yes	66.67(38)	23.97 (8.19)	0.97		0.89 (0.37)	0.03	
Contrast between table and floor							
No	44.83(26)	22.89 (7.07)	---	0.38	0.84 (0.29)	---	0.46
Yes	55.17(32)	24.07 (8.39)	-1.71		0.89 (0.38)	-0.02	
Rounded edges of furniture[c]							
No	48.21(27)	23.62 (7.94)	---	0.53	0.86 (0.34)	---	0.92

Yes	51.79(29)	23.47 (7.79)	-4.12		0.87 (0.34)	-0.08	
Posted menu							
No	29.31(17)	24.92 (7.28)	---	0.21*	0.87 (0.28)	---	0.90
Yes	70.69(41)	23.13 (8.00)	-0.25		0.87 (0.36)	0.05	
Detergent/ non - edibles secured							
No	5.17(3)	22.51 (5.64)	---	0.64	0.86 (0.2)	---	0.92
Yes	94.83(55)	23.63 (7.99)	1.79		0.87 (0.35)	-0.12	
Stove and other dangerous items secured							
No	17.24(10)	24.22 (6.05)	---	0.48	0.87(0.25)	---	0.96
Yes	82.76(48)	23.38 (8.29)	-1.36		0.87 (0.37)	-0.12	
Servery							
No	46.55(27)	23.30 (6.94)	---	0.74	0.88 (0.32)	---	0.79
Yes	53.45(31)	23.80 (8.61)	2.24		0.87 (0.36)	0.04	
Television							

No	74.14(43)	24.07 (8.20)	---	0.05*	0.89 (0.36)	---	0.16*
Yes	25.86(15)	21.95 (6.45)	-3.56		0.81 (0.27)	-0.16	
Clock							
No	12.07(7)	22.48 (7.43)	---	0.69	0.86 (0.26)	---	0.99
Yes	87.93(51)	23.69 (7.91)	-0.96		0.87 (0.35)	-0.04	
Dining room open between meals							
No	22.41(13)	25.43 (7.90)	---	0.06*	0.95 (0.36)	---	0.08*
Yes	77.59(45)	23.00 (7.78)	-2.84		0.85 (0.33)	-0.09	
Adjacent family kitchen							
No	74.14(43)	23.42 (8.11)	---	0.75	0.87 (0.37)	---	0.97
Yes	25.86(15)	23.94 (7.21)	-0.49		0.87 (0.27)	0.02	
Short distance from most bedrooms							
No	84.48(49)	23.61 (7.96)	---	0.72	0.88 (0.35)	---	0.53

Yes	15.52(9)	23.07 (6.84)	-2.77		0.81 (0.29)	-0.08	
Private family dining area							
No	70.69(41)	23.73 (8.04)	---	0.22*	0.90 (0.36)	---	0.07*
Yes	29.31(17)	23.20 (7.49)	-1.09		0.82 (0.29)	0.03	
Accessible washrooms near dining room[d]							
No	41.07(23)	24.59 (9.34)	---	0.08*	0.89 (0.40)	---	0.53
Yes	58.93(33)	23.07 (6.94)	-2.76		0.86 (0.31)	-0.05	
Dining rooms visually accessible from most bedrooms							
No	96.55(56)	23.55 (7.86)	---	0.88	0.87 (0.34)	---	0.95
Yes	3.45(2)	24.31 (8.52)	-1.79		0.88 (0.37)	-0.03	
Accessible beverage service							

No	58.62(34)	24.24 (8.69)	---	0.32	0.91 (0.39)	---	0.14*
Yes	41.38(24)	22.75 (6.68)	1.62		0.83 (0.27)	0.02	
Accessible main kitchen/ servery							
No	74.14(43)	23.75 (8.11)	---	0.25*	0.89 (0.36)	---	0.15*
Yes	25.86(15)	23.02 (7.10)	-0.97		0.82 (0.29)	-0.02	
Use of restraints[e]							
No	52.94(27)	24.12 (8.79)	---	0.47	0.90 (0.40)	---	0.59
Yes	47.06(24)	22.75 (6.72)	-1.63		0.84 (0.28)	-0.08	
Continuous Variables							
Variables	Mean (SD) {Tertile Range}	Correlation with Energy	B	P-Value	Correlation with Protein	β	P-Value
Ease of pathway total score	6.28 (1.55) {4,6,9}	0.09	0.98	0.32	-0.02	0.04	0.99
# of tables	10.74(6.79) {0,9,31}	-0.07	-0.05	0.79	0.08	-0.00	0.86
# of stools	2.86 (3.31) {0,2,12}	0.13	-0.29	0.31	0.16	-0.01	0.15*
# of chairs	13.36(8.83) {0,11,38}	-0.05	-0.04	0.34	-0.03	-0.00	0.74

# of exits	2.91 (1.58) {1,2,9}	-0.01	-0.56	0.44	-0.02	-0.01	0.97
Overall Homelik-eness	4.66 (1.45) {1,5,7}	-0.15	-0.21	0.16*	-0.11	-0.00	0.17*
Overall Function-ality	5.34 (1.24) {2,5.5,7}	0.19	0.39	0.22*	0.13	0.01	0.64

These bivariate analyses were adjusted for age, gender and cognitive performance score
Abbreviations: N= total number of units; SD= standard deviation; kcal= kilocalorie; g=gram; β= parameter estimate
* indicate a significant value of <0.25
[a] n= 17 due to the removal of the "unknown" category
[b] n=57 due to missing data
[c] n=22 due to the removal of the "unknown" category
[d] n=56 due to missing data
[e] n=51 due to the removal of the "unknown" category
There were 455 individuals in general care units; 4 were removed due to having less than 6 meal intake observations, 5 were missing body weight data and 3 were excluded due to missing CPS scores

Table 4.6. Multivariate Models for Energy Intake with DEAP Variables in General Care Units (n=443 residents in 58 units)

Model 2	Model 1 Parameter Estimate	P-value	Parameter Estimate	P-Value
Age	-0.01	0.87	0.00	0.98
Gender[a]	-0.62	0.47	-0.56	0.52
CPS Score	0.34	0.12	0.40	0.07
Province		0.31		0.01*
Site(province)		0.01*		0.25
TV[b]			-3.17	<0.0001*
Obstacles and Clutter			---	0.01*
Some vs None			-3.48	
Several vs None			-1.26	
Private Family Dining Area[b]			-4.24	0.001*
R Squared	0.13		0.15	
Adjusted R Squared	0.05		0.07	

Used backwards regression to determine final model using $p<0.05$
*indicates a significant value of <0.05
[a] Reference category= female
[b] Reference category= no

Table 4.7. Multivariate Models for Protein Intake with DEAP Variables in General Care Units (n=443 residents in 58 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-Value
Age	-0.00	0.47	-0.00	0.61
Gender[a]	-0.00	0.99	-0.00	0.90
CPS Score	0.02	0.09	0.02	0.04*
Province		0.36		0.19
Site(province)		<0.0001*		<0.0001*
TV[b]			-0.19	0.02*
Private Family Dining Area[b]			-0.09	0.01*
R Squared	0.20		0.21	
Adjusted R Squared	0.13		0.14	

Used backwards regression to determine final model using p<0.05
*indicates a significant value of <0.05
[a] Reference category= female
[b] Reference category= no

Table 4.8. Homelikeness and Functionality Associated with Each DEAP Variable (n=82 dining rooms)

		Functionality			Homelikeness		
Variable	Dining Room %(n)	Mean (SD)	Parameter Estimates	P-value	Mean (SD)	Parameter Estimates	P-value
% of residents with a clear view of the garden							
≤24%	10.98(9)	3.56 (0.73)	---	<0.0001 *	4.56 (1.13)	---	0.11*
25-49%	4.88(4)	2.5 (1.73)	-1.06		5.5 (0.58)	0.94	
50-74%	25.61(21)	5.05 (1.20)	1.49		5.10 (0.94)	0.54	
75%+	58.54(48)	4.63 (1.36)	1.07		5.5 (1.22)	0.94	
Lighting intensity							
Poor	3.66(3)	6.00 (0)	---	0.17*	4.33 (0.58)	---	0.003 *
Reasonable	47.56(39)	4.51 (1.40)	1.49		4.95 (1.02)	0.62	
Plenty	48.78(40)	4.40 (1.43)	1.60		5.7 (1.16)	1.37	
Glare							
Strong	10.98(9)	4.44 (1.01)	---	0.65	5.56 (1.01)	---	0.51

Some	65.85(54)	4.61 (1.51)	0.17		5.33 (1.05)	-0.22	
Minimal	23.17(19)	4.26 (1.28)	-0.18		5.05 (1.47)	-0.50	
Respecting/ responding to resident opinion on light, noise and temperature[a]							
No	40.00(28)	4.00 (1.39)	---	0.01*	4.90 (1.03)	---	0.01*
Yes	60.00(42)	4.86 (1.39)	0.86		5.55 (0.99)	0.66	
Size of dining room							
Institutional	23.17(19)	4.21 (1.72)	---	0.35	5.42 (0.96)	---	0.23*
Moderate	41.46(34)	4.77 (1.16)	0.55		5.47 (1.02)	0.05	
Homelike	35.37(29)	4.41 (1.45)	0.20		5(1.36)	-0.42	
Pathway length							
Long	18.29(15)	4.27 (1.87)	---	0.56	5.4 (1.12)	---	0.78
Moderate	46.34(38)	4.68 (1.19)	0.42		5.34 (1.05)	-0.06	
Short	35.37(29)	4.41 (1.43)	0.15		5.17 (1.31)	-0.23	
Obstacles/ clutter							

None	36.59(30)	4.57 (1.28)	---	0.95	6.03(0.96)	---	<0.0001*
Some	54.88(45)	4.47 (1.52)	-0.10		5.04(0.90)	-0.99	
Several	8.54(7)	4.57 (1.40)	0.00		3.71(1.11)	-2.32	
Physical environment supporting supervision							
Low	9.76(8)	4.63 (1.30)	---	0.29	5.13 (1.36)	---	0.21*
Moderate	31.71(26)	4.85 (1.38)	0.22		5 (0.89)	-0.13	
Good	58.54(48)	4.31 (1.43)	-0.31		5.48 (1.22)	0.35	
Mix seating arrangement							
One	42.68(35)	4.14 (1.56)	---	0.12*	5.37 (1.24)	---	0.74
Few	48.78(40)	4.8 (1.24)	0.66		5.28 (1.11)	-0.10	
Multiple	8.54(7)	4.71 (1.25)	0.57		5(1.00)	-0.37	
Adjustable tables							
No	59.76(49)	4.41 (1.50)	---	0.42	5.29 (1.21)	---	0.95
Yes	40.24(33)	4.67 (1.27)	0.26		5.30 (1.07)	0.017	

Contrast between dish and table							
No	32.10(26)	4.19 (1.33)	---	0.19*	5.08 (1.23)	---	0.22*
Yes	67.90(55)	4.64 (1.43)	0.44		5.42 (1.10)	0.34	
Contrast between table and floor							
No	47.56(39)	4.56 (1.27)	---	0.75	5.21 (1.15)	---	0.51
Yes	52.44(43)	4.47 (1.53)	-0.10		5.37 (1.16)	0.17	
Rounded edges of furniture[b]							
No	45.00(36)	4.67 (1.46)	---	0.59	5.67 (0.93)	---	0.02*
Yes	55.00(44)	4.5 (1.53)	-0.17		5.07 (1.21)	-0.60	
Posted menu							
No	32.93(27)	3.81 (1.21)	---	0.001*	4.93 (1.04)	---	0.04*
Yes	67.07(55)	4.85 (1.38)	1.04		5.47 (1.17)	0.55	
Detergent/ non-edibles secured							
No	4.88(4)	5.50 (1.29)	---	0.15*	5.50 (1.29)	---	0.71

Yes	95.12(78)	4.46 (1.40)	-1.04		5.28 (1.15)	-0.22	
Stove and other dangerous items secured							
No	12.20(10)	5.6 (1.17)	---	0.01*	5.8 (0.79)	---	0.14*
Yes	87.80(72)	4.36 (1.38)	-1.24		5.22 (1.18)	-0.58	
Servery / pass through							
No	45.12(37)	4.41 (1.48)	---	0.54	5.24 (1.23)	---	0.73
Yes	54.88(45)	4.6 (1.36)	0.19		5.33 (1.09)	0.09	
Television							
No	68.29(56)	4.39 (1.41)	---	0.26	5.29 (1.22)	---	0.94
Yes	31.71(26)	4.77 (1.39)	0.38		5.31 (1.01)	0.02	
Clock							
No	15.85(13)	3.62 (1.26)	---	0.01*	4.69 (1.18)	---	0.04*
Yes	84.15(69)	4.68 (1.38)	1.07		5.41 (1.12)	0.71	
Dining room open between meals							
No	21.95(18)	4.5 (1.34)	---	0.97	5.39 (0.98)	---	0.69

Yes	78.05(64)	4.52 (1.44)	0.016		5.27 (1.20)	-0.12	
Adjacent family kitchen							
No	73.17(60)	4.56 (1.38)	---	0.69	5.28 (1.21)	---	0.90
Yes	26.83(22)	4.41 (1.50)	-0.14		5.32 (0.99)	0.03	
Short distance from most bedrooms							
No	79.27(65)	4.71 (1.37)	---	0.01*	5.31 (1.16)	---	0.82
Yes	20.73(17)	3.76 (1.35)	-0.94		5.24 (1.15)	-0.07	
Private family dining area							
No	65.85(54)	4.39 (1.45)	---	0.27	5.17 (1.21)	---	0.17*
Yes	34.15(28)	4.75 (1.32)	0.36		5.54 (1.00)	0.36	
Accessible washrooms near dining room[b]							
No	46.25(37)	4.32 (1.43)	---	0.41	5.16 (1.43)	---	0.28
Yes	53.75(43)	4.58 (1.35)	0.26		5.44 (1.16)	0.28	

Dining rooms visually accessible from most bedrooms							
No	96.34(79)	4.58 (1.37)	---	0.02*	5.37 (1.10)	---	0.002 *
Yes	3.66(3)	2.67 (1.15)	-1.92		3.33 (0.58)	-2.03	
Accessible beverage service							
No	57.32(47)	4.34 (1.54)	---	0.20*	5.13 (1.21)	---	0.14*
Yes	42.68(35)	4.74 (1.20)	0.40		5.51 (1.04)	0.39	
Accessible main kitchen/ servery							
No	73.17(60)	4.55 (1.41)	---	0.69	5.40 (1.11)	---	0.16*
Yes	26.83(22)	4.41 (1.44)	-0.14		5.00 (1.23)	-0.40	
Use of restraints[c]							
No	53.42(39)	4.59 (1.46)	---	0.28	5.56 (0.94)	---	0.06*
Yes	46.58(34)	4.24 (1.28)	-0.35		5.06 (1.28)	-0.51	

Continuous Variables							
Variables	Mean (SD) {Tertile Range}	Correlation with Home-likeness	Parameter Estimate	P-Value	Correlation with Functi-onality	Parameter Estimate	P-Value
Ease of pathway total score	6.57 (1.59) {4,6,9}	0.03	0.02	0.81	0.12	1.10	0.30
# of tables	9.82 (6.11) {0,8,31}	0.08	0.02	0.50	0.12	11.02	0.29
# of stools	2.66 (3.03) {0,2,12}	0.09	0.04	0.42	0.01	1.14	0.94
# of chairs	13.68 (7.92) {0,12,38}	0.22	0.04	0.05*	0.17	0.00	0.12*
# of exits	2.80 (1.44) {1,2,9}	-0.13	-0.12	0.24	0.31	2.36	0.01*

[a] n=70 due to the removal of the "unknown" category
[b] n=80 due to missing data
[c] n=73 due to the removal of the "unknown" category
Abbreviations: n= number of dining rooms; SD= standard deviation
*indicate a p-value of <0.25

Table 4.9. DEAP Items and Homelikeness Final Model (n=81 units)

Variable Name	Parameter Estimate	F Value	P-Value
View of garden		7.04	<0.0001
25-49% vs ≤24%	-1.98		
50-74% vs ≤24%	0.88		
75%+ vs ≤24%	0.29		
Clock	0.9	6.28	0.01
Posted menu	1.09	13.8	<0.0001
N	81		
R Squared	0.35		
Adjusted R Squared	0.32		

Used backwards regression to determine final model using $p<0.05$
Abbreviations: n= number of dining rooms

Table 4.10. Functionality Final Model (n=80 units)

Variable Name	Parameter Estimate	F Value	P-Value
Number of chairs	0.03	5.1	0.03
Furniture with rounded edges	-0.42	4.76	0.03
Obstacles/clutter		18.27	<0.0001
Some vs None	-0.92		
Several vs None	-2.06		
Adequate lighting		4.93	0.01
Reasonable vs Poor	0.85		
Plenty vs Poor	1.32		
N	80		
R Squared	0.46		
Adjusted R Squared	0.42		

Used backwards regression to determine final model using $p<0.05$
Abbreviations: N= number of dining rooms

Table 4.11. Descriptive Statistics and Associations between DEAP Functionality and Homelikeness Scales with other Measures

		Functionality		Homelikeness	
Variable	Mean(SD) {Tertile Range}	Spearman Correlation	P-Value	Spearman Correlation	P-Value
Homelikeness Scale (n=82)	4.51(1.41) {1,5,7}				
Functionality Scale (n=82)	5.29(1.15) {2,5,7}			0.26	0.02*
Dining Room Level M-RCC positive:negative ratio (n=82)	1.76(0.64) {0.99, 1.54, 4.43}	0.25	0.02*	0.20	0.07
MTS Person Centered Summary Scale (n=82)	5.47(0.77) {2.25, 5.5, 7.5}	0.14	0.22	0.20	0.07
MTS Physical Summary Scale (n=82)	5.57(0.86) {2.75, 5.75, 7.5}	0.52	<0.0001*	0.18	0.10
MTS Social Summary Scale (n=82)	5.03(0.9) {2.25, 5.17, 7.25}	0.12	0.27	0.11	0.32
Staff PDC Percentage Score (n=461)	61.54(5.49) {51.01, 61.7, 71.75}	0.10	0.35	0.49	<0.0001*
Resident Food Satisfaction Score (n=334)	52.62(6.37) {21, 54, 60}	0.09	0.45	0.09	0.42

DRS (n=634)	2.32(2.92) {0, 1, 14}	0.02	0.84	-0.09	0.44	
Resident Energy Intake (kcal/kg bw) (n=633)	24.55(7.94) {1.87, 23.68, 90.07}	0.02	0.88	-0.23	0.04*	
Resident Protein Intake (protein g/kg bw)(n=633)	0.91(0.35) {0.10, 0.86, 3.90}	-0.002	0.98	-0.23	0.04*	
Resident Level M-RCC positive:negative ratio (n=634)	2.20(1.32) {0.38, 1.89, 12}	0.23	0.04*	0.14	0.20	
MNA-SF (n=638)	10.63 (2.44) {0, 11, 14}	0.26	0.02*	0.13	0.24	
CPS Score (n=634)	Mean(SD)	T Value	P-Value	Mean(SD)	T Value	P Value
None to Mild	5.42(1.06)	1.54	0.12	4.75(1.31)	2.60	0.01*
Moderate to Severe	5.29(1.01)			4.46(1.46)		

Abbreviations: kcal/kg bw= kilocalorie per kilogram body weight; SD= standard deviation; M-RCC= Mealtime Relational Care Checklist; DRS= Depression Rating Scale; MTS= Mealtime Scan; CPS= Cognitive Performance Scale; MNA-SF= Mini Nutritional Assessment- Short Form
*indicates a p-value of <0.05

Table 4.12. Prevalence of DEAP Variables by Province

Variable	AB %(n)	MB %(n)	NB (%)n	ON %(n)
# of residents with a clear view of the garden				
24% or less	17.39(4)	13.64(3)	1(5.36)	5.56(1)
25-49%	4.35(1)	4.55(1)	0(0.00)	11.11(2)
50-74%	8.70(2)	31.82(7)	10.53(2)	55.56(10)
75%+	69.57(16)	50.00(11)	84.21(16)	**47.78(5)**
Lighting intensity				
Poor	4.35(1)	9.09(2)	0.00(0)	0.00(0)
Reasonable	26.09(6)	40.91(9)	57.89(11)	72.22(13)
Plenty	69.57(16)	50.00(11)	42.11(8)	**27.78(5)**
Glare				
Strong	13.04(3)	0.00(0)	0.00(0)	33.33(6)
Some	34.78(8)	72.73(16)	94.74(18)	66.67(12)
Minimal	52.17(12)	27.27(6)	5.26(1)	**0.00(0)**
Respecting/responding to resident opinion on light, noise and temperature				
Yes	75.00(12)[ac]	**27.27(6)[b]**	59.24(9)[ab]	100.00(15)[c]
Size of dining room				
Institutional	30.43(7)	27.27(6)	15.79(3)	16.67(3)
Moderate	39.13(9)	18.18(4)	52.63(10)	61.11(11)
Homelike	30.43(7)	54.55(12)	31.58(6)	**22.22(4)**
Pathway length				

Long	13.04(3)	27.27(6)	21.05(4)	11.11(2)
Moderate	56.52(13)	31.82(7)	66.67(12)	66.67(12)
Short	30.43(7)	40.91(9)	47.37(9)	**22.22(4)**
Obstacles/ clutter				
Several	4.35(1)	9.09(2)	15.79(3)	5.56(1)
Some	56.52(13)	50.00(11)	42.11(8)	72.22(13)
None	39.13(9)	40.91(9)	42.11(8)	**22.22(4)**
Physical environment supporting supervision				
Low	8.70(2)	18.18(4)	0.00(0)	11.11(2)
Moderate	13.04(3)	36.36(8)	31.58(6)	50.00(9)
Good	78.26(18)	45.45(10)	68.42(13)	**38.89(7)**
Mix seating arrangement				
One	56.52(13)	40.91(9)	47.37(9)	22.22(4)
Few	43.48(10)	40.91(9)	47.37(9)	66.67(12)
Multiple	**0.00(0)**	18.18(4)	5.26(1)	11.11(2)
Adjustable tables				
Yes	**13.04(3)**[a]	45.45(10)[ab]	52.63(10)[b]	55.56(10)[b]
Contrast between dish and table				
Yes	65.22(15)	**61.90(13)**	63.16(12)	83.33(15)
Contrast between table and floor				
Yes	69.57(16)	**36.36(8)**	42.11(8)	61.11(11)

Rounded edges of furniture				
Yes	47.83(11)[a]	81.22(18)[a]	**5.88(1)[b]**	77.78(14)[a]
Posted menu				
Yes	73.91(17)	63.64(14)	73.68(14)	**55.56(10)**
Detergent/non-edibles secured				
Yes	95.65(22)	**90.91(20)**	100.00(19)	94.44(17)
Stove and other dangerous items secured				
Yes	86.96(20)	90.91(20)	**84.21(16)**	88.89(16)
Servery / pass through				
Yes	43.48(10)	**40.91(9)**	63.16(12)	77.78(14)
Television				
Yes	**30.43(7)**	31.82(7)	31.58(6)	33.33(6)
Clock				
Yes	86.96(20)	**68.18(15)**	94.74(18)	88.89(16)
Dining room open between meals				
Yes	100.00(23)[a]	90.91(20)[a]	73.68(14)[ab]	**38.89(7)[b]**
Adjacent family kitchen				
Yes	**26.09(6)**	27.27(6)	26.32(5)	27.78(5)
Short distance from most bedrooms				
Yes	30.43(7)	13.64(3)	26.32(5)	**11.11(2)**

Private family dining area				
Yes	52.17(12)[a]	**9.09(2)[b]**	21.05(4)[ab]	55.56(10)[a]
Accessible washrooms near dining room				
Yes	47.83(11)	40.00(8)	63.16(12)	66.67(12)
Dining rooms visually accessible from most bedrooms				
Yes	4.35(1)	**0.00(0)**	10.53(2)	**0.00(0)**
Accessible beverage service				
Yes	47.83(11)	63.64(14)	**25.32(5)**	27.78(5)
Accessible main kitchen/ servery				
Yes	52.17(12)	**13.64(3)**	15.79(3)	22.22(4)
Use of restraints				
Yes	**13.04(3)[a]**	78.95(15)[b]	73.68(14)[b]	16.67(2)[a]
Home Sector				
For Profit	50.00(4)	37.50(3)	**12.50(1)**	25.00%(2)
Continuous variables Mean (SD)				
Ease of pathway total score	6.52(1.62)	6.73(1.96)	6.68(1.42)	**6.33(1.28)**
# of tables	9.83(5.06)	11.73(7.47)	**8.58(7.37)**	8.78(3.34)
# of stools	3.78(3.27)[a]	2.73(3.83)[a b]	**0.84(1.77)[b]**	3.06(1.70)[ab]

# of chairs	**10.26(8.13)**	16.18(8.01)	13.53(8.26)	15.17(5.82)
# of exits	2.57(0.79)[ab]	3.50(1.34)[a]	3.21(2.04)[a]	**1.78(0.65)[b]**
Overall Homelikeness	**4.26(1.57)**	4.41(1.47)	4.47(1.22)	5.00(1.28)
Overall Functionality	5.43(1.34)	**4.95(1.17)**	5.53(1.17)	5.28(0.75)
Home Age	28.75(18.41)	35.38(18.17)	34.88(12.89)	**25.88(17.34)**

[abcd] Values with different letter superscripts within DEAP variables indicate a significant difference at $p<0.01$, absent superscripts indicate no significant difference across provinces
The values that are bolded indicate the province with the lowest prevalence of more positive dining room features
Differences between provinces (as indicated by the superscripts) was computed across all categories as seen in the supplemental table
Abbreviations: n= number of dining rooms; SD= standard deviation; AB= Alberta; MB= Manitoba; NB= New Brunswick; ON= Ontario

Table 4.13. Prevalence DEAP by Province- Supplemental Table

Variable	**AB %(n)**	**MB %(n)**	**NB (%)n**	**ON %(n)**
# of residents with a clear view of the garden				
24% or less	17.39(4)	13.64(3)	1(5.36)	5.56(1)
25-49%	4.35(1)	4.55(1)	0(0.00)	11.11(2)
50-74%	8.70(2)	31.82(7)	10.53(2)	55.56(10)
75%+	69.57(16)	50.00(11)	**16(84.21)**	47.78(5)
Lighting intensity				
Poor	4.35(1)	9.09(2)	0.00(0)	0.00(0)
Reasonable	26.09(6)	40.91(9)	57.89(11)	72.22(13)
Plenty	69.57(16)	50.00(11)	42.11(8)	**27.78(5)**
Glare				
Strong	13.04(3)	0.00(0)	0.00(0)	33.33(6)
Some	34.78(8)	72.73(16)	94.74(18)	66.67(12)
Minimal	52.17(12)	27.27(6)	5.26(1)	**0.00(0)**
Respecting/responding to resident opinion on light, noise and temperature				
No	25.00(4)	72.73(16)	47.06(8)	0.00(0)
Yes	75.00(12)	**27.27(6)**	59.24(9)	100.00(15)
Size of dining room				
Institutional	30.43(7)	27.27(6)	15.79(3)	16.67(3)
Moderate	39.13(9)	18.18(4)	52.63(10)	61.11(11)

Homelike	30.43(7)	54.55(12)	31.58(6)	**22.22(4)**
Pathway length				
Long	13.04(3)	27.27(6)	21.05(4)	11.11(2)
Moderate	56.52(13)	31.82(7)	66.67(12)	66.67(12)
Short	30.43(7)	40.91(9)	47.37(9)	**22.22(4)**
Obstacles/ clutter				
Several	4.35(1)	9.09(2)	15.79(3)	5.56(1)
Some	56.52(13)	50.00(11)	42.11(8)	72.22(13)
None	39.13(9)	40.91(9)	42.11(8)	**22.22(4)**
Physical environment supporting supervision				
Low	8.70(2)	18.18(4)	0.00(0)	11.11(2)
Moderate	13.04(3)	36.36(8)	31.58(6)	50.00(9)
Good	78.26(18)	45.45(10)	68.42(13)	**38.89(7)**
Mix seating arrangement				
One	56.52(13)	40.91(9)	47.37(9)	22.22(4)
Few	43.48(10)	40.91(9)	47.37(9)	66.67(12)
Multiple	**0.00(0)**	18.18(4)	5.26(1)	11.11(2)
Adjustable tables				
No	86.96(20)	54.55(12)	47.37(9)	44.44(8)
Yes	**13.04(33)**	45.45(10)	52.63(10)	55.56(10)
Contrast between dish and table				
No	34.78(8)	38.10(8)	36.84(7)	16.67(3)

Yes	65.22(15)	**61.90(13)**	63.16(12)	83.33(15)
Contrast between table and floor				
No	30.43(7)	63.64(14)	57.89(11)	38.89(7)
Yes	69.57(16)	**36.36(8)**	42.11(8)	61.11(11)
Rounded edges of furniture				
No	52.17(12)	18.18(4)	94.12(16)	22.22(4)
Yes	47.83(11)	81.22(18)	**5.88(1)**	77.78(14)
Posted menu				
No	26.09(6)	36.36(8)	26.32(5)	44.44(8)
Yes	73.91(17)	63.64(14)	73.68(14)	**55.56(10)**
Detergent/non-edibles secured				
No	4.35(1)	9.09(2)	0.00(0)	5.56(1)
Yes	95.65(22)	**90.91(20)**	100.00(19)	94.44(17)
Stove and other dangerous items secured				
No	13.04(3)	9.09(2)	15.79(3)	11.11(2)
Yes	86.96(20)	90.91(20)	**84.21(16)**	88.89(16)
Servery / pass through				
No	56.52(13)	59.09(13)	36.84(7)	22.22(4)
Yes	43.48(10)	**40.91(9)**	63.16(12)	77.78(14)
Television				
No	69.57(16)	68.18(15)	68.42(13)	66.67(12)

Yes	**30.43(7)**	31.82(7)	31.58(6)	33.33(6)
Clock				
No	13.04(3)	31.82(7)	5.26(1)	11.11(2)
Yes	86.96(20)	**68.18(15)**	94.74(18)	88.89(16)
Dining room open between meals				
No	0.00(0)	9.09(2)	26.32(5)	61.11(11)
Yes	100.00(23)	90.91(20)	73.68(14)	**38.89(7)**
Adjacent family kitchen				
No	73.91(17)	72.73(16)	73.68(14)	72.22(13)
Yes	**26.09(6)**	27.27(6)	26.32(5)	27.78(5)
Short distance from most bedrooms				
No	69.57(16)	86.36(19)	73.68(14)	88.89(16)
Yes	30.43(7)	13.64(3)	26.32(5)	**11.11(2)**
Private family dining area				
No	47.83(11)	90.91(20)	78.95(15)	44.44(8)
Yes	52.17(12)	**9.09(2)**	21.05(4)	55.56(10)
Accessible washrooms near dining room				
No	52.17(12)	60.00(12)	36.84(7)	33.33(6)
Yes	47.83(11)	**40.00(8)**	63.16(12)	66.67(12)
Dining rooms visually accessible from most bedrooms				

No	95.65(22)	100.00(22)	89.47(17)	100(18)
Yes	4.35(1)	**0.00(0)**	10.53(2)	**0.00(0)**
Accessible beverage service				
No	52.17(12)	36.36(8)	73.68(14)	72.22(13)
Yes	47.83(11)	63.64(14)	**25.32(5)**	27.78(5)
Accessible main kitchen/ servery				
No	47.83(11)	86.36(19)	84.21(16)	77.78(14)
Yes	52.17(12)	**13.64(3)**	15.79(3)	22.22(4)
Use of restraints				
No	86.96(20)	21.05(4)	26.32(5)	83.33(10)
Yes	**13.04(3)**	78.95(15)	73.68(14)	16.67(2)
Home Sector				
For Profit	50.00(4)	37.50(3)	**12.50(1)**	25.00%(2)
Not for Profit	50.00(4)	62.50(5)	87.50(7)	75.00(6)
Continuous variables Mean (SD)				
Ease of pathway total score	6.52(1.62)	6.73(1.96)	6.68(1.42)	**6.33(1.28)**
# of tables	9.83(5.06)	11.73(7.47)	**8.58(7.37)**	8.78(3.34)
# of stools	3.78(3.27)	2.73(3.83)	**0.84(1.77)**	3.06(1.70)
# of chairs	**10.26(8.13)**	16.18(8.01)	13.53(8.26)	15.17(5.82)
# of exits	2.57(0.79)	3.50(1.34)	3.21(2.04)	**1.78(0.65)**

Overall Homelikeness	**4.26(1.57)**	4.41(1.47)	4.47(1.22)	5.00(1.28)
Overall Functionality	5.43(1.34)	**4.95(1.17)**	5.53(1.17)	5.28(0.75)
Home Age	28.75(18.41)	35.38(18.17)	34.88(12.89)	**25.88(17.34)**

Abbreviations: n= number of dining rooms; SD= standard deviation; AB= Alberta; MB= Manitoba; NB= New Brunswick; ON= Ontario
Bolded numbers indicate the province with the lowest score

Chapter 5

Construct Validity and Prevalence Estimates of the Mealtime Scan

5.1 Introduction

Low food intake is a prevalent problem in long term care (LTC) homes resulting in malnutrition (9,11,30,53). The mealtime environment, which consists of the physical and psychosocial environment (including social interactions and person-directed care practices) is believed to be important in improving the food intake and quality of life of residents (9,24,25,28,29,31,34,36–38,113,118–120). It is anticipated that if these environments can be positively influenced, it is one means of improving food intake in this highly vulnerable population (15). One way to improve the psychosocial environment may be through how staff interacts with residents.

Person centered care (PCC) is considered a best practice (22,26). Reimer and Keller (2009) conducted a review of the literature to identify the components of person centered mealtimes and suggested that PCC practices at mealtimes provide residents with the promotion of choice and preferences, independence, respect and social interaction which are believed to be beneficial to their well-being (85). A qualitative study in a nursing home in Norway confirmed that residents believed that thriving in the LTC environment is in part due to the quality of care they receive, with the caregivers being respectful and kind to the residents. A relatively new concept of relational centered care (RCC) is also applicable to mealtimes and addresses some of the criticisms of PCC. For example, PCC does not adequately focus on the multidimensional relationship between staff and residents; rather it demonstrates relationships between staff and residents as unidirectional with residents receiving care and staff giving care (88). RCC addresses this issue by expanding on PCC through the use of mutually beneficial relationships between staff and residents (87,88,149,150). Additionally, PCC practices focus on providing residents with choice; however, resident choices are often limited to facility-determined options rather than preferences that residents choose to be satisfying (88). It is important that PCC and RCC behaviours be assessed in LTC with a standardized instrument, to improve care practices.

The psychosocial mealtime environment may also be influenced by the number of staff to assist and supervise during mealtimes; studies have shown that energy and protein intake increased when adequate mealtime assistance is present (23,74,151,152). Further, with smaller resident-to-staff ratios, staff are more able to treat the residents with high quality person centered care (26). While PCC practices are beneficial to LTC residents, interventions that implement person centered care practices are assessed inconsistently across studies resulting in an inability to compare results (35,37,116,117). High quality research must be conducted that utilizes a standardized instrument to develop valid and reliable conclusions to support the feasibility of PCC implementation.

The physical environment is also relevant to food intake in LTC. Environmental press is conceptualized as environmental forces that conflict with the needs of individuals evoking a negative response (93). Individuals with reduced competence, such as impaired cognitive capacity, become more vulnerable to the effects of environmental press. The physical environment can increase the environmental press within LTC dining environments due to unsupportive characteristics such as large dining rooms, increased group sizes and excess noise (81). The physical environment can reduce environmental press by providing residents with a more intimate, home-scale environment that supports social interactions. Interestingly, an enhanced physical environment may affect the ability of staff to execute PCC practices, as staff may be better equipped to support residents' needs and preferences (78). The physical environment can also promote RCC by creating opportunities for relationship building among residents and staff (77). An enhanced physical environment and the implementation of person and/or relationship centered care philosophy are conducive to creating a therapeutic dining environment (78,81).

Intervention research has demonstrated the importance of psychosocial and physical dining environments and nutrition. Roberts (2011) found that homelike dining décor and personalized surroundings led to increased social interaction and satisfaction at mealtimes (30). However, residents were only exposed to the homelike dining room once a week and confounders were not considered (e.g. cognitive impairment), greatly impacting the validity of the conclusions. Lack of a standardized instrument to assess the improvements in the

physical and psychosocial mealtime environments also influences replication and translation of findings, and food intake itself was not assessed. The number of social interactions that residents in a Canadian geriatric hospital experienced has been found to be positively correlated with their food intake (35). However, social interactions involving care providers were excluded (35). Others corroborated the positive associations between dining in an environment that promotes social interactions and the amount of protein and energy consumed (37). Both studies utilized the Comstock scale in which researchers visually estimated the percentage of food that residents consumed (0%, 25%, 50%, 75%, 100%); when attempting to determine overall energy and macronutrient intake; this method lacks an acceptable level of accuracy (153). To assess the psychosocial environment, both studies used the Social Behaviour Inventory where the number of social interactions are counted, and classified by type (35,37). This instrument quantifies social interactions, limiting the description of the social environment (154). Further, it is unclear from the research to date how physical and psychosocial environments potentially work together to influence food intake.

Studies conducted to date provide a foundation for further research, but fail to evaluate if and which different aspects of the mealtime environment influence food intake and have not considered physical and psychosocial features together. Researchers have implemented changes to the physical and psychosocial environment, including training staff on PCC, but it is unclear which changes have a potentially greater effect on food intake and thus, which features homes should invest in. Primary reasons for this lack of understanding are: inadequate measurement; small study samples; and placing focus on only a few environmental changes at a time. The Making Most of Mealtimes (M3) prevalence study is a large cross-sectional study that not only measured food intake in a rigorous manner, but also captured key aspects of the physical and psychosocial environments with standardized measures (17). Specifically, the M3 study created and utilized a tool called the Mealtime Scan (MTS) that quantitatively assesses the physical and psychosocial environments during mealtimes. The MTS has three summative scales that will be of importance in this study, which have demonstrated inter-rater reliability (physical scale intraclass correlation (ICC)

=0.73, p<0.0001; social scale ICC=0.81, p<0.0001; and PCC scale ICC=0.82, p<0.001; (40)). Further, the MTS also assesses PCC and RCC practices in the Mealtimes Relational Care Checklist (M-RCC) using a variety of positive and negative staff behaviours/interactions with residents and found that these also demonstrate inter-rater reliability (ICC (positive actions) = 0.73, ICC (negative) = 0.85, p<0.0001) (40). The M3 prevalence study provides the opportunity to further explore various environmental components and food intake as well as prevalence of features and association of summary scales with other measures. This study aims to: 1) identify the significant associations between various psychosocial or physical environmental characteristics, as assessed by the MTS, and energy and protein intake in residents living in LTC, 2) demonstrate what factors on MTS are independently associated with summative scales of physical, social and person centered care, 3) examine if the MTS exhibits construct validity when compared to other measures, including nutritional status and energy and protein intake, and, 4) describe the prevalence of environmental features and how the physical and psychosocial environments differ in LTC homes across the Canadian provinces of Alberta, Manitoba, New Brunswick and Ontario.

5.2 Methodology

5.2.1 Sample and Participants

A secondary data analysis of the M3 data set was used to address the research questions. This was a multisite, cross sectional study that collected data from LTC homes in four Canadian provinces: Alberta, Manitoba, New Brunswick and Ontario. This dataset includes data collection at the resident, dining room, staff, and home levels; however, this secondary data analysis focuses primarily on the resident and dining room levels, specifically examining the construct validity of the MTS (17).

32 LTC homes were recruited, consisting of 8 LTC homes in each province. Homes that were eligible had: 1) been operating for at least 6 months, 2) a minimum of 50 residents that met the resident eligibility criteria, and 3) diversity in home characteristics. For- profit and not-for-profit homes and homes with special characteristics were recruited to promote sample diversity. Within each home, data was collected on from one to four randomly

selected care units; 82 dining rooms were assessed during data collection from these units (17).

The eligibility criteria of residents included: 1) residing on the units selected, 2) over the age of 65, 3) required a minimum of 2 hours each day of nursing care, 4) resided in the home for at least one month and 4) they, or a substitute decision maker, consented to participate. Exclusion criteria included: 1) resided in the home for less than one month, 2) medically unstable at the time of recruitment, 3) short term admission at the time of recruitment, 4) required tube feeding, 5) at the end of life and/or 6) had advanced directives that excluded them from research. Eligible residents were randomly sampled from the study units, with twenty residents having been recruited from each home. A total of 640 residents were recruited for data collection; the final sample was 639 as one participant withdrew consent (17). Eligible staff were staff from nursing, recreation or dietary that were regular part-time or full-time employees. A minimum of 10 employees working on the chosen units were recruited (17) for completion of a questionnaire on PCC.

5.2.2 Data Collection and Measures

An assessment of the physical and psychosocial environments was conducted using the Mealtime Scan for LTC in each dining area by the trained provincial coordinator and/or research assistants. This instrument was performed 4-6 times in each unit's dining room (n=82) with observations at breakfast, lunch and dinner. The mean of items from these measures across assessed meals was used in this analysis. The first section of the MTS begins with recordings of the meal start and end times, temperature, light, humidity and sound levels (measured two times during each meal at a minimum of two locations in the room). Sound, temperature, lighting and humidity were measured with an environmental meter (Shimana SE-DT-8820) using a standardized protocol (17). Environmental measure values were averaged for each meal observation as this data was collected multiple times in different locations during each meal. Following this, the MTS assesses the physical environment including: the number of individuals in the dining room during mealtime and who these individuals were (e.g. residents, staff, volunteers); orientation cues (the presence of food aroma; decorations on table; meal menu on table; table settings; tablecloth; condiments on

table; contrast between the plate and food); presence of music (including the source of music, type, and loudness); excess noise (for example resident screaming and hallway traffic). The orientation cues were summed and scaled from zero to fourteen, where a low score indicates a low amount of orientation cues and a high score indicates an environment that has many orientation cues. Excess noise was scaled in a similar way from zero to forty-four with a low value indicating little excess noise and a high value indicated significant excess noise that would impact social interactions/conversation. A social sound variable (based on items from the excess noise scale) was also created that included talk among residents and talk between residents/staff and was scaled from zero to eight where a low value indicated little social sound and a high value indicated significant social sound. Additionally, an excess noise variable that excluded the social sound components was created and was scaled from zero to thirty-six. Music is categorized as music present or absent.

The next section on MTS uses a checklist to assess Mealtime Relational Centered Care (M-RCC) practices, which include a variety of positive and negative staff-resident mealtime-specific interactions that were observed across the entire dining area. There are three sections to this checklist, one that is relevant for all residents (18 items), the second relates only to residents that require eating assistance (7 items) and the third focused on mealtime clean-up activities (2 items) that can affect ambiance. Each positive and negative behaviour for the entire resident population and the actions specific to residents that require eating assistance are shown in Appendix A. Each positive and negative behaviour was given a score of either zero (behaviour not observed) or one (behaviour observed). All MTS information, including the M-RCC, was summarized by three summative scales which assess the physical, social and person centered environments using one as the lowest possible rating and eight representing a pleasant dining environment (see Appendix F).

Constructs to compare to MTS summary scales were assessed with a variety of measures. An assessment of RCC behaviours was also conducted at the resident level using the M-RCC a total of three times per resident across three non-consecutive days with one observation for breakfast, lunch and dinner (17). Assessment and scoring were the same as for the MTS M-RCC. The mean positive:negative behaviour ratio across the three

observations was created and used for analysis. The staff reported person-directed care (PDC) instrument was developed to assess staff perception of person-directed care practices by classifying care into: personhood, comfort care, autonomy, knowing the person and support for relationships (94). The staff PDC is a questionnaire that utilizes Likert scales to gain understanding of the extent that staff report performing PCC behaviours. This questionnaire is self-reported by staff members and has demonstrated face validity and conceptually distinct constructs (Cronbach's alpha 0.86-0.91) (121). The staff PDC is given a maximum score out of 100. Examples of items include the number of residents that the staff member knows their preferred music; the number of residents that staff are able to have personal conversations with; and the number of residents that decide where they want to eat.

The Dining Environment Audit Protocol (DEAP) (124) is an instrument that assesses the physical environment of dining spaces in LTC (26). The DEAP tool has demonstrated inter-observer reliability with intraclass correlations for homelikeness and functionality scales of 0.68 and 0.70, respectively (39). Data was collected by a trained provincial coordinator once at the beginning of data collection for the home, when the dining room was empty (n=82). Homelikeness and functionality of the dining room are rated on a scale from 1 (low) to 8 (high) as seen in Appendix E.

The Resident Food and Foodservice Satisfaction survey (122) is an instrument that is completed in an interview with residents and consists of 21 questions. There are three components to the survey: aspects of food, aspects of food service and quality of life (see Appendix B). Each question is asked with responses from 1 (less than half the time) to three (most of the time). This instrument was only conducted in person with residents that had adequate cognition to complete (17). This survey has a total score out of 63. The interRAI Long Term Care Form is a standardized checklist which assesses the health, mental and quality of life of LTC residents (123). Key items from this instrument were collected by trained provincial coordinators who interviewed staff members familiar with the resident's current care and behaviour. The components assessed included: cognitive performance, pain, activities of daily living, depression and challenging behaviours. The items that were used for this analysis were the Depression Rating Scale (DRS) (Appendix C) which is given an

overall score that is out of 33 (123,129), and the Cognitive Performance Scale (CPS) which is out of 6 (see Appendix G) (128).

The Mini Nutritional Assessment- Short Form (MNA-SF) is a tool used to evaluate risk of malnutrition. Data was gathered from resident charts, the residents themselves or care providers familiar with the resident. The MNA-SF collects information on food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and body mass index (see Appendix D). Each of these components were summed, creating a total score out of 14, where a higher score indicates better nutritional status. The MNA-SF has been deemed as a valid and reliable instrument in assessing nutritional risk (130,131).

Food intake for each resident was assessed on three non-consecutive days, including one weekend day, throughout four weeks. Food intake data was gathered by weighing the main plates before and after meals and fluid and side dish consumption was estimated. The detailed protocol for collecting weighed and estimated food intake data has been previously described (17). Food and beverages consumed between meals were estimated based on questioning and or observing residents and or staff. The evening snack and any other food provided to the resident after supper was recorded by home staff. The home recipes were gathered and assembled in a program called Food Processor (version 10.14.1) and a nutrient analysis was used to estimate intake for each resident based on the portion of all food and fluid consumed. An estimated average energy and protein intake variable for each resident was created by averaging each of the daily total intake values. Energy intake was a proxy for total food intake while protein was a proxy for the quality of the diet. Ethics clearance was provided by review boards from the Universities of Waterloo, Alberta, and Manitoba and Université de Moncton. Where required, ethics approval at individual nursing homes was also completed. Informed written consent was provided by residents or in the event of cognitive impairment, their alternative decision maker. Staff participants also provided informed written consent.

5.2.3 Data Analysis

Descriptive analyses were performed for resident characteristics and dementia care and general care units. To determine statistically significant differences, student t-tests were

computed using a p-value of 0.01. To utilize the MTS appropriately, overall scores were created that captured social sound, orientation cues, excess noise without social sound, excess noise including social sound, the M-RCC positive:negative ratio and the M-RCC assistance-only ratio. The M-RCC positive:negative ratio includes all 26 PCC/RCC practices and the M-RCC assistance-only ratio includes the seven PCC/RCC practices specific to those requiring eating assistance. A resident to staff ratio was created for each mealtime observation. Environmental measures for lighting, noise, sound and humidity were kept continuous for analyses, as their distribution was not aligned with the recommended cut points found in the literature and categorizing the variables would result in the loss of information. The 4-6 observations of each MTS score and summary scales were averaged. Medians were used for variables that had high level of variation and outliers (eg. lighting, humidity, sound, number of residents, number of residents eating alone, number of residents eating with others, number of other persons, number of family/volunteers, total excess noise without social noise, meal length, and the resident to staff ratio). For music availability, which is a categorical variable (0= no music, 1= music), the mean was computed across 4-6 observations. From this mean, this variable was categorized as music available less than 50% of the time and more than 50% of the time.

To address the first objective, a secondary data analysis of the M3 data was performed, using data from the dining room/unit level as collected from the MTS instrument, and the resident level (energy and protein intake). Kilocalorie per kilogram body weight (kcal/kg) and grams of protein per kilogram body weight (g/kg) were created by averaging intake variables across three days and dividing by each resident's kilogram of body weight. Using hierarchical regression analysis, the associations between each score and summary scale was computed for kcal/kg of energy and g/kg of protein, while adjusting for sex, age and CPS. Analyses were stratified by dementia care and general care units, as it was anticipated that there would be physical and psychosocial environment differences at mealtimes in these units. Descriptive analysis of each MTS score was computed for both units. There were a total of 184 residents in dementia care units; those with less than 6 meals of food intake data were excluded and those with missing cognitive performance scores were

excluded, leaving a total of 180 residents for analysis. There were a total of 455 residents in general care units; four were removed for having less than 6 days of food intake data, five were missing body weight data and three were missing cognitive performance scores, leaving a total of 443 residents for analysis. A p-value of <0.25 was used as cut off for inclusion into the multivariate model. Multivariate models were created using backwards elimination and a final p-value of 0.05 was used as a cut off for determining final models. This multivariate process was performed for both kcal/kg and g/kg for protein intake in both the dementia and general unit. Province and site were also included in full models. Multicollinearity was assessed for each final model; however none of the correlations were greater than 0.5 indicating that multicollinearity was not present.

For the second objective, the dataset was reorganized with each MTS observation (1-6) to allow for comparison of variables within the MTS to physical, social and PCC summary scales from that observation. Descriptive statistics were computed for each MTS variable, the mean, standard deviations and ranges were determined. Bivariate analysis with each MTS summary scale was performed; those that had a p-value<0.25 were included in the multivariate model for that summary scale. These and the multivariate models were adjusted for dining room to account for any clustering effect. A multivariate model of all variables found to have potential association with each summary scale was built and backwards elimination was performed using a p-value of 0.05 as the cut off. The final model was achieved when all variables had a p-value of 0.05 or lower. Collinearity tests were performed using the tolerance values and cooks d to gather information on the existing relationships between each of the variables that remained in the final model. For the physical scale, there was multicollinearity as the total number of residents variable had a tolerance value of 0.06 (less than 0.2) and was moderately associated with the number of staff passing food (0.51). Removing these variables individually did not alter the general interpretation of the final model, thus supporting their inclusion. For the social scale, there was some multicollinearity as the tolerance value for residents requiring assistance was 0.16; however, when removing this variable the general interpretation of the model remained the same, thus supporting the inclusion of this variable in the final model.

In addressing the third objective, the construct validity of the MTS physical, social and PCC summary scales was assessed. Descriptive statistics were computed for each of the instruments that the scales were compared to, which included: the DEAP summary scales of homelikeness and functionality; staff person directed care (PDC) score; the resident Food and Food Service Satisfaction survey; the resident DRS from the interRAI; resident energy and protein intake; the resident total M-RCC positive:negative ratio; nutritional risk from the MNA-SF; and CPS score. Since the MTS was collected at the unit level, when performing correlations to resident level instruments the median was used for instruments that had a high level of variance (energy and protein intake and resident level M-RCC ratio) and the mean was used for those that had little variability. A Spearman rho correlation was computed for each instrument with the average MTS summary scale scores, a p-value of 0.05 was used as a cut off to indicate statistical significance. To determine the correlation between CPS and the physical, social and PCC scales, the CPS score was dichotomized into none to mild cognitive impairment (scores 0-2) and moderate to severe cognitive impairment (3-6). Using a Student t-test, it was determined if the MTS summary scales varied by cognitive status.

To address research question 4, chi squared tests were computed to determine if the provinces were statistically different from one another. The MTS numerical variables were averaged based on the 4-6 observations in the 82 dining rooms. For music availability, which is a categorical variable (0= no music, 1= music), the mean was computed across 4-6 observations. From the mean, this variable was categorized as music available less than 50% of the time and more than 50% of the time for each dining room. For numerical variables, analysis of variance was computed and Tukey's tests were conducted to determine significant differences among the four provinces. For the categorical variable (music availability) a chi squared test was computed to determine if the provinces were statistically different from one another, if significant ($p<0.01$), a Fisher's test was performed. All analyses were performed using SAS University (version 9.4).

5.3 Results

5.3.1 Determinants of Energy and Protein Intake in Dementia Care Units

The residents in dementia care units had an average age of 85.92±8.20 years of age, approximately 28% were male and the average CPS score was 3.69±1.45 (out of six). Residents living in dementia care units had an average intake of 1675.78 calories (standard deviation (SD) = 418.27), average protein intake of 62.90g (SD= 18.71), with an average of 26.98 kcal/kg (SD= 7.62) and 1.02g of protein/kg (SD=0.35) (table 5.1). These values were significantly higher than residents living in general care units. The average M-RCC ratio in these units was 1.66±0.53, the mean total excess noise score was 11.68±2.70 and mean orientation cue score was 3.79±2.29. This orientation score in dementia care units was significantly lower than for general care units. Additionally, dementia care units had an average MTS physical environment rating of 5.54±0.77, an average social environment rating of 4.91±0.76 and average PCC rating of 5.30±0.71.

Table 5.2 provides the descriptive statistics for MTS variables. In dementia care units, the mean resident:staff ratio was 6.33±2.79, the mean total number of people in the dining room was 26.34±9.8, the mean social sound score was 2.78±0.69 and the M-RCC assistance only ratio mean was 2.11±0.94. Table 5.2 provides the bivariate associations between the MTS variables and energy and protein intake adjusted for age, gender and CPS score using cluster regression for those residing in dementia care units. Those negatively associated ($p<0.25$) with kcal/kg and protein g/kg were the M-RCC ratio (includes all 26 RCC practices), the person centered environment summary scale and the number of residents eating alone. Humidity and music availability were negatively associated with energy intake only. The following MTS variables were negatively associated with protein intake only: length of meal, temperature and number of residents eating alone. None of the MTS variables were positively associated with protein intake exclusively.

The multivariate model for energy intake (kcal/kg body weight) is found in table 5.3. CPS score (β (parameter estimate) = 0.94, $p=0.01$) and site within province ($p=0.02$) were significant ($p<0.05$) predictors of energy intake in dementia care units. This initial model had an R^2 of 0.23 and adjusted R^2 of 0.11. Adjusting for these covariates, the number of residents

eating alone was the only MTS variable associated with energy intake (β= -0.60, p=0.05); this association was negative, meaning the more residents eating alone was associated with lower energy intake. CPS score did remain significant indicating that those with more impaired cognition had higher intakes; however, site within province was no longer significant. The final model had R^2 values that were not different than the base model.

The multivariate model for protein intake (protein g/kg body weight) of residents in dementia care units is found in table 5.4. CPS score (β= 0.05, p=0.01) and site within province (p<0.0001) were found to be significant (p<0.05) predictors of protein intake in dementia care units. Adjusting for these covariates, length of meal (β= -0.01, p=0.04), number of residents eating alone (β= -0.05, p=0.01) and the M-RCC ratio (β= -0.51, p<0.0001) were negatively associated with protein intake. Thus longer meals, more residents eating alone and more positive person centered and relational care interactions were associated with lower protein intakes. CPS score remained significant; however, site within province was no longer significant as this variance was now explained by the MTS variables. The final model had an R^2 of 0.36 and adjusted R^2 of 0.26.

5.3.2 Determinants of Energy and Protein Intake in General Care Units

Table 5.1 provides the resident characteristics in general care units; the average age was 87.12±7.65 years of age, approximately 33% of residents were male and the average CPS score was 2.53±1.80 (out of six), significantly lower than residents in dementia care units. Residents who lived in general care units had an average kilocalorie intake of 1537.85 (SD= 396.30), average protein intake of 56.86g (SD= 17.21), average kcal/kg/day of 23.56 (SD= 7.86) and average of 0.87g of protein/kg/day (SD= 0.34). The average M-RCC ratio in these units was 1.81±0.68, the mean total excess noise score was 11.78±3.06 and mean orientation cue score was 5.87±2.25. Additionally, general care units had an average MTS physical environment rating of 5.58±0.91, an average social environment rating of 5.09±0.96 and average PCC rating of 5.54±0.78.

Table 5.5 provides the descriptive statistics for MTS variables in general care units. In general care units, the mean resident:staff ratio was 7.87±5.17, the mean total number of people in the dining room was 33.17±17.71, the mean social sound score was 2.95±0.8 and

the M-RCC assistance only ratio mean was 2.68±1.62. As seen in table 5.5, bivariate analysis using cluster regression identified the following variables to be positively associated ($p<0.25$) with both energy and protein intake: sound as measured with the environmental meter, number of other persons in the dining room, excess noise and excess noise without social sound. None of the MTS variables were negatively associated ($p<0.25$) with both energy and protein intake. Energy intake was positively associated ($p<0.25$) with social sound only; none of the MTS variables were negatively associated ($p<0.25$) with energy intake. Protein intake was positively associated ($p<0.25$) with length of meal and the M-RCC ratio, while negatively associated ($p<0.25$) with the M-RCC assistance-only ratio.

The multivariate models for energy intake (kcal/kg body weight) and protein intake (g/kg) for residents in general care units are found in tables 5.6 and 5.7. Site within province ($p=0.01$) was the only significant predictor ($p<0.05$) of energy intake in model 1 and model 2 for general care units, meaning that no MTS variables predicted energy intake in general care units. This energy intake model had an R^2 of 0.13 and adjusted R^2 of 0.05. The protein model had an R^2 value of 0.20 and adjusted R^2 of 0.13, with the final model including total number of other persons in the dining room ($\beta= 0.06$, $p=0.03$), M-RCC assistance only ratio ($\beta= -0.01$, $p=0.02$). Site within province ($p<0.0001$) remained significant from the base model but CPS score ($\beta= 0.02$, $p=0.04$) became significant in this final model. Those who had more cognitive impairment had a higher protein intake, as did those eating in dining rooms with more total people present. However, more positive person centered and relational care from staff was associated with a lower protein intake in general care units.

5.3.3 MTS Variables Associated with the Physical, Social and Person Centered Summary Scales

Table 5.8 displays descriptive statistics for MTS variables and associations between these variables and the physical, social and PCC summary scales on the MTS. There were 376 individual MTS observations and bivariates were adjusted for dining room to account for the potential cluster effect. The average number of residents in the dining room during mealtimes was 23.12±14.06, the mean resident to staff ratio was 7.22±5.17, the mean M-RCC ratio was 1.73±0.8 and the mean orientation cue score was 5.56±1.09. Surprisingly, less than 25% of dining rooms had music available during mealtimes; total excess noise and

social sound was generally low with average scores of 11.43±3.98 and 2.85±1.09, respectively.

The MTS variables positively associated ($p<0.25$) with the physical, social and PCC summary scales were the M-RCC ratio and the M-RCC assistance-only ratio. The MTS variables that was positively associated ($p<0.25$) with the social and physical environments was music availability. Social sound and excess noise were positively associated ($p<0.25$) with the social and PCC ratings. The following variables were negatively associated ($p<0.25$) with the physical environment: temperature, sound measured by the meter, number of residents, number of residents eating together, number of residents requiring total assistance, number of staff providing assistance, number of staff involved in passing, number of family/volunteers, number of total people in the dining room, excess noise and excess noise without social sound; while length of meal was positively associated ($p<0.25$) with the physical environment. Social environment was positively associated with the number of residents requiring total assistance, while length of meal was negatively associated ($p<0.25$) with the social environment. PCC rating was positively associated with excess noise without the social score.

Table 5.9 provides the multivariate model for the physical environment. Number of staff involved in passing ($\beta= -0.12$, $p=0.02$) and number of residents ($\beta= -0.03$, $p=0.01$) were negatively associated ($p<0.05$) with this score; while music availability ($\beta= 0.29$, $p=0.03$) and the M-RCC ratio ($\beta= 0.29$, $p<0.0001$) were positively associated ($p<0.05$) with the physical environment. These associations were unsurprising. This model had an R^2 of 0.67 and adjusted R^2 of 0.55. Table 5.10 provides the multivariate model for the social environment. Social sound ($\beta= 0.31$, $p<0.0001$), number of residents that required assistance ($\beta= 0.11$, $p=0.02$) and the M-RCC ratio ($\beta= 0.45$, $p<0.0001$) were all positively associated ($p<0.05$) with the social environment summary scale. This model had an R^2 value of 0.54 and adjusted R^2 of 0.41. Table 5.11 provides the multivariate model for the PCC rating. Lighting ($\beta= 0.01$, $p=0.04$), excess noise ($\beta= 0.05$, $p<0.0001$) and the M-RCC ratio ($\beta= 0.52$, $p<0.0001$) were positively associated ($p<0.05$) with the PCC rating scale. This model had an R^2 of 0.51 and adjusted R^2 of 0.37. The relatively substantial R^2 for final models for these MTS summary

scales indicates that a good amount of the variance in the summary scales is explained by these MTS variables; however, not all the variance was explained by the MTS variables alone.

5.3.4 Construct Validity of the MTS Physical, Social and Person Centered Summary Scales

Table 5.12 provides the descriptive statistics for each of the measures used to assess the construct validity of the MTS summary scales. The MTS physical scale was positively associated ($p<0.05$) with the DEAP functionality scale ($\rho= 0.52$, $p<0.0001$), the MTS PCC summary scale ($\rho= 0.47$, $p<0.0001$), the MTS social summary scale ($\rho= 0.45$, $p<0.0001$), the resident level M-RCC ratio ($\rho= 0.37$, $p=0.001$) and the MNA-SF ($\rho= 0.40$, $p=0.0002$). The social scale was positively associated ($p<0.05$) with the MTS physical summary scale ($\rho= 0.47$, $p<0.0001$), the MTS PCC summary scale ($\rho= 0.70$, $p<0.0001$), the MNA-SF ($\rho=0.26$, $p=0.02$) and negatively with the CPS score ($t (634) = 4.53$, $p<0.0001$). The PCC summary scale was positively associated with the MTS physical summary scale ($\rho= 0.47$, $p<0.0001$), the MTS social summary scale ($\rho= 0.70$, $p<0.0001$), the resident level M-RCC ratio ($\rho= 0.29$, $p=0.01$), the MNA-SF ($\rho= 0.26$, $p=0.01$) and negatively associated with CPS score ($t (634) = 2.57$, $p=0.01$).

5.3.5 Prevalence of MTS Variables and Differences among Alberta, Manitoba, New Brunswick and Ontario

Table 5.13 provides the descriptive results for MTS variables across provinces and denotes where statistically significant differences exist. Of the 32 homes in this study, 10 were for-profit and 22 were not-for-profit (17), with New Brunswick including the most number of not-for-profit homes (87.50%) and Alberta including the highest number of for-profit homes (50%) included in this sample. The mean home age was of this sample was 31.22; on average Ontario included the newest homes (25.88 years) and Manitoba included the oldest homes (35.38 years). Manitoba dining rooms had the lowest temperature ($\mu= 21.73(SD= 0.51)$) and Ontario had the highest average temperature ($\mu= 24.23(SD= 1.10)$), which was significantly higher ($F (3, 82) = 14.94$, $p<0.0001$) than other provinces. Length of meal was longest, on average in New Brunswick dining rooms ($\mu= 65.96(SD= 21.92)$), while

Alberta had the shortest meal lengths (μ= 49.08(SD= 9.05)). New Brunswick meals were significantly longer than meals in Alberta ($F(3, 82) = 4.49$, $p=0.01$). Ontario had the lowest number of family/volunteers (μ= 0.81(SD= 0.91)) while Alberta had the highest number of family and volunteers present during mealtimes (μ= 2.52(SD= 1.52)), which was significantly higher than all other provinces ($F(3, 82) = 6.66$, $p=0.0005$). Manitoba had the lowest M-RCC ratio (μ= 1.24(SD= 0.13)) which was significantly lower than Alberta and Ontario ($F(3, 82) = 8.55$, $p<0.0001$). Manitoba also had the lowest M-RCC assistance ratio (μ= 1.43(SD= 0.42)), which was significantly lower than Ontario only ($F(3, 82) = 9.39$, $p<0.0001$).

Number of other persons in the dining room was lowest in Ontario (μ= 0.55(SD= 0.47)), which was significantly lower than Alberta only ($F(3, 82) = 21.38$, $p<0.0001$). Manitoba had the lowest social sound score (μ= 2.44(SD= 0.53)), which was significantly different from New Brunswick only ($F(3, 82) = 7.88$, $p=0.0001$). Sound, as measured by the environmental meter, was lowest in New Brunswick dining rooms (μ= 50.58(SD= 8.11)), which was significantly different from the rest of the provinces ($F(3, 82) = 21.03$, $p<0.0001$). Ontario had the lowest excess noise score (μ= 9.55(SD= 1.55)), which was significantly lower than Alberta and New Brunswick ($F(3, 82) = 17.47$, $p<0.0001$). Ontario also had the lowest excess noise excluding social sound score (μ= 6.85(SD= 1.46)), which was significantly lower than Alberta and New Brunswick ($D(3, 82) = 11.38$, $p<0.0001$). Manitoba had the lowest physical summary scale score (μ= 5.14(SD= 0.56)), the lowest social summary scale score (μ= 4.59(SD= 0.74)) and the lowest PCC summary scale score (μ= 5.23(SD= 0.67)). The physical score in Manitoba was significantly lower than New Brunswick only ($F(3, 82) = 3.95$, $p=0.01$). All provinces had moderate to low summary scales, with no province having means in the higher range (i.e., 6-8).

5.4 Discussion

This study demonstrates that the needs of residents in dementia care units differ from those in general care units. Residents in dementia care differed ($p<0.01$) from those in general care units as they had more significant cognitive impairment (higher CPS score), consumed more energy and protein and thus stratifying analyses by dementia care and

general care units was appropriate (table 5.1). Additionally, the only unit level characteristic that was significantly different across unit types was the orientation cue score, which was significantly lower in dementia care units compared to general care units. This finding is troublesome as orientation cues, such as food aroma, can stimulate appetite (23,108,113,155) thus these components should be prioritized in both unit types. The summative scales and M-RCC ratio were consistent across unit types.

Cognitive status was significantly associated ($p<0.05$) with resident energy and protein intake in dementia care units and protein intake in general care units. Prior research has shown that the environmental needs of dementia care residents are unique (14,22,27,29,33,75,78,81), which align with the findings of this study. All multivariate models for energy and protein intake had essentially the same R^2 as the initial model, therefore the individual variables in the physical and psychosocial environments as assessed by MTS were minimally explaining the variance in intake for these residents. Individual characteristics, such as age, gender and CPS score, are of greater importance to predicting protein and energy intake (137), although CPS was the only variable consistently associated with intake across models in this study. The only MTS characteristic significantly associated with energy and protein intake in dementia care units was the number of residents eating alone with a higher number eating alone in these units being associated with lower protein and energy intake. While there is limited research on seating arrangements in LTC, two studies did demonstrate that eating with others significantly increases calorie intake (120,156); however, 24 hour dietary recall was used (120), there were small sample sizes (n=50, n=13) and they did not include residents in long term care (120,156). Additionally, it is known that residents eating alone are subject to fewer social interactions (77), which may negatively influence intake. This finding is supported in table 5.8 as number of residents eating alone was also negatively correlated with the physical, social and PCC summary scales. These associations in this study may be highlighting the importance of quality seating arrangements and minimizing the number of residents eating alone during mealtimes. Residents should be provided more choice in seating arrangements (157) and when assigned seating is used there should be careful consideration of tablemates (72,85,154). This variable

was only significant in dementia care units suggesting that residents in general care units may be resilient to the potential effects of seating arrangements. Protein intake for residents in dementia care units was also negatively associated with length of meal which may be due to increased waiting time, increased agitation, and thus reduced food intake (71). It could however, also indicate more eating challenges. Interestingly, protein intake was also negatively associated with the M-RCC ratio; this ratio was positively associated with the physical, social and person centered summary scales at the multivariate level, demonstrating its potential importance. Yet the negative association may suggest that PCC and RCC practices are not enough to increase protein intake and must be implemented in collaboration with additional meal quality, meal access and mealtime experience characteristics (15,137). Further analysis considering potential confounders on intake is warranted to better understand these associations.

In general care units, none of the MTS variables were significantly associated with energy intake at the multivariate level (97,98). The stress threshold is greater for residents who do not have dementia, thus residents in general care units have an increased ability to process their environment and may be more resilient to the physical and psychosocial environments (81,97,98). The lack of associations between the MTS variables and energy intake in general care units may be a result of this resilience. While this hypothesis is important, residents eating alone was the only variable associated with energy intake in dementia care units, therefore the MTS variables are generally poor predictors of energy intake in both dementia care and general care units. In general care units, the number of other persons present in the dining room was positively associated with protein intake. Other persons included nurses who entered the dining room but were not involved in mealtime activities, health care aides and other home staff or management. It is important to note that other persons was not significant in dementia care units which may be due to the lower average number of these other persons (e.g. 2.27 vs. 1.28) in those dining rooms, potentially due to home policy to limit distractions. The presence of these other persons may have resulted in meaningful social interactions and thus increased protein intake, emphasizing the importance of relational care. The eating assistance component of the M-RCC was negatively

associated with protein intake, consistent with the dementia care units. Interestingly, the M-RCC assistance-only ratio was significant in the general care units while the overall M-RCC ratio was only significant in dementia care units. This may be due to a greater level of inconsistency in RCC practices for those that require assistance in general care units than in dementia care units, as indicated by a larger range and standard deviation in general care units (see table 5.2 and 5.4).

The MTS physical environment summary scale was positively associated with music availability and the M-RCC ratio, but negatively associated with the number of staff involved in passing food and number of residents in multivariate analyses. Age appropriate music in the dining room, for example soothing music or music that the residents prefer (140) has been found to be therapeutic as it can positively stimulate residents, transforms moods (106) and reduce agitated behaviours (24,29,158,159). Interestingly, music has also been found to improve social interactions (75) which this study supports, as music was positively associated ($p=0.07$) with the social environment at the bivariate level. The negative association between number of staff passing food and number of residents and the physical environment promotes the need for smaller dining spaces in LTC with fewer residents. Larger dining spaces have been associated with increased agitation while smaller spaces have been found to enhance well-being (160), reduce declines in activities of daily living (161) and improve quality of life (162). More residents in a dining room requires more staff involved in passing to ensure that food is served in a timely way; a higher number of staff handing out food to residents may increase commotion and traffic in the dining area. This increased traffic may reduce resident comfort and the overall atmosphere of the dining environment. Importantly, the physical scale was positively associated ($p<0.05$) with the functionality scale on the DEAP ($p<0.0001$). This finding demonstrates that these measures, which both assess the physical features of the dining environment are producing similar interpretations of the environment, despite being collected at different times and based on different constructs, suggesting that the physical scale on the MTS is construct valid.

The social summary scale was positively associated ($p<0.05$) with the social sound score in multivariate analyses. This finding is important as it demonstrates that the social

scale is capturing the social elements and ambiance of the dining room. Interestingly, the social summary scale was also positively associated ($p<0.05$) with the number of residents that required assistance, which may be due to an increase in social interactions between staff and residents while staff are providing eating assistance. This is supported in the literature as one study found that there was reduced social interactions between staff and residents when residents required little assistance (85,163). For example, staff may be socializing with the residents requiring assistance or other residents sitting at the same table with that resident. Additionally, staff members who had adopted a PCC philosophy may engage more with residents as promoting social interactions was one of the emerging themes of PCC as discussed by Reimer and Keller (85). This is supported by the significant ($p<0.05$) association in multivariate analyses between the social summary scale and the dining room level M-RCC, as interacting in conversation with residents results in higher RCC practices and vice versa (77,87,88,150). It is recommended that LTC homes continue to promote meaningful social interactions through the implementation of RCC.

Increased lighting was found to be positively associated ($p<0.05$) with the PCC rating in multivariate analyses. The range of lighting in these LTC homes suggests that residents are provided with lower lighting than recommended as the minimum was 72.15 lux and the maximum was 1505 lux. Ambient lighting has been recommended as 320 to 750 lux (164) while others recommend as high as 2000 lux (75,165). The implementation of PCC practices must be performed in conjunction with environmental changes as characteristics such as adequate lighting create a supportive work environment to facilitate PCC (166). Additionally, excess noise was positively associated with the PCC rating which may be a result of a relatively low rating of excess noise in these dining rooms (maximum score was 26 out of 44). There is limited research regarding noise levels and the ability to execute PCC; however, sound that was measured with the environmental meter, was not associated with PCC supporting this hypothesis, as social sound was included in the excess noise score.

The dining room level M-RCC ratio was significantly associated with all three summary scales suggesting that RCC practices during mealtimes are important for improving the overall dining environment and ambiance. A homelike dining environment reinforces

culture change and creates more flexible work environments for staff (167) and more functional environments allow staff to navigate the dining room and work at a more relaxed pace during mealtimes (78,106), thus encouraging RCC behaviours. Further, construct validity is demonstrated in that the resident level M-RCC collected at the resident level on three separate days was associated with all three MTS scales collected by a different assessor at the dining room level (table 5.12).

All three multivariate models for the physical, social and PCC summary scales had relatively high R^2 values indicating that a good portion of the variance is being explained by the MTS variables modelled, further supporting the validity of these scales. As well, all MTS summary scores were associated with each other (table 5.12). This finding is important as it suggests that these environments are dependent on one another and together contribute to the overall mealtime experience as supported by the Five Aspects of Meal Model (15,69). The Five Aspects of Meal Model identifies that the room (eg. physical space), social interactions, food products and the management control system (eg. staff training) contribute to the overall dining atmosphere while also interacting with each other (68). The social and PCC scales had the highest correlation (ρ=0.70), while the physical and social scales had the lowest (ρ=0.45), suggesting that the MTS is able to effectively assess differences between environments by evaluating the three scales independently as conceptually distinct constructs of the overall dining environment.

This study did not find associations between the summary scales and intake; however, all of the scales were significantly associated with nutritional status as measured by MNA-SF, further demonstrating their construct validity. This finding is important as the Quality Nutrition Outcomes Long Term Care model suggests that nutritional status is an intermediate outcome to overall quality of life (138,139), which is further supported by the literature which suggests that environmental factors are associated with resident quality of life (80,82,87,99,102,112,124,125,134–136,141,143,162). Future work should measure quality of life when MTS is used to determine associations with this resident outcome. Additionally, CPS score was associated with the PCC and social summary scales; specifically, these scores decreased for residents with moderate to severe cognitive impairment. While this finding is

troublesome as residents with dementia require supportive environments (85,87), this does support the construct validity of the social and PCC scales. Persons with moderate to severe dementia tend to communicate non-verbally thus reducing opportunities for social interactions (77,168), which would reduce the overall social environment score in dementia care units due to a higher prevalence of residents with moderate to severe dementia. This finding also supports the construct validity of the PCC scale as non-verbal residents tend to interact with staff in a task-focused manner (87) and stress of staff caring for residents with cognitive impairments may increase (169), potentially impeding their ability to care for residents using PCC practices.

In this study, few of the MTS variables were different across provinces suggesting that LTC physical and psychosocial environments at mealtimes are relatively similar. In terms of the physical environment, it was found that the environmental measures of temperature and sound significantly differed. Differences in temperature may be due to varying provincial regulations and recommendations. For example, Ontario regulations dictate a minimum of 22 degrees in LTC, while in New Brunswick and Manitoba the regulations stipulate 21 degrees (133,170,171). Noise is currently not regulated, it is only recommended that noise be kept to a minimum in Ontario (133). Differences in social interactions and PCC/RCC practices exist due to a lack of regulations to enhance the dining environment by implementing homelike and PCC or RCC practices. Ultimately, differences in RCC practices are a result of staff training which may differ greatly across provinces, suggesting that provinces should exchange experiences on delivery of care to promote relational care consistency on a national level (172). Additionally, length of meal was significantly different across provinces, with Alberta having the shortest meals. As discussed earlier, length of meal was negatively associated with protein intake which may be a result of longer wait times during meals resulting in increased agitation and a reduction food intake (71). This is further supported by the finding that Alberta had significantly higher counts of family/volunteers in the dining room during mealtimes which may provide staff increased assistance and reduce resident wait times.

Manitoba received consistently lower scores for the summary scales, however this was only significant ($p<0.01$) for the physical scale. This may be due to lack of awareness of the benefits of an enhanced physical environment or regulations that influence the mealtime environments. To corroborate these ratings, these scale values were consistent with the individual variables that contribute to these summary scales. For example, Manitoba received the lowest rating for social sound and the lowest score for the overall social scale suggesting that there was less social interaction in Manitoba than in the other provinces. Additionally, Manitoba received the lowest M-RCC ratio on average which contributed to its lowest PCC summary scale rating. Alternatively, Ontario received the highest M-RCC ratio, yet New Brunswick received the highest PCC rating; yet, the overall ratings for this summary scale for Ontario and New Brunswick were very similar ($\mu= 5.55$ and $\mu= 5.67$, respectively). These findings further support the validity of the overall summary scales, as they can discriminate differences in individual MTS variables. Finally, improvements in the physical and psychosocial dining environment need to be made across all provinces, as indicated by the relatively low (< 6) physical, social and PCC ratings. This study demonstrates that generally the provinces are not very different in MTS characteristics, and all can improve with directed interventions.

5.4.1 Strengths and Limitations

This analysis cannot be considered representative of all long term care homes and residents in Canada or worldwide. Since data was only collected from Alberta, Manitoba, Ontario and New Brunswick, it cannot be assumed that these homes represent the LTC population within Canada. Homes within each province were purposively sampled, rather than randomly selected and thus are potentially biased; however, procedures in M3 promoted identifying and recruiting homes to attain diversity by including those with residents who were cultural minorities, private and corporate, for-profit, not-for-profit, faith-based, rural and urban. While these limitations may introduce bias into the prevalence estimates of the sample, it is likely that associations used to assess construct validity are less influenced by these selection biases.

Food Processor was used for the calculation of energy and protein intake. While food composition software is cost effective compared to chemical analysis, there are limitations associated with this method which include: variability in food composition, variability in energy conversion factors, accuracy of nutrient values, converting units and household measures into weight, assigning weight factors and errors in the nutrient analysis program based on the contents of the recipe (145–147). Additionally, foods that are not found in the database require a substitute which may be different from the item used in the recipe and nutrient values may differ among countries (147). Despite these limitations, weighed food intake is the next best way to assess food intake; duplicate portions in LTC for a direct chemical analysis would be prohibitively expensive and unrealistic (145). Clear protocols were used in the M3 study to promote consistency in nutrient analysis. Another limitation is that the MTS was not always performed at specific meals where food intake data was being collected. There is the potential that the physical and psychosocial environments could have differed among meals; however, both of these items were collected a number of times increasing the reliability of the results.

There were also limitations in some of the measures used to determine construct validity of the MTS. The interRAI LTCF was completed by interviewing a single staff member for each resident who knew them best, but this could have introduced bias. Recently, a review was conducted that assessed the validity of the variety of PDC measures, including the staff PDC (148). This review stated that construct validity and internal consistency was good for this tool; however, test-retest reliability has not been demonstrated and it was unclear if the two dimensions (PDC and person centered environment) should be interpreted autonomously (148). Also, the number of staff participants in each home varied between ten and twenty, potentially affecting the results due to the unequal sample sizes for each home. The Food and Food Service Satisfaction questionnaire also had minimal development and testing (122) and was only completed by a sub-sample of the M3 participants with adequate cognition. Due to these measurement limitations, it is not surprising that the MTS scales were more highly associated with measures based on systematic observations, as seen with the M-RCC and DEAP functionality scale.

An important limitation of this study is that more in depth home level and resident level variables were not analyzed. For example, staffing levels, organizational policies, physical activity levels were not included as covariates. It is important to acknowledge that these variables influence resident outcomes, such as quality of life. Quality of life was also not measured in the M3 study and environmental dining room factors may have a greater impact on this resident outcome (80,82,87,99,102,112,124,125,134–136,141,143,162). Further, qualitative data was not collected as part of M3, which would have allowed for insight on resident, staff and family perspectives, through interviews or focus groups, to better understand environmental characteristics that contribute to the resident mealtime experience. While this data was not available or used in this analysis, the purpose of this study was not to fully explain all covariates of dependent variables (e.g. energy intake, physical summary scale), but to demonstrate construct validity of the MTS and its summary scales.

A significant issue of bias was due to the use of different assessors in the M3 study to complete MTS, potentially leading to measurement error due to subjectivity of some MTS scores and summary scales. This would potentially weaken the correlations between the MTS summary scales and the variety of instruments used to determine construct validity. As well, different assessors could bias the prevalence estimates across the provinces resulting in potentially spurious differences. These analyses suggest that spurious differences across provinces were minimal as the majority of MTS characteristics were consistent across provinces, and province was generally insignificant and controlled for in the multivariate analyses for energy and protein intake. Yet, some inconsistencies between individual variables and summary scales in these provincial comparisons suggest either more subjectivity in summary scale ratings, or consideration of multiple variables to provide the overall physical, social and PCC ratings. Using the same individuals to assess all instruments in all of the provinces would overcome this issue; however, this would be extremely time consuming and expensive. The M3 study reduced the risk of this limitation by extensively training research assistants, although it is still important to note that this method potentially increased measurement error.

5.5 Conclusion

This secondary data analysis contributes to the prevention and treatment of malnutrition in Canadian LTC homes by narrowing the knowledge gap through the examination of the MTS variables and summary scales and food intake and nutritional status. MTS summary scales were positively associated with nutritional status, but not food intake. The literature has outlined a variety of benefits to creating optimal physical and psychosocial environments; however, it was unclear before now, what these environments should consist of. This analysis outlines which characteristics significantly contribute to ambiance, as measured by physical and social environments and PCC summary scales; relational care practices are a key component for ambiance as noted in this analysis. Construct validity of scales was demonstrated and this study supports the use of the MTS to assess the physical and psychosocial environment; however, researchers must be trained due to potential subjectivity of the ratings. The data collected by the MTS in the four Canadian provinces demonstrated prevalence of various aspects of the environment providing opportunities where provinces and homes can improve; prevalence estimates of influential factors that lead to improved ambiance should be the focus.

Table 5.1. Characteristics of Residents and Units in Dementia Care (n=180, n=24) and General Care Units (n=443, n=58)

	Dementia Care Unit Mean (SD)	General Unit Mean (SD)
Resident Characteristics		
Age (years)	85.92 (8.20)	87.12 (7.65)
CPS Score	3.69 (1.45)[a]	2.53 (1.80)[b]
Calorie intake (kcal)	1675.78 (418.27)[a]	1537.85 (396.50)[b]
Kcal/kg body weight	26.98 (7.62)[a]	23.56 (7.86)[b]
Protein intake (g)	62.90 (18.71)[a]	56.86 (17.21)[b]
Protein g/kg body weight	1.02 (0.35)[a]	0.87 (0.34)[b]
Unit Characteristics		
Orientation Cues Score	3.79 (2.29)[a]	5.87 (2.25)[b]
Total Excess Noise Score	11.68 (2.7)	11.78 (3.06)
M-RCC Ratio (pos:neg)	1.66 (0.53)	1.81 (0.68)
MTS Physical Environment Summary Scale	5.54 (0.77)	5.58 (0.91)
MTS Social Environment Summary Scale	4.91 (0.76)	5.09 (0.96)
MTS Person Centered Summary Scale	5.30 (0.71)	5.54 (0.78)

[ab] Values with different letter superscripts within resident variables indicate a significant difference at $p<0.01$, absent superscripts indicate no significant difference across unit types
Abbreviations: CPS= Cognitive Performance Scale; MTS= Mealtime Scan; kcal= kilocalorie; kg= kilogram; g= gram; SD= Standard Deviation

Table 5.2. Averaged MTS Variables Associated with Resident Energy and Protein Intake Who Live in Dementia Care Units (n=180 in 24 dining rooms)

		Energy			Protein		
Continuous Variables							
Variables	Mean (SD) {Tertile Range}	Correlation with Energy	β	P-Value	Correlation with Protein	β	P-Value
Length of meal (minutes)	59.24 (11.49) {43.50,56.35, 81.75}	-0.24	-0.27	0.83	-0.36	-0.02	0.14*
Lighting (lux)	335.19 (147.93) {145.25, 339.01, 801.81}	-0.25	-0.13	0.75	-0.22	-0.00	0.36
Tempera-ture (Celsius)	22.83 (1.22) {21.26, 22.47, 25.8}	0.06	-1.76	0.34	0.01	-0.15	0.09*
Humidity (%)	34.80 (764) {22.12, 32.36, 47.72}	-0.29	-7.42	0.12*	-0.09	-0.30	0.81

Sound (dB)	58.29 (6.31) {39.83, 59.55, 66.93}	-0.13	1.11	0.84	0.01	0.05	0.94
# of Residents	18.52 (7.80) {9.6, 17.10, 46}	0.05	-0.90	0.40	-0.05	-0.03	0.56
# of Residents Eating Alone	2.20 (2.31) {0.17, 1.23, 8.75}	-0.18	-0.60	0.05*	-0.24	-0.01	0.09*
# of Residents Eating Together	16.32 (6.74) {8.4,14.77 , 37.25}	0.03	-0.58	0.71	-0.07	-0.01	0.90
# of Residents Requiring Total Assistance	3.47 (2.38) {0, 2.98, 8.5}	0.07	0.82	0.67	0.20	0.05	0.82
# of Staff Providing Assistance	3.48 (1.60) {0.8, 3.55, 7.4}	0.02	1.22	0.99	0.10	0.07	0.94
Resident: Staff Ratio	6.33 (2.79)	-0.08	-0.57	0.72	-0.25	-0.03	0.53

	{2.41, 6.36, 14.38}						
# of Staff Involved in Passing food	1.28 (0.73) {0,1.33,3}	0.07	-3.11	0.37	-0.05	-0.17	0.79
# of Family/ Volunteer	1.57 (1.32) {0.25, 1.1, 6}	0.28	3.64	0.31	0.11	0.19	0.93
# of Other Persons	1.48 (1.62) {0,0.98,7}	-0.05	-0.52	0.44	-0.18	-0.07	0.76
# of Total People in Dining Room	26.34 (9.8) {16.4,25.3 ,63.75}	0.09	0.67	0.42	-0.04	0.04	0.62
Orienta-tion Cues Score	3.79 (2.29) {1,3.5, 11.25}	-0.02	-1.30	0.50	-0.22	-0.05	0.34
Social Sound Score	2.78 (0.69) {1.6, 2.75, 4.5}	0.24	-1.55	0.74	0.15	0.06	0.81
Total Excess Noise	11.68 (2.7) {7.67,	0.38	0.97	0.34	0.36	0.07	0.78

Score	10.88, 16.17}						
Excess Noise Score (without Social Sound)	8.76 (2.25) {4.83, 8.1, 13.17}	0.24	0.60	0.68	0.33	0.05	0.45
M-RCC Ratio (pos:neg)[a]	1.66 (0.53) {1, 1.51, 3.10}	0.07	-9.19	0.23*	-0.16	-0.41	0.01*
M-RCC Assistance Only Ratio (pos:neg)	2.11 (0.94) {1.05, 1.72, 4.17}	0.09	-3.39	0.74	0.06	-0.17	0.93
Physical Environ-ment Summary Scale	5.54 (0.77) {3.83, 5.55, 7}	0.03	-3.49	0.75	0.03	-0.19	0.81
Social Environ-ment Summary Scale	4.91 (0.76) {3.2, 5, 6}	-0.11	-1.89	0.39	-0.02	-0.01	0.89

Person Centered Summary Scale	5.30 (0.71) {4,5.3,7}	-0.12	-2.61	0.18*	-0.29	-0.04	0.02*
Categorical Variables							
Variable	Unit %(n)	Mean (SD)	β	P-Value	Mean (SD)	β	P-Value
Music Available[b]							
No Music <50% of the time	66.67(16)	26.31 (7.41)	--	0.20*	0.99 (0.36)	--	0.37
Yes 50%+ of the time	33.33(8)	28.33 (7.90)	-3.57		1.07 (0.32)	-0.02	

These bivariate analyses were adjusted for age, gender and cognitive performance score
* indicate a significant value of <0.25
[a] This M-RCC ratio accounts for all 25 actions on the checklist
[b] Reference value= No music 50% of the time
Abbreviations: N= total number of units; SD= standard deviation; kcal= kilocalorie; g=gram; β= parameter estimate
N=180 as 2 individuals were missing body weight data and 2 individual had <6 meals of food intake data

Table 5.3. Multivariate Models for Energy Intake with MTS Variables in Dementia Care Units (n=180 in 24 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-Value
Age	0.02	0.85	0.01	0.86
Gender[a]	-1.15	0.50	-0.97	0.49
CPS Score	0.94	0.01*	1.02	0.01*
Province		0.55		0.73
Site(province)		0.02*		0.11
Number of Residents Eating Alone			-0.60	0.05*
R Squared	0.23		0.23	
Adjusted R Squared	0.11		0.11	

Used backwards regression to determine final model using $p<0.05$
*****indictes a significant value of $p<0.05$
[a] Reference category= female

Table 5.4. Multivariate Models for Protein Intake with MTS Variables in Dementia Care Units (n=180 in 24 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-Value
Age	-0.00	0.57	-0.00	0.57
Gender[a]	0.01	0.99	0.01	0.76
CPS Score	0.05	0.01*	0.05	0.01*
Province		0.14		0.15
Site(province)		<0.0001*		0.10
Meal Length (minutes)			-0.01	0.04*
Number of Residents Eating Alone			-0.05	0.01*
M-RCC Ratio			-0.51	<0.0001*
R Squared	0.35		0.36	
Adjusted R Squared	0.26		0.26	

Used backwards regression to determine final model using p<0.05
*indicates a significant value of <0.05
[a] reference category= female

Table 5.5. MTS Variables Associated with Resident Energy and Protein Intake Who Live in General Care Units (n=443 in 58 dining rooms)

		Energy			Protein		
Continuous Variables							
Variables	Mean (SD) {Tertile Range}	Correlation with Energy	β	P-Value	Correlation with Protein	β	P-Value
Length of meal (minutes)	57.18 (17.34) {31, 53.37, 125.83}	-0.10	-0.05	0.28	0.02	0.00	0.25*
Lighting (lux)	329.21 (133.57) {97.49, 306.95, 841.56}	0.14	0.01	0.29	0.12	0.00	0.90
Temperatu-re (Celsius)	23.00 (1.26) {20.77, 22.73, 25.84}	0.27	0.62	0.10*	0.18	0.03	0.35
Humidity (%)	39.09 (10.11) {23.18, 36.64, 70.83}	-0.12	-0.34	0.97	-0.08	-0.01	0.63

Sound (dB)	56.73 (6.78) {37.17, 58.52, 65.08}	0.15	0.41	0.07*	0.20	0.01	0.14*
# of Residents	24.55 (14.91) {5.8, 20.38, 77.4}	-0.02	-0.02	0.89	0.18	-0.00	0.48
# of Residents Eating Alone	1.98 (1.72) {0, 1.5, 8.2}	-0.07	-0.34	0.55	-0.07	-0.02	0.41
# of Residents Eating Together	22.56 (14.94) {0, 17.96, 75}	-0.03	-0.01	0.94	0.17	0.00	0.42
# of Residents Requiring Total Assistance	2.86 (2.71) {0, 2.63, 14.75}	-0.10	-0.50	0.55	0.01	-0.02	0.69
# of Staff Providing Assistance	3.18 (2.31) {0, 3, 12}	0.01	-0.52	0.80	0.02	-0.01	0.26
Resident: Staff Ratio	7.87 (5.17) {1.72,	0.10	0.16	0.61	0.23	0.00	0.90

	6.62, 26.5}						
# of Staff Involved in Passing Food	1.89 (1.11) {0, 1.79, 4.67)	-0.03	0.21	0.81	0.06	-0.00	0.99
# of Family/ Volunteers	1.33 (1.37) {0, 0.82, 5}	-0.11	-0.95	0.51	-0.04	-0.04	0.66
# of Other Persons	2.23 (2.16) {0, 1.68, 10.5}	0.07	1.22	0.21*	0.20	0.04	0.10*
# of Total People in Dining Room	33.17 (17.71) {10, 29.13, 94.6}	0.01	-0.03	0.98	0.20	-0.00	0.33
Orientation Cues Score	5.87 (2.25) {1, 6, 11.5}	-0.02	0.45	0.72	0.09	0.01	0.41
Social Sound	2.95 (0.80) {0.67, 3, 4.5}	0.16	0.29	0.10*	0.11	-0.01	0.36
Total Excess Noise Score	11.78 (3.06) {7.17,	0.11	0.18	0.17*	0.15	0.00	0.20*

	1143, 20.5}						
Excess Noise Score (without Social Score)	8.71 (2.81) {5, 8.45, 16}	0.09	0.14	0.25*	0.12	0.00	0.25*
M-RCC Ratio (pos:neg)[a]	1.81 (0.68) {1.06, 1.56, 4.43}	0.06	0.47	0.70	-0.09	0.00	0.18*
M-RCC Assistance Only Ratio (pos:neg)	2.68 (1.62) {0.96, 2.04, 7}	-0.02	0.01	0.37	-0.27	-0.02	0.03*
Physical Environ-ment Summary Scale	5.58 (0.91) {2.75, 5.75, 7.5}	0.07	0.28	0.90	-0.04	0.01	0.69
Social Environ-ment Summary Scale	5.09 (0.96) {2.25, 5.23, 7.25}	-0.09	0.30	0.55	-0.13	0.00	0.73
Person Centered Summary Scale	5.54 (0.78) {2.25, 5.5, 7.5}	0.15	1.44	0.57	0.06	0.05	0.86

Categorical Variables							
Variable	Unit %(n)	Mean (SD)	β	P-Value	Mean (SD)	β	P-Value
Music Available[b]							
No Music <50% of the time	82.76 (48)	23.51 (7.94	---	0.72	0.87 (0.35)	---	0.86
Yes 50%+ of the time	17.24 (10)	23.85 (7.45)	-0.32		0.88 (0.30)	-0.00	

These bivariate analyses were adjusted for age, gender and cognitive performance score
* indicate a significant value of <0.25
[a] This M-RCC ratio accounts for all 25 actions on the checklist
[b] Reference value= No music 50% of the time
Abbreviations: N= total number of units; SD= standard deviation; kcal= kilocalorie; g=gram; β= parameter estimate
There were 455 individuals in general care units; 4 were removed due to having less than 6 meal intake observations, 5 were missing body weight data and 3 were excluded due to missing CPS scores

Table 5.6. Multivariate Models for Energy Intake with MTS Variables in General Care Units (n=443 in 58 units)

Model 2	Model 1 Parameter Estimate	P-value	Parameter Estimate	P-Value
Age	-0.01	0.87	-0.01	0.87
Gender[a]	-0.62	0.46	-0.62	0.46
CPS Score	0.34	0.12	0.34	0.12
Province		0.31		0.31
Site(province)		0.01*		0.01*
R Squared	0.13		0.13	
Adjusted R Squared	0.05		0.05	

Used backwards regression to determine final model using $p<0.05$
*indicates a significant value of <0.05
[a] reference category= female

Table 5.7. Multivariate Models for Protein Intake with MTS Variables in General Care Units (n=360 in 58 units)

	Model 1 Parameter Estimate	P-value	Model 2 Parameter Estimate	P-Value
Age	-0.00	0.47	-0.00	0.40
Gender[a]	0.00	0.99	-0.00	0.88
CPS Score	0.02	0.09	0.02	0.04*
Province		0.36		0.08
Site(province)		<0.0001*		<0.0001*
Number of other persons			0.06	0.03*
M-RCC Assistance Only Ratio			-0.01	0.02*
R Squared	0.20		0.21	
Adjusted R Squared	0.13		0.13	

Used backwards regression to determine final model using p<0.05
*indicates a significant value of <0.05
[a] Reference category= female

Table 5.8. Association between MTS Variables and Physical, Social and Person Centered Care Environment Scales (n=376 observations across 82 dining rooms)

		Physical			Social			Person Centered		
Variable	Mean (SD) {Tertile Range}	Correlation with Physical	β	P-Value	Correlation with Social	β	P-Value	Correlation with PCC	β	P-Value
Length of meal (minutes)	58.79 (25.20) {22,55,225}	-0.03	0.00	0.18*	0.01	-0.00	0.10*	0.00	0.00	0.97
Lighting (lux)	332.94 (181.58) {72.15, 331.44, 1505}	0.05	0.00	0.49	0.00	0.00	0.39	0.08	0.00	0.02*
Temperature (Celsius)	22.81 (1.57) {18.55, 22.58, 28.45}	0.06	-0.06	0.18*	0.06	-0.06	0.30	0.12	0.00	0.96
Humidity (%)	37.19 (10.37) {19.95,33.95,73.6}	0.05	-0.01	0.48	0.05	-0.00	0.96	0.13	0.00	0.96
Sound (dB)	57.51 (7.69) {29.38,	-0.26	-0.02	0.02*	-0.07	0.01	0.45	-0.07	0.01	0.39

	58.98, 71.93}									
# of Residents	23.12 (14.06) {2,19,84}	-0.05	-0.04	0.00*	0.20	0.02	0.30	0.09	-0.01	0.31
# of Residents Eating Alone	2.10 (2.28) {0,2,15}	-0.07	-0.03	0.70	-0.04	0.00	0.96	-0.01	-0.01	0.89
# of Residents Eating Together	21.02 (14.03) {0,18,83}	-0.04	-0.03	0.0*	0.21	0.01	0.35	0.09	-0.01	0.38
# of Residents Requiring Total Assistance	3.13 (2.85) {0,3,15}	-0.17	-0.06	0.09*	-0.11	0.08	0.10*	-0.16	-0.02	0.61
# of Staff Providing Assistance	3.33 (2.50) {0,3,15}	-0.22	-0.06	0.07*	-0.06	0.05	0.26	-0.11	-0.03	0.47
Resident: Staff Ratio	7.22 (5.17) {1.25, 6, 51}	0.11	0.01	0.56	0.21	0.01	0.78	0.20	0.02	0.33
# of Staff Involved in Passing Food	1.73 (1.26) {0,2,9}	-0.05	-0.13	0.01*	0.14	-0.07	0.32	0.09	-0.02	0.80

#of Family/ Volunteer	1.35 (1.80) {0,1,13}	-0.01	-0.05	0.24*	0.05	0.02	0.69	0.03	-0.01	0.75
# of Other Persons	1.89 (2.20) {0.1.15}	-0.13	0.02	0.51	-0.00	0.00	0.94	0.01	-0.00	0.91
# of Total People in Dining Room	31.42 (16.84) {4,27,98}	-0.10	-0.03	<0.0001*	0.17	0.01	0.30	0.07	-0.01	0.28
Orientation Cues Score	5.56 (1.09) {0,5,13}	0.16	0.01	0.66	0.25	0.00	0.94	0.26	0.00	0.97
Social Sound	2.85 (1.09) {0,3,6}	0.21	-0.04	0.36	0.37	0.29	<0.0001*	0.27	0.16	0.01*
Total Excess Noise Score	11.43 (3.98) {2,11,26}	-0.01	-0.02	0.20*	0.12	0.05	0.01*	0.05	0.03	0.08*
Excess Noise Score (without Social Sound)	8.58 (3.63) {1,8,22}	-0.07	-0.02	0.25*	0.02	0.03	0.13*	-0.03	0.02	0.25*
M-RCC Ratio (pos:neg)[a]	1.73 (0.80) {0.62, 1.5, 6}	0.30	0.33	<0.0001*	0.33	0.38	<0.0001*	0.40	0.49	<0.0001*

M-RCC Assistan-ce Only Ratio (pos:neg)	2.34 (1.84) {0.4,1.67, 7}	0.22	0.07	0.05*	0.18	0.06	0.20*	0.23	0.13	<0.0 001*
Categorical Variable										
Categori-cal Variable	%(n)	Mean (SD)	β	P-Value	Mean (SD)	β	P-Value	Mean (SD)	β	P-Value
Music Available [b]										
No Music	78.78 (297)	5.47 (1.10)	---	0.01*	5.00 (1.30)	---	0.07*	5.45 (1.12)	0.10	0.54
Yes	21.22 (80)	5.88 (0.98)	0.33		5.16 (1.27)	0.34		5.45 (1.04)		

*Indicates a significant value of <0.05; adjusted for dining room

[a] This M-RCC ratio accounts for all 25 actions on the checklist

[b] Reference value= No music 50% of the time

Abbreviations: β= parameter estimate; SD= standard deviation; N=number of observations

Table 5.9. Physical Environment Final Model (n=376 observations)

Variable Name	Parameter Estimate	F Value	P-Value
Music Available [a]	0.29	5.08	0.03*
Number of staff involved in passing	-0.12	5.24	0.02*
Number of Residents	-0.03	7.00	0.01*
M-RCC Ratio	0.29	15.13	<0.0001*
R Squared	0.67		
Adjusted R Squared	0.55		

Used backwards regression to determine final model using $p<0.05$; adjusted for dining room
[a] Reference category= No music
*Indicates a significant value of $p<0.05$

Table 5.10. Social Environment Final Model (n=376 observations)

Variable Name	Parameter Estimate	F Value	P-Value
Social Sound	0.31	22.34	<0.0001*
Number of residents that require assistance	0.11	5.44	0.02*
M-RCC Ratio	0.45	18.64	<0.0001*
R Squared	0.54		
Adjusted R Squared	0.41		

Used backwards regression to determine final model using $p<0.05$; adjusted for dining room
*Indicates a significant value of $p<0.05$

Table 5.11. Person Centered Care Environment Final Model (n=376 observations)

Variable Name	Parameter Estimate	F Value	P-Value
Lighting	0.01	3.91	0.04*
Total Excess Noise Score	0.05	8.04	<0.0001*
M-RCC Ratio	0.52	31.67	<0.0001*
R Squared	0.51		
Adjusted R Squared	0.37		

Used backwards regression to determine final model using $p<0.05$; adjusted for dining room
*Indicates a significant value of $p<0.05$

Table 5.12. Descriptive Statistics and Correlations for MTS Summary Scales and Other Measures (n= 82 dining rooms; 4-6 MTS observations)

		Physical		Social		Person Centered	
Variable	Mean(SD) {Tertile Range}	Spearman Correlation	P-Value	Spearman Correlation	P-Value	Spearman Correlation	P-Value
Dining Room Physical Scale (MTS) (n=82)	5.57(0.86) {2,75, 5.75, 7.5}	---	---	0.45	<0.0001 *	0.47	<0.0001*
Dining Room Person Centered Scale (MTS) (n=82)	5.47(0.77) {2.25, 5.5, 7.5}	0.47	<0.0001 *	0.70	<0.0001 *	---	---
Dining Room Social Scale (MTS) (n=82)	5.03(0.90) {2.25, 5.17, 7.25}	0.45	<0.0001 *	---	---	0.70	<0.0001*
DEAP Homelikeness Scale (n=82)	4.51(1.41) {1, 5, 7}	0.18	0.10	0.11	0.32	0.20	0.07
DEAP Functionality Scale (n=82)	5.29(1.15) {2, 5, 7}	0.52	<0.0001 *	0.12	0.27	0.14	0.22
DEAP Homelikeness Scale (n=82)	4.51(1.41) {1, 5, 7}	0.18	0.10	0.11	0.32	0.20	0.07
Staff PDC Score (n= 461)	61.54(5.49) {51.01,61.7 ,71.75}	0.10	0.38	0.20	0.07	0.16	0.15
Resident Food Satisfaction Score	52.62(6.37) {21, 54, 60}	0.07	0.55	0.02	0.87	0.08	0.47

(n= 334)							
Resident DRS (n= 634)	2.32(2.92) {0, 1, 14}	0.07	0.50	0.12	0.27	-0.11	0.35
Resident Energy Intake (kcal/kg bw) (n=633)	24.55(7.94) {1.87, 23.68, 90.07}	0.02	0.88	-0.12	0.30	-0.01	0.95
Resident Protein Intake (protein g/kg bw) (n=633)	0.91(0.35) {0.10, 0.86, 3.90}	-0.06	0.58	-0.12	0.28	-0.10	0.39
Resident M-RCC positive: negative ratio (n=634)	2.20(1.32) {0.38, 1.89, 12}	0.37	0.001*	0.20	0.07	0.29	0.01*
MNA-SF (n=638)	10.63 (2.44) {0, 11,14}	0.40	0.0002*	0.26	0.02*	0.27	0.01*

	Physical			Social			Person Centered		
CPS Score (n=634)	Mean (SD) Physical	T Value	P-Value	Mean (SD) Social	T Value	P-Value	Mean (SD) PCC	T Value	P-Value
None to Mild	5.60 (0.84)	1.45	0.15	5.22 (0.82)	4.53	<0.0001*	5.53 (0.71)	2.57	0.01*
Moder-ate to Severe	5.50 (0.86)			4.91 (0.88)			5.39 (0.76)		

Abbreviations: kcal/kg bw= kilocalorie per kilogram body weight; protein g/kg body weight= grams of protein per kilogram body weight; SD= standard deviation; M-RCC= Mealtime Relational Care Checklist; DRS= Depression Rating Scale; MTS= Mealtime Scan; CPS= Cognitive Performance Scale; MNA-SF= Mini Nutritional Assessment- Short Form
*indicates a p-value of <0.05

Table 5.13. MTS Variables by Province (n= 82 dining rooms; 4-6 MTS observations)

	AB Mean(SD)	**MB Mean(SD)**	**NB Mean(SD)**	**ON Mean(SD)**
Length of meal (minutes)	**49.08 (9.05)[a]**	61.00 (10.54)[ab]	65.96 (21.92)[b]	56.35 (12.75)[ab]
Lighting (lux)	**317.46 (132.46)**	318.35 (99.12)	339.25 (69.56)	354.88 (219.69)
Temperature (Celsius)	22.99 (1.81)[a]	**21.73 (0.51)[b]**	23.12 (0.78)[ac]	24.23 (1.10)[c]
Humidity (%)	**34.41 (5.02)**	40.11 (8.47)	42.28 (12.16)	34.74 (10.40)
Sound (dB)	55.58 (5.01)[a]	62.29 (2.08)[b]	**50.58 (8.11)[c]**	59.96 (2.95)[ab]
# of Residents	23.31 (13.71)	25.53 (18.33)	**20.03 (10.36)**	21.67 (8.48)
# of Residents Eating Alone	2.20 (1.93)	1.88 (1.12)	2.63 (2.60)	**1.44 (1.66)**
# of Residents Eating Together	21.10 (13.45)	23.65 (17.87)	**17.40 (10.83)**	20.24 (8.53)
# of Residents Requiring Total Assistance	**2.38 (2.19)**	3.56 (2.80)	3.14 (3.45)	3.12 (1.81)
# of Staff Providing Assistance	3.12 (1.84)	3.55 (2.86)	**2.50 (1.94)**	2.93 (1.32)
Resident: Staff Ratio	8.40 (5.59)	7.32 (4.80)	7.27 (4.85)	**6.26 (2.21)**

# of Staff Involved in Passing	1.73 (1.04)	1.81 (0.99)	1.69 (1.45)	**1.59 (0.58)**
# of Family/Volunt-eers	2.52 (1.52)[a]	1.13 (1.07)[b]	0.93 (0.99)[b]	**0.81 (0.91)[b]**
# of Other Persons	4.07 (2.66)[a]	1.83 (0.85)[b]	1.11 (0.76)[b]	**0.55 (0.47)[b]**
# of Total People in Dining Room	34.74 (16.70)	33.83 (21.08)	**26.26 (11.90)**	28.55 (10.41)
Orientation Cues Score	5.84 (2.14)	5.61 (2.27)	**4.34 (2.65)**	5.06 (2.65)
Social Sound Score	3.07 (0.43)[ab]	**2.44 (0.53)[b]**	3.42 (1.06)[a]	2.70 (0.63)[ab]
Total Excess Noise Score	13.42 (2.27)[a]	10.12 (1.45)[b]	13.69 (3.50)[a]	**9.55 (1.55)[b]**
Excess Noise Score (without Social Sound)	9.99 (2.37)[a]	7.61 (1.44)[b]	10.26 (3.25)[a]	**6.85 (1.46)[b]**
M-RCC Ratio (pos:neg)	1.97 (0.50)[ac]	**1.24 (0.13)[b]**	1.61 (0.40)[bc]	2.30 (0.82)[a]
M-RCC Assistance Only Ratio (pos:neg)	2.31 (0.98)[ab]	**1.43 (0.42)[b]**	2.81 (1.43)[ab]	3.54 (1.80)[a]
Physical Scale	5.65 (1.06)[ab]	**5.14 (0.56)[b]**	6.01 (0.90)[a]	5.53 (0.62)[ab]
Social Scale	5.11 (1.00)	**4.59 (0.74)**	5.22 (1.03)	5.27 (0.67)

Person Centered Scale	5.45 (1.00)	**5.23 (0.67)**	5.67 (0.68)	5.55 (0.60)
Home Age	28.75(18.41)	35.38(18.17)	34.88(12.89)	**25.88(17.34)**
Music Available	AB %(n)	MB %(n)	NB %(n)	ON %(n)
No Music <50% of the time	78.26(18)	77.27(17)	84.21(16)	72.22(13)
Yes 50%+ of the time	21.74(5)	22.73(5)	**15.79(3)**	27.78(5)
Home Sector				
For Profit	50.00(4)	37.50(3)	**12.50(1)**	25.00%(2)
Not for Profit	50.00(4)	62.50(5)	87.50(7)	75.00(6)

[abcd] Values with different letter superscripts within MTS variables indicate a significant difference at $p<0.01$, absent superscripts indicate no significant difference across provinces
Abbreviations: SD= standard deviation; n= number of observations; AB= Alberta; MB= Manitoba; NB= New Brunswick; ON= Ontario
Bolded numbers indicate the province that was given the lowest score for the MTS variables

Chapter 6

Construct Validity and Prevalence Estimates of the Mealtime Relational Care Checklist

6.1 Introduction

A high quality psychosocial environment improves emotional, mental and social well-being which can ultimately enhance quality of life through reducing environmental stressors (173). Person centered care (PCC) practices are believed to enhance the overall psychosocial environment and is defined as when "individuals' values and preferences are elicited and, once expressed, guide all aspects of their health care, supporting their realistic health and life goals (AGS Expert Panel on Person-Centered Care, 2016, p. 16)" (82). PCC, and the concept of personhood, described by Kitwood (3) moves away from the institutional and medical models of care. PCC is a philosophy of care in long term care (LTC) homes that supports residents, especially those with dementia, to be *treated as a person* with their own likes and dislikes, having a unique perspective of the world around them, and providing them with a sense of place that values their social being (83). While PCC is a meaningful concept, implementing models of care based on this philosophy is difficult due to the lack of identified effective strategies and processes. Rockwell interviewed staff members and found that while there was overall acceptance of the PCC model, it was also difficult to implement due to existing organizational structures that tended to be medically focused and inflexible (88). Further, the PCC model focuses on providing residents with quality care but fails to provide staff with personal benefit due to the unidirectional nature of PCC. Relational care is an adaption and extension of PCC that recognizes the multidirectional relationships and meaningful engagement with staff during everyday activities, providing residents with quality care through staff and resident interactions, while also acknowledging the mutually beneficial relationships that occur between staff and residents (87,88,149,150).

It is contended that the psychosocial environment is an important factor to promote food intake (174), thus relational and PCC practices should be implemented into LTC dining rooms to promote resident health and well-being (87). But, research and practical

interventions to improve this aspect of care are limited by lack of quality measurement of these mealtime care aspects that can't not only identify when these practices are occurring, but also guide staff in examples of what PCC care looks like in the dining room. There is a current need for a standardized instrument that empirically assesses the psychosocial mealtime environment, and specifically these practices, accurately and reliably as it is potentially relevant to health, food and quality of life (80,82,112,175). Such a tool will promote high quality research that can be replicated and will aid in comparisons across research studies and settings. Further, such a measure could be used as the basis for education and training and an outcome variable, allowing for the evaluation of interventions that target the psychosocial aspects of the mealtime environment.

Reimer and Keller (2009) defined PCC at mealtimes as providing residents with the choice and preferences, independence, respect and social opportunities (85). More recently, mealtimes have also been considered as a way for relational centered care (RCC) to occur, being more family-like, and relationship-focused. It has been suggested that RCC is an ultimate goal of LTC mealtime experiences (87). While these concepts are potentially advantageous to residents in LTC, they are relatively new and understudied with respect to mealtimes and food intake of residents. Prior research has attempted to measure PCC behaviours at mealtimes, but a variety of methods were used resulting in challenges comparing and interpreting results (116,121). These measurements assessed PCC through self-reporting of behaviours by staff (116,121) which may introduce bias. Measurements based on observation of PCC practices would provide a different perspective.

Recently, a mealtime relational care checklist (M-RCC) was developed. This checklist is included in the Mealtime Scan (MTS), a standardized instrument that quantitatively assesses the psychosocial and physical environment, where this checklist specifically assesses the PCC and RCC concepts through the observation of positive and negative interactions between staff and residents at mealtimes. The M-RCC was developed through theory and systematic observation of social interactions among residents and between residents and staff (40,87,154) at mealtimes; observable interactions that represented PCC (85) and RCC concepts at mealtimes were identified (87). While the M-RCC has not

been tested for construct validity, the foundations of this tool are supported by scientific evidence (87,154). The checklist focuses on observations of positive and negative interactions, such as being provided food quickly versus having to wait a long time to get the meal. The M-RCC can be completed at the dining room level or at the individual resident level. There are three components: the first is relevant for all residents and includes 17 common mealtime interactions between staff and residents (e.g., conversing, passing food); the second consists of 7 items specific to residents who require eating assistance and the third is focused on two items of meal clean-up that provide a sense of mealtime ambiance. Inter-rater reliability has been demonstrated for this scale (positive items ICC 0.73, negative items 0.85 p-value<0.001) (40), but the M-RCC requires further analysis, and specifically construct validation. This study will: 1) assess the construct validity of the M-RCC checklist, and 2) demonstrate the prevalence and differences in PCC and RCC mealtime practices in homes located in Alberta, Manitoba, New Brunswick and Ontario.

6.2 Methodology

6.2.1 Sample and Participants

A secondary data analysis of the M3 data set was used to address the research questions (17). This was a multisite, cross sectional study that collected data from LTC homes in four Canadian provinces: Alberta, Manitoba, New Brunswick and Ontario. This dataset includes collection at the resident, staff, and home levels. 32 LTC homes were recruited, consisting of 8 LTC homes in each province. Homes that were eligible followed the criteria of: 1) operating for at least 6 months, 2) having a minimum of 50 residents that meet the resident eligibility criteria and 3) promoting diversity in home characteristics. For-profit and not-for-profit homes and homes with special characteristics were recruited to promote sample diversity. Within each home, data was collected on one to four care units; residents who met the eligibility criteria were randomly selected for recruitment from these units. 82 dining rooms were assessed during data collection (17). The eligibility criteria of residents included: 1) residing on the units selected, 2) over the age of 65 years, 3) required a minimum of 2 hours each day of nursing care, 4) resided in the home for at least one month,

and 4) they, or a substitute decision maker, provided consent to participate. Resident exclusion criteria included: 1) residing in the home for less than one month, 2) medically unstable at the time of recruitment, 3) being a short term admission at the time of recruitment, 4) requiring tube feeding, 5) being at the end of life and/or, 6) having advanced directives that excluded them from research. Eligible staff were staff from nursing, recreation or dietary that were regular part-time or full-time employees. A minimum of 10 employees working on the chosen units were recruited (17).

6.2.2 Data Collection and Measures

An assessment of RCC and PCC behaviours was conducted using the M-RCC checklist. The resident level M-RCC used in M3 is slightly different from the dining room level, as one item specific to meal clean-up was not included. This assessment was performed a total of three times per resident across three non-consecutive days with one observation at a breakfast, lunch and dinner, completed by research assistants who also observed food intake (17). The M-RCC checklist assesses RCC/PCC behaviours which includes a variety of positive and negative staff-resident interactions that were observed between staff and individual residents who were having their food intake assessed that day (see Appendix A). Each positive and negative behaviour was given a score of either zero (absent) or one (present). A positive M-RCC score indicates the occurrence of an interaction that supported PCC/RCC, while a negative score indicates that the interaction was task focused and/or undignified. A ratio of positive:negative interactions is typically used in analysis. Scores across the three observed meals were averaged. A ratio of positive to negative behaviours was used in analyses, with a higher ratio indicating more positive RCC/PCC behaviours than negative.

The staff reported person-directed care (PDC) instrument was developed to assess person-directed care practices by classifying care into: personhood, comfort care, autonomy, knowing the person and support for relationships (94). The staff PDC is a questionnaire that utilizes Likert scales to gain understanding of the extent that staff perform PCC behaviours. It is self-reported by staff members and has demonstrated face validity and conceptually distinct constructs (Cronbach's alpha 0.86-0.91) (121). Although the PDC and the M-RCC

instruments are slightly different in terms of the types of questions being asked, both measures are believed to assess PCC. The staff PDC is given a maximum score out of 100. Some examples of items include the proportion of residents that the staff member knows their preferred music, the number of residents that staff are able to have personal conversations with and the number of residents that decide where they want to eat. For this analysis, the average score from all staff participating in a home was calculated.

The MTS is (40) an instrument which assess the physical and psychosocial mealtime environment as a meal is in process. The MTS has been deemed a reliable tool, with good intraclass correlations across three summary scales (0.65 to 0.85) (see Appendix F), of social and physical environments, and person centered care (rating 1= low to 8= high) for the entire meal process (40). MTS data was collected in each dining area typically by the trained provincial coordinator or, when scheduling did not permit, the research assistants who observed food intake. This instrument was performed 4-6 times in each unit's dining room (n=82) with observations at breakfast, lunch and dinner. The M-RCC is also included on the MTS, however, the MTS collects data at the dining room level rather than the resident level, as well as other characteristics that could impact PCC, and thus influence the MTS PCC summary scale. Scores for these three summary scales across observations per dining room were averaged for analysis.

The DEAP (124) is an instrument that assesses the physical environment of dining spaces in LTC (26). The DEAP tool has demonstrated inter-observer reliability with intraclass correlations for homelikeness and functionality of 0.68 and 0.70, respectively (39). Data was collected by a trained provincial coordinator once at the beginning of data collection for the home, when the dining room was empty (n=82). Homelikeness and functionality are summary scales that consider all features assessed on DEAP; these scales range from 1 (low) to 8 (high) as seen in Appendix E.

The Resident Food and Foodservice Satisfaction survey (122) is an instrument that is completed in an interview with residents and consists of 21 questions. There are three components to the survey: aspects of food, aspects of food service and quality of life (see Appendix B). Each question is asked with responses from 1 (less than half the time) to three

(most of the time). This instrument was only completed with residents that had adequate cognition to answer questions reliably (17). This survey is given a total score out of 63.

The interRAI Long Term Care Form is a standardized assessment for the health, mental and quality of life of LTC residents (123). The instrument was collected by trained provincial coordinators who interviewed staff members familiar with the resident's current care and behaviour. The items that were used for this analysis were the Depression Rating Scale (DRS; Appendix C) which is given an overall score that is out of 33 (123,129), and the Cognitive Performance Scale (CPS) which is out of six (see Appendix G) (128).

Nutritional risk was measured using the Mini Nutritional Assessment- Short Form (MNA-SF). This tool was completed by gathering information from resident charts, the residents themselves or from care providers who are familiar with the resident. Information was collected on food intake, weight loss, mobility, psychological stress or acute disease, neuropsychological problems and body mass index (see Appendix D). These responses were summed to create a total score out of 14, where a higher score indicates better nutritional status. The MNA-SF has been deemed as a valid and reliable instrument in assessing nutritional risk (130,131).

Food intake was determined for each resident based on intake from three non-consecutive days, including one weekend day, throughout four weeks. The process of collecting weighed and estimated food intake data in this study can be found in the Making Most of Mealtimes protocol (17). Home recipes were gathered and assembled in Food Processor (version 10.14.1) and used to estimate intake for each resident based on the portion of all food and fluid consumed. The estimated average energy intake variable for each resident used in this analysis was created by averaging each of the daily total energy intake values and dividing by resident body weight. The same approach was done for protein intake. Ethics clearance was provided by review boards from the Universities of Waterloo, Alberta, and Manitoba and Université de Moncton. Where required, ethics approval at individual nursing homes was also completed. Informed written consent was provided by residents or in the event of cognitive impairment, their alternative decision maker. Staff provided informed consent for completion of their questionnaire (17).

6.2.3 Data Analysis

Descriptive statistics were completed for each of the instruments used and Spearman's rho correlations determined associations between average resident M-RCC positive:negative scores with selected constructs. The MTS summary scales of the physical, social and PCC environments, the homelikeness and functionality scales of the DEAP, the dining room level M-RCC ratio from the MTS, the staff PDC score, the Food and Food Service Satisfaction score, DRS, energy and protein intake and the MNA-SF were treated continuously for this analysis. To determine the association between CPS and the M-RCC, CPS was dichotomized into none to mild cognitive impairment (scores 0-2) and moderate to severe cognitive impairment (3-6); a Student t-test was used to determine if the M-RCC ratio significantly varied by cognitive status category.

To determine the prevalence of the 25 resident level M-RCC interactions/behaviours and if the four Canadian provinces differed amongst each other, the average proportion for each positive RCC interaction (yes 'occurred at all 3 meals' or no 'never occurred') for each resident by province was computed and a chi squared test was performed. A 'sometimes' category was also created by indicating that the variable was observed at least once, but not at all three meal observations. If the chi square was significant (<0.01) a Fisher's exact test was conducted to account for non-independence among M-RCC variables. Chi squared and Fisher's exact tests compared all three groups to one another (no, sometimes, yes). For the variable "ate at the table with staff", data from New Brunswick could not be used due to a data entry issue. All analyses were performed using SAS University (version 9.4).

6.3 Results

Table 6.1 provides the home and resident level characteristics of those who participated in the M3 study. Almost a third (28.8%) of residents in this sample resided in dementia care units, and the entire sample had an average CPS score of 2.90 (SD 1.78); over half (55.70%) of all residents had moderate to severe dementia status as assessed using the CPS. About a third (31.10%) of the residents in this study were male and the total resident sample had a mean age of 86.80 (SD 7.8) years old. As for home characteristics, 68.50% of

the homes used in this study were not for profit, and the average home age was 31.20 (SD 16.3) years old. The average M-RCC ratio across all residents was 2.2 (SD 1.32).

6.3.1 Construct Validity of the M-RCC

Descriptive statistics and correlations were performed on each instrument used to assess construct validity and can be found in table 6.2; proportions for each M-RCC item are provided in table 6.3. The resident level M-RCC ratio was positively associated with the functionality scale on the DEAP (ρ=0.23, p=0.04), the dining room level M-RCC ratio (ρ=0.25, p=0.02), the dining room PCC summary scale from the MTS (ρ=0.28, p=0.01), the physical scale from the MTS (ρ= 0.42, p=<0.001) and nutritional risk (ρ= 0.16, p<0.0001), but was negatively associated with CPS (t (629) = 4.88, p<0.0001), and protein intake (ρ=-0.13, p=0.001). Positive associations mean that more RCC/PCC behaviours (i.e. a higher positive:negative ratio) were associated with a more functional and person centered dining room, as well as better nutritional status; those with more cognitive impairment experienced more negative practices than those with less cognitive impairment. Those who ate less protein had higher RCC/PCC behaviours. The other measures were not significantly associated with the resident level M-RCC.

6.3.2 M-RCC Differences across Provinces

Table 6.3 displays the differences in person and relational care practices across the provinces of Alberta, Manitoba, New Brunswick and Ontario as well as prevalence overall of M-RCC items. Prevalence estimates were categorized as yes, the activity happened at least once at three meals observed vs. no, not observed. Across all provinces, there was low prevalence for residents being given seating choice (19.17%), asking residents if they would like a clothing protector (26.22%) and residents eating at the table with staff (7.44%). Being included in social conversations with staff (44.55%), talking with tablemates (56.72%), asking food preference (64.66%), being informed of what they were eating (58.91%) and being given continuous assistance with eating (60.31%) also show room for improvement. There were high prevalence rates across all provinces for addressing residents respectfully (100%), informing residents of actions before they were taken (95.72%), avoiding restraints

(94.64%), providing residents with food quickly (95.9%) and permitting residents to linger in the dining room (99.53%).

The following overview identifies those provinces with the significantly lowest RCC/PCC performance at the resident level. There were significant differences in the practice of giving residents choice in seating arrangements with this being a less common practice in Ontario (13.29%), with significant differences seen when compared to the province of Manitoba (χ^2 (6, 634) = 24.90, p=0.0004). Residents in New Brunswick were asked if they wanted a clothing protector the least often (0.7%), which was significantly different than Ontario and Alberta (χ^2 (6,634) = 99.08, p=<0.0001). Residents in Ontario were most likely to be restrained at meals (12.66% restrained), which was significantly higher than Alberta and New Brunswick (χ^2 (6, 634) = 39.92, p<0.0001). Residents in Manitoba were asked their meal preferences the least often (33.33%), and the frequency of this care activity was significantly different among all provinces (χ^2 (6, 634) = 38.13, p<0.0001). Ontario residents were least likely to be provided food quickly (91.77%), which was lower than all other provinces (χ^2 (6, 633) = 55.63, p<0.0001). New Brunswick residents were most likely to receive medications at mealtimes (45.22%), while Alberta residents were the least likely (11.25%) (χ^2 (6, 634) = 60.83, p<0.0001). Ontario residents had the lowest prevalence of being informed of actions before they were taken (89.87%) which was significantly lower than all other provinces (χ^2 (6, 632) = 151.80, p<0.0001). New Brunswick residents were least likely to be discreetly excluded from staff's process related conversations (47.83%), which was significantly different from all other provinces (χ^2 (6, 463) = 107.81, p<0.0001). Ontario residents were least likely to be included in social conversations with staff (34.18%), which was significantly different from Manitoba and New Brunswick (χ^2 (6, 523) = 73.47, p<0.0001) and Ontario residents also received less nonverbal interactions from staff (82.91% did not receive) (χ^2 (6,634) = 175.45, p<0.0001). Ontario residents were least likely to eat at the table with staff (1.9%), which was significantly different from Alberta (New Brunswick data could not be used for this variable) (χ^2 (6, 471) = 107.40, p<0.0001). Manitoba residents had the lowest prevalence of receiving assistance when they wanted to leave the dining room (29.11% χ^2 (6, 369) = 112.41, p<0.0001) and the lowest prevalence of

having their dishes removed when they were finished eating (43.62% χ^2 (6, 528) = 115.49, p<0.0001). In Manitoba, residents were more likely to wait for assistance with food in front of them (71.43%), which was much higher than all other provinces (χ^2 (6, 126) = 20.89, p=0.002). Lastly, Manitoba residents had the lowest prevalence of staff using a napkin to wipe the mouth of residents (25.0%), which was significantly different from all other provinces (χ^2 (6, 136) = 49.70, p<0.0001). No single province stood out as better or worse with respect to PCC/RCC practices. This is supported as the mean ratios were not significantly different from one another; however, New Brunswick received the highest ratio score (μ= 3.26, SD= 1.46) and Ontario received the lowest ratio score (μ= 1.78, SD= 1.03).

6.4 Discussion

The M-RCC ratio was found to be significantly associated with the physical environment, specifically functionality, dining room level rating on PCC and M-RCC ratio of positive:negative RCC/PCC behaviours. All components of the dining environment are inter-related with one another, thus the correlation between the M-RCC, the functionality score and the MTS physical scale was anticipated (17,71,80). The correlation between functionality and the resident M-RCC is positive suggesting that a more functional environment enhances the capacity of staff to care for residents in a relational manner. Prior research supports this finding as a more functional dining environment allows staff to sit with residents during mealtimes and increases the ability for staff members to work together, reducing staff stress, and allowing staff and residents to navigate the dining room easily (78,106). This is further supported in this study as the MTS physical scale was also positively associated (p<0.05) with the resident level M-RCC as perhaps the physical environment evokes RCC/PCC practices exhibited by staff (78). Homelikeness was not associated with the M-RCC ratio, which may be a result of the general lower homelikeness scores and lower variation in the sample dining rooms on this summary scale as compared to functionality (average score 4.58 versus 5.34). A lack of association may also suggest problems with the homelikeness measure or simply that homelikeness in physical space is not associated with staff providing RCC and PCC interactions.

A promising finding in this study that supports the construct validity of the M-RCC is that the M-RCC ratio at the resident level was significantly associated with the M-RCC ratio at the dining room level. Although these are essentially the same measure, the focus of the assessor differs (full room vs. individual resident) and in the case of this study, the assessors were also different, with provincial coordinators completing most dining room-level measures and research assistants the resident level M-RCC. It is expected that these two ratios would be similar even with data gathered at different meals and different levels. Further, staff practices at the resident level and staff practices at the dining room level are also anticipated to be similar due to home wide policies and practices that are adopted by staff. The PCC summary scale from the MTS was also significantly and positively correlated with the resident level M-RCC. While the PCC summary scale is not the same measure, it summarizes the entire dining ambiance with respect to PCC practices and considers the M-RCC completed at the dining room level in its rating. Lack of significance with the Food and Food Service Satisfaction questionnaire is attributed to the low number of residents completing this measure, while lack of association with the social scale on MTS may be due to inadequate variability in this rating.

Interestingly, the M-RCC ratio significantly decreased as CPS score increased with individuals with none to mild dementia having an M-RCC ratio of 2.48 (SD=1.41) and those with moderate to severe dementia having an M-RCC ratio of 1.98 (SD=1.85). This indicates that as cognitive performance declines, RCC/PCC practices executed by staff also declines. This is a troublesome finding as residents with dementia are more susceptible to environmental press as cognition is diminished (81,93). Residents with dementia require supportive environments that allow them to sustain physical and mental functioning and maintain autonomy (85,87). This negative association was expected, as persons with severe dementia tend to communicate non-verbally, and interactions with staff then change to being more task focused (87). Staff may also feel increased stress when caring for residents with cognitive impairments (169), potentially impeding their ability to provide relational care. To improve relational care in LTC, Ducak et al. recommend that all residents should be engaged regardless of disability (87). In support of this hypothesis, the staff PDC was not associated

with the M-RCC ratio, which could be due to the difference in perspectives of these two instruments. Staff members may have knowledge of resident likes and dislikes, and reported this in the staff PDC, but this does not necessarily translate into asking about preferences or socially interacting with residents at mealtimes, which were assessed by M-RCC. Knowing what a resident wants and providing it does not equate *to asking* a resident their preference and providing choice. Potential time constraints and other stressors that resist PCC practices need to be further examined.

The Quality Nutrition Outcomes Long Term Care model outlines a pathway in which nutritional status is an intermediate outcome that influences quality of life (138,139). This hypothesis is supported by the results of this study, specifically that nutritional risk as measured by MNA-SF was positively associated ($p<0.0001$) with the M-RCC. Further, energy ($p=0.06$) and protein ($p<0.05$) intake were negatively associated with the M-RCC which was surprising and is contrary to prior literature on food intake. For example Chang et al. suggest that a household model that promotes PCC practices may aide residents in maintaining their nutritional status (21). These findings support the need to further investigate the relationship between PCC/RCC practices and food intake while accounting for potential confounders, such as home level characteristics. There is limited research that evaluates the impact of RCC and PCC practices on nutritional status (33,176) which may be a result of the novelty of these concepts and lack of an instrument that assesses observational PCC and RCC practices. Further work to determine potential mediators that might explain this negative association are warranted. For example, other analyses in M3 have shown that those who receive total eating assistance from staff, have better energy and protein intakes (Keller et al. unpublished), but requiring total eating assistance does not predict malnutrition when adjusting for other key covariates (Vucae et al. unpublished). Those residents who received total eating assistance are also are more likely to have severe dementia in the M3 sample, and as noted in this analysis, receive less RCC/PCC. The development of the M-RCC allows for RCC practices to be assessed in LTC, thus it is recommended that further work be performed to investigate this complex relationship between RCC/PCC practices, food intake, nutritional status and overall quality of life.

To date, this is the first study that evaluated mealtime RCC and PCC practices across Canadian provinces. The findings of this study demonstrate that no single province is a leader or a laggard with respect to these practices and that all need improvement. In these provinces, the RCC/PCC behaviours that were executed towards less than half of the residents were giving seating choice/not assigned seating (19.17%), asking the resident if they would like a clothing protector (26.22%), including the residents in social conversations with staff (44.55%) and eating at the table with staff (7.44%). Likely, some of these behaviours are not performed due to provincial policies, which should be re-examined for their potential benefit to the quality of life of residents. Yet, including residents in social conversations with staff and asking residents if they would like their clothing protector are basic dignified care practices that do not take extra time but have potential to greatly improve the sense of control and ambiance of the mealtime. It is evident that education and support for improving the psychosocial environment in LTC is needed. Further, best practice guidance could also drive improved mealtime environments. When working to improving RCC practices, provinces should exchange service delivery experiences to further improve national consistency (172). The creation of a construct valid and reliable tool such as the M-RCC can support improving practice.

6.4.1 Strengths and Limitations

There are many strengths to this study. Specifically, M-RCC has been shown to be reliable prior to this study (40), and the sample is based on a large and diverse group of residents from several LTC homes. Several measures theoretically expected to be associated with relational care at mealtimes were examined. Yet, some constructs had only weak associations with M-RCC, which may be a result of their inadequate development. Recently, a review was conducted that assessed the validity of a variety of PDC measures, including the staff PDC (148). This review stated that construct validity and internal consistency was good for this tool; however, test-retest reliability has not been demonstrated and it was unclear if the two dimensions (PDC and person centered environment) should be interpreted autonomously (148). Similarly, the Food and Food Service Satisfaction questionnaire has had minimal development and testing (122,175) and was only completed by a sub-sample of the

M3 participants with adequate cognition. Further, the staff PDC is completed through self-report and may be open to bias. As the number of staff participants in each home varied between ten and twenty, results may be influenced by the unequal sample sizes for each home. Further work with M-RCC should contrast this measure with resident quality of life (87,175) and staff experiences with mealtimes. The M-RCC collects data using systematic observation, thus it is expected that associations between this measure and other constructs would be modest, especially as variability meal to meal also occurred for individual residents. Higher associations were seen with researcher observed constructs, such as the DEAP functionality scale.

Prevalence estimates of RCC/PCC practices in each province need to take into account the potential bias in the sample as the homes within each province were purposively sampled, rather than randomly selected. Since data was only collected from Alberta, Manitoba, Ontario and New Brunswick, this sample cannot be considered representative of the LTC population within Canada. These provinces were chosen based on the availability of researchers having expertise in nutrition and LTC, therefore LTC homes in these provinces could differ from the provinces that were not included in the M3 study. While these limitations mean that results are not necessarily representative, it is also important to note that residents and units within each home were randomly selected and thus representative of their home.

A significant issue of bias was due to the use of different assessors across provinces to complete the M-RCC and other observational measures. The use of different assessors may potentially affect prevalence estimates (table 6.3). As well, potential subjectivity for ratings could potentially weaken correlations between the M-RCC ratio and some instruments used such as the MTS and DEAP summary scales. Many of the M-RCC practices differed across provinces in this study, thus it is important to note that some of these differences may be a result of the data collection methods used in this study. Using the same individuals to assess all instruments in all of the provinces would overcome this issue; however, this would be extremely time consuming and expensive. The M3 study reduced the risk of this limitation by extensively training research assistance.

6.5 Conclusion

This study supports the use of the M-RCC as it demonstrated construct validity when contrasted with measures that evaluated the same RCC and PCC concepts as well as other constructs such as the physical functionality of the dining room. It also demonstrated discriminant relational practices between persons with more and less cognitive impairment and nutritional risk. The creation of the M-RCC will provide an opportunity for researchers to make more useful comparisons across populations, and will aid in the development and evaluation of interventions that target this aspect of care. Further, by utilizing data from a high quality multilevel multi-site study, such as M3, comparisons of PCC/RCC practices across different provincial jurisdictions was possible. This secondary data analysis from M3 will contribute to mealtime relational and person centered care research in LTC, which is currently limited. While RCC is a relatively new concept, having been derived from PCC, multidirectional relationships and mutually beneficial relationships promote the well-being of LTC residents. While Canada is moving in the right direction to implement RCC into Canadian LTC homes, prevalence estimates suggest that organizational and governmental policy changes are necessary to support staff in executing RCC/PCC behaviour into their daily interactions with residents.

Table 6.1: Resident and Home Level Characteristics

Resident Level Characteristics	**%(n)**
Number of residents in dementia care units	28.8 (184)
Gender, male	31.10 (199)
Moderate to Severe Dementia Status	55.70 (353)
	Mean (SD)
CPS Score	2.90 (1.78)
Resident Age	86.80 (7.83)
Home level Characteristics	**%(n)**
Not for profit	68.50(438)
	Mean (SD)
Home Age	31.20 (16.31)
Resident M-RCC positive:negative ratio	2.20 (1.32)

Abbreviations: CPS= Cognitive Performance Scale; n= number of residents; SD= standard deviation

Table 6.2. Descriptive statistics and associations between the Resident M-RCC and other measures

Variable	Mean (SD) {Tertile Range}	Spearman Correlation	P-Value
Homelikeness Scale (n=82)	4.58 (1.40) {1,5,7}	0.14	0.20
Functionality Scale (n=82)	5.34 (1.03) {2,5,7}	0.23	0.04*
MTS Person-Centred Summary Scale (n=82)	5.47 (0.77) {2.25, 5,5, 7,5}	0.29	0.01*
MTS Physical Summary Scale	5.57 (0.86) {2.75, 5.75,7.5}	0.37	0.001*
MTS Social Summary Scale	5.03(0.90) {2.25, 5.17,7.25}	0.20	0.07
MTS M-RCC positive:negative ratio (n=82)	1.75 (0.59) {0.99, 1.54, 4.43}	0.28	0.01*
Staff PDC Score (n=461)	61.54 (5.49) {51.01, 61.28, 71.75}	0.07	0.70
Food Satisfaction Score (n=334)	52.62 (6.37) {21, 54, 60}	0.10	0.07
DRS (n=634)	2.32 (2.92) {0, 1, 14}	0.06	0.14

Energy Intake (kcal/kg bw) (n= 633)	24.41 (8.04) {1.87, 23.57, 90.07}	-0.08	0.06
Protein Intake (g/kg bw) (n=633)	0.91 (0.35) {0.10, 0.86, 3.90}	-0.13	0.001*
MNA-SF (n=638)	10.63 (2.44) {0, 11, 14}	0.16	<0.0001*
CPS Score (n=634)	Mean Ratio(SD)	T Value	P-Value
None to Mild	2.48(1.41)	4.88	<0.0001*
Moderate to Severe	1.98(1.85)		

Abbreviations: kcal/kg bw= kilocalorie per kilogram body weight; CPS= Cognitive Performance Scale; DRS= Depression Rating Scale; MTS= Mealtime Scan; SD= standard deviation; M-RCC= Mealtime Relational Care Checklist; g/kg bw= grams of protein per kilogram body weight; MNA-SF= Mini Nutritional Status- Short Form

Table 6.3. Provincial Differences in Resident Level M-RCC items (n= 634 residents)

Variable	%(n)	AB %(n)	MB %(n)	NB %(n)	ON %(n)
Given choice/Not assigned seating					
Sometimes/ Yes	19.17(121)	21.26(34) [ab]	22.64(36)[a]	19.48(30)[ab]	**13.29(21)[b]**
Requested or was asked if he/she wanted a protector					
Sometimes/ yes	26.22(145)	28.58(38)[a]	24.26(33)[ab]	**0.7(1)[b]**	51.41(73)[a]
Was Not restrained					
Sometimes/ yes	94.64(600)	100.0(160)[a]	94.34(150)[bc]	96.81(152)[a b]	**87.34(138)[c]**
Was asked meal preference					
Sometimes/ yes	64.66(410)	45.63(74)[a]	**33.33(53)[b]**	98.73(155)[c]	81.65(129)[d]
Was provided food quickly					
Sometimes/ yes	95.9(607)	98.74(157)[a]	98.74(157)[a]	94.27(148)[b]	**91.77(145)[c]**
Did not receive					

medications at meals					
Sometimes/ yes	75.08(476)	88.76(142)[a]	81.13(129)[ac]	**54.78(86)[b]**	75.32(119)[c]
Was informed of actions before taken					
Sometimes/ yes	95.72(605)	96.83(153)[a]	96.86(154)[a]	99.36(156)[a]	**89.87(142)[b]**
Was discreetly excluded from staff's process related conversation					
Sometimes/ yes	93.52(433)	93.89(123)[a]	96.69(146)[a]	**47.83(11)[b]**	96.84(153)[a]
Was included in social conversation with staff					
Sometimes/ yes	44.55(233)	39.74(62)[a]	57.7(89)[b]	50.91(28)[b]	**34.18(54)[a]**
Received Nonverbal interaction from staff					

Sometimes/ Yes	90.54(574)	93.75(150)[a]	85.54(136)[b]	100.00(157)[c]	**82.91(131)[b]**
Talked with tablemates					
Sometimes/ yes	56.72(346)	56.88(91)	61.78(97)	**48.15(65)**	58.86(93)
Was addressed respectfully					
Sometimes/ yes	100.0(634)	100.0(160)	100.0(159)	100.0(157)	100.0(158)
Ate at the table with staff [e]					
Sometimes/ yes	7.44(35)	10.01(16)[a]	8.72(13)[ab]	N/A	**1.9(3)[b]**
Was allowed to determine if they want to eat					
Sometimes/ yes	99.21(629)	100.0(160)	**97.49(155)**	100.0(157)	99.37(157)
Was permitted to linger in the dining area					
Sometimes/ yes	99.53(629)	**98.75(158)**	99.37(158)	100.0(156)	100.0(157)
Received assistance					

when they want to leave					
Sometimes/ yes	72.36(267)	80.38(86)[ac]	**29.11(23)[b]**	93.91(77)[a]	80.19(81)[c]
Attempted mealtime tasks are allowed to be involved					
Sometimes/ yes	94.69(588)	**90.0(144)**	94.97(151)	95.97(143)	98.04(150)
Had their dishes removed when finished					
Sometimes/ yes	60.8(321)	46.57(68)[a]	**43.62(65)[a]**	85.71(126)[b]	72.09(62)[b]
Did not wait for assistance with food in front of them					
Sometimes/ yes	68.25(86)	74.57(44)[a]	**28.58(6)[b]**	77.27(17)[a]	79.17(19)[a]
Had a napkin used to wipe their mouth					
Sometimes/ yes	72.79(99)	94.91(56)[a]	**25.0(6)[b]**	75.0(18)[ac]	65.52(19)[c]

Was continuously assisted					
Sometimes/ yes	60.31(79)	**52.95(27)**	68.0(17)	66.67(16)	61.29(19)
Received one-on-one assistance					
Sometimes/ yes	81.54(106)	88.0(44)	**76.0(19)**	79.17(19)	77.42(24)
Was given enough time when assisted to eat					
Sometimes/ yes	96.16(125)	96.0(48)	100.0(25)	100.0(24)	**90.33(28)**
Was told what they were eating by those who assisted					
Sometimes/ yes	58.91(76)	55.10(27)	58.0(14)	83.33(20)	**48.39(15)**
Assisted by staff using safe practices					
Sometimes/ yes	90.0(117)	88.0(44)	100.0(25)	87.5(21)	87.09(27)

M-RCC Total Score	Total Mean(SD)	AB Mean(SD)	MB Mean(SD)	NB Mean(SD)	ON Mean(SD)
	2.20 (1.32)	1.90(0.89)	1.83(1.10)	3.26(1.46)	1.78(1.03)

[abcd] Values with different letter superscripts within M-RCC variables indicate a significant difference at $p<0.01$, absent superscripts indicate no significant difference across provinces

[e] Due to a data entry issue for New Brunswick, the data could not be used

Abbreviations: AB= Alberta; MB= Manitoba; NB= New Brunswick; ON= Ontario; n= number of observations; SD= standard deviation

The "sometimes" category indicates that the practice was observed at least once during three meals observed, but not at all meals

The values that are bolded indicate the province with the lowest prevalence of positive person directed care actions

Differences between provinces (as indicated by the superscripts) was computed on all 3 categories: no, sometimes and yes

Table 6.4. Provincial Differences in Resident Level MRCC items- Supplemental Chart

Variable	%(n)	AB %(n)	MB %(n)	NB %(n)	ON %(n)
Given choice/Not assigned seating					
No	80.82(510)	78.75(126)	77.36(123)	80.52(124)	86.71(137)
Sometimes	10.14(64)	10.63(17)	13.21(21)	2.60(4)	9.49(15)
Yes	9.03(57)	10.63(17)	9.43(15)	16.88(26)	**3.80(6)**
Requested or was asked if he/she wanted a protector					
No	73.78(408)	71.43(95)	75.74(103)	99.30(141)	48.59(69)
Sometimes	19.17(106)	24 (18.05)	18.38(25)	0.00(0)	40.14(57)
Yes	7.05(39)	14 (10.53)	5.88(8)	**0.70(1)**	11.27(16)
Was Not restrained					
No	5.36(34)	0(0)	5.66(9)	3.18(5)	12.66(20)
Sometimes	5.21(33)	4.38(7)	5.66(9)	1.27(2)	9.49(15)
Yes	89.43(567)	95.62(153)	88.68(141)	95.54(150)	**77.85(123)**
Was asked meal preference					
No	224(35.33)	54.38(87)	66.67(106)	1.27(2)	18.35(29)
Sometimes	28.86 (183)	32.50(52)	28.93(46)	4.46(7)	49.37(78)
Yes	35.8(227)	13.13(21)	**4.40(7)**	94.27(148)	32.28(51)
Was provided food quickly					
No	4.11(26)	1.26(2)	1.26(2)	5.73(9)	8.23(13)
Sometimes	34.6(219)	27.04(43)	20.75(33)	46.50(73)	44.30(70)
Yes	61.3(388)	71.7(114)	77.99(124)	47.77(75)	**47.47(75)**

Did not receive medications at meals					
No	24.92(158)	11.25(18)	18.87(30)	45.22(71)	24.68(39)
Sometimes	57.57(365)	61.88(99)	63.52(101)	46.5(73)	58.23(92)
Yes	17.51(111)	26.88(43)	17.61(28)	8.28(13)	17.09(27)
Was informed of actions before taken					
No	4.27(27)	3.14(5)	3.14(5)	0.64(1)	10.13(16)
Sometimes	32.75(207)	32.91(52)	32.08(51)	4.46(7)	61.39(97)
Yes	62.97(398)	63.92(101)	64.78(103)	94.9(149)	**28.48(45)**
Was discreetly excluded from staff's process related conversation					
No	6.48(30)	6.11(8)	3.31(5)	52.17(12)	3.16(5)
Sometimes	24.19(112)	28.24(37)	13.25(20)	0.00(0)	34.81(55)
Yes	69.33(321)	65.65(86)	83.44(126)	**47.83(11)**	62.03(98)
Was included in social conversation with staff					
No	55.45(290)	60.26(94)	42.21(65)	49.09(27)	65.82(104)
Sometimes	30.02(157)	31.41(49)	33.12(51)	10.91(6)	32.28(51)

Yes	14.53(76)	8.33(13)	24.68(38)	40.00(22)	**1.90(3)**
Received Nonverbal interaction from staff					
No	9.46(60)	6.25(10)	14.47(23)	0(0)	17.09(27)
Sometimes	35.49(225)	41.25(66)	47.80(76)	1.91(3)	50.63(80)
Yes	55.05(349)	52.50(84)	37.74(60)	98.09(154)	**32.28(51)**
Talked with tablemates					
No	43.28(264)	43.13(69)	38.22(60)	51.85(70)	41.14(65)
Sometimes	35.08(214)	35.63(57)	36.94(58)	21.48(29)	44.30(70)
Yes	21.64(132)	21.25(34)	24.84(39)	26.67(36)	**14.56(23)**
Was addressed respectfully					
No	0(0)	0(0)	0(0)	0(0)	0(0)
Sometimes	9.15(58)	2.50(4)	6.92(11)	1.91(3)	25.32(40)
Yes	90.85(576)	97.5(156)	93.08(148)	98.09(154)	**74.68(118)**
Ate at the table with staff [a]					
No	92.57(436)	90.00(144)	91.28(136)	N/A	98.1(155)
Sometimes	5.10(24)	5.63(9)	8.05(12)		1.90(3)
Yes	2.34(11)	4.38(7)	0.67(1)		**0.00(0)**
Was allowed to determine if they want to eat					
No	0.79(5)	0(0)	2.52(4)	0(0)	0.63(1)

Sometimes	4.42(28)	1.25(2)	7.55(12)	1.91(3)	6.96(11)
Yes	94.79(601)	98.75(158)	**89.94(143)**	98.09(154)	92.41(146)
Was permitted to linger in the dining area					
No	0.47(3)	1.25(2)	0.63(1)	0(0)	0(0)
Sometimes	8.23(52)	6.25(10)	13.21(21)	0.00(0)	13.380(21)
Yes	91.30(577)	92.50(148)	**86.16(137)**	100.00(156)	86.62(136)
Received assistance when they want to leave					
No	27.64(102)	19.63(21)	70.89(56)	6.1(5)	19.8(20)
Sometimes	31.71(117)	28.04(30)	15.19(12)	34.15(28)	46.53(47)
Yes	40.65(150)	52.34(56)	**13.92(11)**	59.76(49)	33.66(34)
Attempted mealtime tasks are allowed to be involved					
No	5.31(22)	10.00(16)	5.03(8)	4.03(6)	1.96(3)
Sometimes	7.09(44)	6.25(10)	10.06(16)	5.37(8)	6.54(10)
Yes	87.60(544)	**83.75(134)**	84.91(135)	90.60(135)	91.50(140)
Had their dishes removed when finished					
No	39.2(207)	53.42(78)	56.38(84)	14.29(21)	27.91(24)
Sometimes	10.80(57)	13.01(19)	17.45(26)	5.44(8)	4.65(4)
Yes	50.00(264)	33.56(49)	**26.17(39)**	80.27(118)	67.44(58)
Did not wait for assistance with					

food in front of them					
No	31.75(40)	25.42(15)	71.43(15)	22.73(5)	20.83(5)
Sometimes	11.90(15)	11.86(7)	14.29(3)	9.09(2)	12.50(3)
Yes	56.35(71)	62.71(37)	**14.29(3)**	68.18(15)	66.67(16)
Had a napkin used to wipe their mouth					
No	27.21(37)	5.08(3)	75.0(18)	25.0(6)	34.48(10)
Sometimes	25.00(34)	25.42(15)	25.00(6)	20.83(5)	27.59(8)
Yes	47.79(65)	69.49(41)	**0.00(0)**	54.17(13)	37.93(11)
Was continuously assisted					
No	39.69(52)	47.06(24)	32.0(8)	33.33(8)	38.71(12)
Sometimes	38.17(50)	39.22(20)	40.00(10)	37.50(9)	35.48(11)
Yes	22.14(29)	**13.73(7)**	28.00(7)	29.17(7)	25.81(8)
Received one-on-one assistance					
No	18.46(24)	12.0(6)	24.0(6)	20.83(5)	22.58(7)
Sometimes	31.54(41)	32.00(16)	32.00(8)	37.50(9)	25.81(8)
Yes	50.00(65)	56.00(28)	44.00(11)	**41.67(10)**	51.61(16)
Was given enough time when assisted to eat					
No	3.85(5)	4.0(2)	0.00(0)	0.00(0)	9.68(3)
Sometimes	23.08(30)	12.00(6)	28.00(7)	8.33(2)	48.39(15)
Yes	73.08(95)	84.00(42)	72.00(18)	91.67(22)	**41.94(13)**

Was told what they were eating by those who assisted					
No	41.09(53)	44.9(22)	44.0(11)	16.67(4)	51.61(16)
Sometimes	31.78(41)	34.69(17)	36.00(9)	33.33(8)	22.58(7)
Yes	27.13(35)	20.41(10)	**20.00(5)**	50.00(12)	25.81(8)
Assisted by staff using safe practices					
No	10.0(13)	12.0(6)	0.00(0)	12.5(3)	12.9(4)
Sometimes	20.77(27)	20.00(10)	16.00(4)	37.50(9)	12.90(4)
Yes	69.23(90)	68.00(34)	84.00(21)	**50.00(12)**	74.19(23)
M-RCC Total Score	Total Mean(SD)	AB Mean(SD)	MB Mean(SD)	NB Mean(SD)	ON Mean(SD)
	2.20 (1.32)	1.90(0.89)	1.83(1.10)	3.26(1.46)	1.78(1.03)

[a] Due to a data entry issue for New Brunswick, the data could not be used

Abbreviations: AB= Alberta; MB= Manitoba; NB= New Brunswick; ON= Ontario; n= number of observations; SD= standard deviation

The "sometimes" category indicates that the practice was observed at least once at one of three observed meals, but not at all meals

The values that are bolded indicate the province with the lowest prevalence of positive person directed care actions

Chapter 7
Discussion

The purpose of this thesis was to describe in detail the mealtime environments, compare and contrast mealtime characteristics by unit type and province as well as determine the construct validity of the DEAP, MTS and M-RCC. Additionally, associations between the physical and psychosocial environment with energy and protein intake were performed in dementia care and general units to better understand if key environmental characteristics have the potential to affect food intake.

7.1 The Physical Environment

Some gaps in the literature, specifically the lack of valid tools that assess the physical environment in long term care (LTC), have been addressed in this secondary data analysis. In Chapter 4: *Construct Validity of the Dining Environment Audit Protocol* and Chapter 5: *Construct Validity of the Mealtime Scan*, key findings were that residents in dementia care and general units were different in terms of energy and protein intake as well as cognition; some aspects of the physical environment also varied by unit type. Multivariate analyses suggest that some interventions to improve the dining environment are needed regardless of type of unit, while some aspects are unique to dementia care. Further, energy and protein intake models were consistent to a point, suggesting that some aspects of dining environment may influence quantity (i.e., energy) and quality (e.g. protein) of the diet consumed. These results are supported by the concept of environmental press as characteristics of the dining room that negatively stimulate residents, such as a television and obstacles and clutter, were found to negatively influence energy and protein intake. Additionally, the Five Aspects of Meal model supports the findings of these studies as the physical environment was positively associated with the psychosocial components of the mealtime environment, contributing to an enhanced overall dining atmosphere (68).

There are a variety of areas that can be improved upon in the physical environments of all M3 site dining rooms as assessed by the DEAP and MTS, regardless of unit type. A few examples of these will be discussed. As extensively discussed in this thesis, homelike

dining environments are important to implement in LTC. However, according to a DEAP variable that classifies dining rooms as homelike or institutional based on the number of residents in the dining room, only 35.37% of dining rooms were considered to be homelike and 23.17% were institutional. The DEAP classifies dining rooms as a homelike environment when there are fewer than 20 residents; this low prevalence of homelikeness in the observed units is supported by data collected in the MTS where the average number of residents in dining rooms was 23.12 (SD(standard deviation)= 14.06). Research suggests that LTC homes should promote the use of small, homelike dining environments in all units to benefit residents (27,104,106). As measured using the environmental meter, average lighting across observations was 332.94(SD= 181.58), which could be enhanced, regardless of the finding that 58.54% of dining rooms provided 75% or more residents with a clear view of the garden and thus accessibility to natural lighting. The mean orientation cue score was fairly low (5.56(SD= 1.09) out of fourteen) therefore dining rooms should improve characteristics that may aide in stimulating resident orientation to the meal, and thus appetite or interest in eating. Finally, the average DEAP functionality score (5.29(SD= 1.15)) and MTS physical environment score (5.57(SD= 0.86)) across dining rooms were relatively good, whereas the average summary DEAP homelikeness score was lower (4.51(SD= 1.41)) suggesting that generally, dining rooms need more work in this area.

Physical environments within dementia care and general units had a variety of differences as seen across chapters 4 and 5. Overall, general units were larger and more institutional compared to dementia care units, with a higher number of residents in the dining room (μ(general)= 24.55(SD= 14.91) versus μ(dementia care)= 18.52(SD= 7.80)). Not surprisingly, only 31.03% of dining rooms in general units were rated as relatively homelike compared to 45.83% of dining rooms in dementia care units, as classified on the DEAP according to number of residents in the dining room. While dementia care units may have been smaller as indicated by the lower number of residents, dementia care units (4.17(SD= 1.27)) received a lower homelikeness score, as evaluated using the DEAP summary scale, than general units (4.66(SD= 1.45)). Although these findings suggests that dining room design and size was considered in the dementia units, homelike characteristics outside of the

number of residents in the dining room need to be improved to promote homelikeness in dementia care units. Some examples of promoting homelikeness include decorating the dining room with table top decorations and providing table settings in the dining room; however, it is important to consider that these components may be difficult to implement in dementia care units as they may distract residents from eating and may introduce increased risk during mealtimes (e.g. having knives as part of the table setting).

A qualitative comparison of the proportions of key characteristics in these different units suggests that dementia units also attempted to reduce risks to residents more so than general units. For example, dementia care units had a higher proportion with good physical environment supervision and round edged furniture as compared to general units, and none of the dementia care units had an unsecured stove, whereas almost 83% of general units did. This could have led to lower than anticipated homelikeness scores for these dementia units. Additionally, orientation cues as assessed by the MTS were statistically less prevalent in dementia care units (μ= 3.79(SD= 2.29) out of 14) compared to general units (μ= 5.87(SD=2.25) out of 14) suggesting that characteristics of the dining room that stimulate appetite, such as food aromas, should be promoted in dementia care units to also promote homelikeness. Residents in dementia care dining rooms included in this sample had higher CPS scores, suggesting a greater need for addressing environmental press for these residents. While the excess noise score was higher in general units (μ= 11.78(SD= 3.06)) compared to dementia care units (μ= 11.68(SD= 2.7)), this difference was modest despite dining rooms in general units being larger than dementia care units (μ(general)= 33.17 (SD= 17.71); μ(dementia care)= 26.34(SD= 9.8)) as indicated by the increased number of individuals in these units. Despite the finding that dementia care units were smaller, sound levels, as measured by the environmental meter, were higher in dementia care units (μ= 58.29 (SD= 6.31)) compared to general units (μ= 56.73(SD= 6.78)), which also may have contributed to the lower mean homelikeness score in dementia care units. Dementia care units were also less likely to have a posted menu and providing majority of residents with a view of the garden which further explains the lower homelikeness score in these units. This analysis also suggests that providing residents with a view of the garden, clock and posted menu in the

dining room promote homelikeness, thus these characters should be implemented into dementia care units. Despite these noted differences in unique features, summary scales from DEAP and MTS were relatively consistent between the two unit types and were not statistically different across unit types (MTS physical environment dementia care (μ= 5.54(SD=0.77)) and general units (μ= 5.58(SD= 0.91)); DEAP homelikeness (μ(dementia care)= 4.17(SD= 1.27); μ(general)= 4.66(SD= 1.45)); DEAP functionality (μ(dementia care)= 5.17(SD= 0.92); μ(general)= 5.34(SD= 1.24)). Lowest scores on these eight-item scales were found for homelikeness, indicating that this area of the physical environment needs the most improvement regardless of unit type.

The summative scales of homelikeness and functionality were not statistically different across provinces; however, on average homelikeness scores were lowest in Alberta and functionality scores were lowest in Manitoba. Similarly to functionality, the MTS physical rating scale was also lowest in Manitoba, which was significantly different from New Brunswick only. While the physical environment across provinces were relatively consistent, policy should be implemented that addresses the design of the dining room to continue to promote consistency. Inconsistencies in policy and funding across these provinces may explain the observed differences across provinces in this study. Room temperature in Manitoba was significantly lower than all other provinces, which may be due to the lack of policy in this province regarding temperature, as was respecting and responding to resident opinions regarding environmental characteristics including temperature. It is unknown if the temperature was too cool for residents, but certainly a recommendation from this work is that capacity to respond to their preferences with respect to room temperature and lighting be considered in these homes and all provinces should implement a standard for temperature in LTC homes. The characteristics of the physical environment that were different across provinces are likely due to policy or funding inconsistencies. For example, across provinces, New Brunswick homes included in this study had the lowest number of stools, which was significantly different from Alberta, which may be due to the lower staffing levels in this province and/or provincial level funding resulting in a reduced number of staff available to assist residents during mealtimes. Alternatively, lower number of stools

could have been due to home policy to use regular chairs to promote homelikeness, and staff sitting at tables with residents. New Brunswick also had the lowest number of dining rooms that had furniture with rounded edges which may be due to less government funding available for furniture in this province. Currently, provinces lack policy regarding appropriate sound levels in LTC homes, thus policies that address sound levels may be beneficial to promote consistency across provinces as this was statistically different across provinces. Alberta had the highest number of family/volunteers and other persons in the dining room, which was significantly higher than all other provinces; however, Alberta also had the highest resident to staff ratio. These findings may potentially be due to different policies for staffing levels, suggesting that more family members may have been present during mealtimes to provide additional assistance. Alternatively, this could signal differences in the resident participants in that province with potentially a higher proportion requiring eating assistance. Regardless, this commentary demonstrates the complexity of factors that can influence the physical environment in LTC dining rooms. The remaining physical characteristics of the dining room did not have one province which was significantly higher or lower from the others or the variables were not significantly different across provinces, suggesting that overall physical characteristics of dining rooms in this study were relatively similar.

The factors of the physical environment, regardless of unit type, that were negatively associated with intake and diet quality were the presence of a television and obstacles/clutter in the dining room. The presence of a television in the dining area contributes to negative stimulation of residents (81) and increased environmental press and stimuli (93,98), resulting in negative behaviours (100) which discourages residents from eating (27). This finding strongly supports the recommendation that televisions be removed from all dining rooms as the effects are consistent across dementia care and general units. These results also suggest that less obstacles/clutter in the dining area may benefit resident outcomes in addition to improving environmental press (26,81). Despite obstacles/clutter affecting different outcomes in general and dementia care units, it is strongly recommended that all dining

rooms in both unit types minimize obstacles/clutter to promote quantity and quality of resident intake.

Exclusively in dementia care units, posted menus and number of exits were positively associated ($p<0.05$) with intake while an accessible kitchen was negatively associated ($p<0.05$) with intake. Diet quality (i.e., protein) was positively associated ($p<0.05$) with a view of the garden while negatively associated ($p<0.05$) with accessible kitchens. Qualitatively, dementia care units had a menu posted in the dining room less frequently than dining rooms in general units by over 10%. This positive association between a posted menu and intake suggests that menus should be posted in dementia care units as it may be beneficial to resident intake. Similarly, dining rooms in dementia care units were less likely to provide 75% or more residents with a view of the garden compared to general units; however, having a view of the garden is positively associated with diet quality suggesting that dining rooms in dementia care units should provide majority of residents with visual access to a garden during mealtimes. To implement this into mealtimes, resident seating arrangements can be reorganized to provide an optimal number of residents with a garden view. Additionally, while an accessible kitchen was negatively associated with intake and diet quality, it is not recommended that LTC homes remove accessible kitchens from dining rooms as this is a preliminary finding and not supported in previous literature (26). More research should be done to investigate this association and determine if accessible kitchens are appropriate to have in dementia care units as the M3 study did not collect information on resident use of accessible kitchens. Accessible kitchens may be valuable as they improve flexibility in the dining space, for example they can create a quiet space for residents who are overwhelmed by the loud noises of the dining room, provide privacy for residents who may be having a bad day and allow family members to interact with their loved ones in a quiet environment. While the number of exits was found to be positively associated with intake, recommendations cannot be made regarding this specific characteristic of the dining room. On average, dementia care units ($\mu= 2.50(SD= 0.98)$) had less exits than general units ($\mu= 2.91(SD= 1.58)$), and an increasing number of exits was found to enhance functionality at the bivariate level. However, an increasing number of exits also reduces the homelikeness of the

dining room at the bivariate level, thus a clear recommendation cannot be made regarding the optimal number of exits in the dining room. Qualitative research should further examine this association by investigating beneficial layouts of the dining room, for example open concept dining spaces.

Exclusive to general units, a private family dining area was the only variable associated with intake and diet quality and was negatively associated ($p<0.05$) with both outcomes. Similar to accessible kitchens, the M3 study did not collect data on resident use of private family dining areas, which could promote flexibility in the dining area if used routinely for meals. For example, these dining areas create an intimate environment for visiting family members to interact with residents and quiet spaces for residents who may be overwhelmed or prefer to eat alone. This same variable was positively associated with homelikeness and functionality (Chapter 4) thus a clear recommendation cannot be made in regard to this characteristic. Further research should be conducted to investigate this association to demonstrate if a private family dining area should be implemented in general units and the resulting implications of doing so.

The physical environment minimally influenced intake and diet quality as indicated by the small R^2 values of the multivariate models. Rather, resident level characteristics, such as CPS score, explain more of the variance of these outcomes. Regardless of this finding, LTC homes should continue to enhance dining environments as the physical environment may have a greater influence on other resident outcomes, such as quality of life. The DEAP functionality and MTS physical environment scales were positively correlated ($p<0.05$) with nutritional status. The lack of association between these scales and intake may be because the physical environment, as assessed by these scales, facilitates more permanent positive changes (e.g. nutritional status). Food intake is highly variable and intra-individual variation is influenced by many factors. Additionally, the MNA-SF evaluates nutritional status based on resident characteristics within the past three months, whereas food intake data was only collected across three days. Residents may have already become accustomed to the physical environment therefore minimally impacting daily intake; however, only an intervention study can further explore this hypothesis. The positive associations with the MNA-SF suggest that

the physical environment may influence quality of life (138,139). Despite the finding that the physical environment minimally influenced intake and diet quality, the physical environments of LTC dining rooms should be enhanced to improve resident outcomes by following the recommendations provided in this thesis. Additionally, future research should consider organizational and staff factors that impact the physical environment as there is limited understandings of provincial differences for home level characteristics which may influence food intake. Further recommendations to improving intake outside of the mealtime environment are provided in additional papers resulting from the M3 study.

The summative scales of the DEAP and the MTS physical scale are validated by the findings of the analyses conducted in this thesis. While these scales were minimally different across unit types and provinces, these differences demonstrate the ability of these instruments to pick up subtle differences across a variety of dining environments. Additionally, the homelikeness scale and functionality scale were associated with different characteristics of the dining room, which are unique to these concepts; for example, homelikeness was positively associated with a garden view. Conceptually, this component should enhance homelikeness as it brings natural light into the dining room and provides residents with a view of outside. Conversely, a view of the garden would not enhance functionality, as supported in this thesis, as it does not alter the residents' ability to navigate and be within the dining room; rather, functionality was associated with adequate lighting. The bivariate analysis demonstrates that these scales are appropriately representing the discrete items on the DEAP, which one would theoretically expect. The MTS physical scale also exhibited construct validity as this scale was significantly associated with items that specifically alter the physical environment such as the number of residents in the dining area, which in part explains the size of the dining room. The physical scale of the MTS was also associated with the dining room level M-RCC. The functionality and physical environment scale were both associated with the dining room M-RCC; an enhanced physical space may allow staff members to work together efficiently, improving PCC practices during mealtimes (78,106). The homelikeness scale was not associated with the M-RCC, which may indicate that the homelike concept is more prone to subjectivity, resulting in inconsistency with the other

assessments of the physical environment. Alternatively, a homelike physical space does not necessary translate into improved person centred interactions between residents and staff. It is evident that the DEAP functionality scale and the MTS physical scale are closely related ($p<0.0001$) and are similarly associated with many of the additional measures used in this thesis (e.g. nutritional status). Additionally, these scales had similar averages, the MTS physical scale score had a mean of 5.57(SD= 0.74) and the functionality scale score had a mean of 5.29(SD= 1.15). This suggests that these scales are evaluating similar components of the dining rooms at different points, when the room was empty and when a meal was in process. The homelikeness scale appears to evaluate a specific concept of the dining environment, which may explain the lack of association with the MTS physical scale. It is recommended that the MTS physical, DEAP functionality and homelikeness scales be used to assess the physical environment in LTC dining rooms as they exhibit construct validity.

The results of this thesis allow for the provision of recommendations with regard to enhancing the physical dining environments in LTC. In all unit types, LTC homes should:

- Remove televisions from dining areas
- Reduce the presence of obstacles and clutter

In dementia care units, it is recommended that dining rooms have:

- Posted menus
- A view of the garden for majority of residents

These recommendations would not require alterations to the structural integrity of the dining room; however, resident seating arrangements and staff activities should be altered to implement these changes. Additionally, the homelikeness, functionality and overall physical environment of the dining rooms should be enhanced by implementing the characteristics of the DEAP and MTS that were significantly associated with these concepts. The overall physical environment can be improved by:

- Providing residents with music during mealtimes
- Reducing the number of individuals in the dining rooms during meals
- Promoting PCC/RCC practices during mealtimes

To enhance homelikeness in the dining room, it is recommended that:

- Provide majority of residents with a view of the garden
- A clock is present in the dining room
- Posted menu be provided in the dining room

The following recommendations enhance the functionality of the dining room:

- Increase the number of chairs
- Remove obstacles/clutter
- Have adequate lighting

For consideration in further research

- Determine how furniture with rounded edges changes seating configuration and may affect physical accessibility, clutter etc.

7.2 The Psychosocial Environment

There is a current need for standardized instruments that assess the psychosocial environments in LTC (39,40,80,82,112,124,175). This study found that the MTS and the M-RCC are potential solutions to address this need, as detailed in Chapter 5 and Chapter 6. In support of the findings of these studies, the Five Aspects of Meal model aligns with our results as the physical and psychosocial environments were found to be positively correlated, contributing to an enhanced overall dining atmosphere (68). The energy and protein intake analyses identified external factors that influence intake, specifically PCC and RCC staff actions, demonstrating that influences of resident intake interact on multiple levels, as supported by the Mealtimes as Active Processes in LTC conceptual model (71). Additionally, analyses demonstrated that interventions that are associated with psychosocial environments could be improved in all units, whereas others are unique to dementia care units. The specific aspects of the dining environment that influence quantity (i.e., energy) versus quality (e.g. protein) of the diet consumed during mealtimes will also be discussed.

Multiple components of the psychosocial environments can be improved in all units as indicated by the descriptive statistics collected from the MTS. Generally, social noise was low in all units as the average score across observations was 2.85(SD= 1.09) out of 8 suggesting that interactions specifically among residents and between residents and staff can

be improved through encouraging and facilitating meaningful social engagement. The overall social summary scale received a moderate score (μ= 5.03(SD= 0.90) out of 8) and this score was the lowest across the three MTS scales. Further, the M-RCC ratio was on average also relatively low at 1.73(SD= 0.8) further supporting this recommendation to promote social interactions during mealtimes.

In addition to social interactions, other elements of the dining space can promote psychosocial stimulus. For example, 21.22% of mealtime observations did have music playing and further consideration for use of music is suggested due to the known therapeutic benefits associated with music in the dining room (24,29,75,106,140,158,159). Also noteworthy, music was more common in dementia care units (33.33% vs. 17.24%). It is recommended that LTC homes encourage staff to provide residents with music during mealtimes, specifically music that the residents prefer and associate with. For residents who would prefer or need a quiet dining space without music, flexible dining spaces such as a family dining area, allows for both options to be available to residents.

Dementia care and general units surprisingly had similar components of the psychosocial environments present in their dining rooms, outside of the noted difference above in music use. For example, the social score in dementia care units was a mean of 2.78(SD= 0.69) while in general units this score was only slightly higher at 2.95(SD= 0.80). A qualitative comparison found that the largest difference between the two unit types with respect to social aspects was the M-RCC eating assistance ratio, where in dementia care units this ratio received a mean of 2.11(SD= 0.94), which was lower than general units (2.68(SD= 1.62)). The MTS social (μ(dementia care= 4.91(SD= 0.76) versus μ(general)= 5.09(0.96)) and MTS PCC (μ(dementia care)= 5.30(SD= 0.71) versus μ(general)= 5.54(SD=0.78)) summative scales were very similar across unit types further supporting the finding that the psychosocial environments in dementia care and general units minimally differed.

Across provinces there were a few notable differences with regard to the psychosocial environments; however it is important to emphasize that none of the provinces stood out for having optimal psychosocial environments in LTC. The M-RCC eating assistance ratio on the MTS was lowest in Manitoba (μ= 1.43(SD= 0.42)), which was significantly different

from Alberta and Ontario. Similarly on the resident level M-RCC, Manitoba received the lowest score for providing residents with assistance quickly, using a napkin to wipe their mouth and receiving one-on-one assistance throughout the meal, suggesting that Manitoba should focus on improving PCC/RCC practices specifically for those requiring eating assistance. The MTS social and MTS PCC summative scales were not statistically different across provinces further demonstrating that the provinces were relatively similar in terms of the psychosocial environments that they provide their residents. Despite this finding, it is recommended that all provinces continue to move towards relational care to support the improvement of psychosocial environments.

In dementia care units the M-RCC ratio was negatively associated ($p<0.05$) and the M-RCC eating assistance ratio specifically was negatively associated ($p<0.05$) with diet quality in general units. While these associations were negative, the M-RCC ratios were positively associated with the MTS social and PCC summative scales, suggesting that the psychosocial environment may have a greater influence on other resident outcomes, such as quality of life than on food intake. Despite these negative associations with food intake, it is recommended that LTC homes promote culture change through the implementation of relational care to move away from the medical model of care. Interestingly, the PCC rating of the MTS was not associated with diet quality, whereas the M-RCC at the dining room and resident level were. This discrepancy may be due to the specific PCC/RCC actions that support intake rather than the general PCC concept. The resident level checklist also identifies the degree of PCC/RCC practices towards individual residents whereas the PCC rating assesses the overall environment, which may not be indicative of specific resident experiences. As the therapeutic benefits of RCC practices continues to be explored, it will become increasingly important to evaluate this care practice in LTC units with the M-RCC.

Exclusive to dementia care units, meal length and the number of residents eating alone were negatively associated ($p<0.05$) with diet quality and energy intake. This suggests that dementia care units should minimize the number of residents eating alone and that staff in dementia care units be cognisant of residents' interests, preferences and personalities when creating seating arrangements, or allow residents to choose who they sit with and where they

sit to promote autonomy. Supporting this finding, there were a greater number of residents eating alone in dementia care (μ= 2.20(SD= 2.31)) as compared to general units (μ= 1.98(SD= 1.72)), despite there being fewer residents in these dining rooms. The negative association between meal length and diet quality could suggest that staff should provide residents with assistance in a timely manner to reduce wait times during meals. Certainly the average length of mealtimes was longer in dementia care units (μ= 59.24 (SD=11.49)) as compared to general units (μ= 57.18 (SD=17.34)). This negative association may also be explained by the higher number of residents requiring eating assistance in dementia care units (μ (dementia care)= 3.87(SD= 2.38) versus μ(general)= 2.86(SD= 2.71)) or having more eating challenges. As well, an average of 31.75% of residents requiring eating assistance waited for assistance with food in front of them, 39.69% were not consistently assisted and 27.64% did not receive assistance when they wanted to leave the dining room, which may also contribute to this negative association with protein intake. Finally, residents in dementia care units may have been more likely to wander increasing the length of mealtimes, which would result in a cold entrée that the resident may not want to eat reducing overall protein intake. Flexibility in these dining rooms with respect to food availability may be one way to improve food intake.

Exclusive to general units, number of *other* persons in the dining room was positively associated with diet quality. As the M3 study collected data quantitatively, there are uncertainties surrounding the positive benefits of having other persons in the dining room; perhaps there was more social interactions or greater assistance with eating from volunteers or family. This finding may also be confounded by other characteristics of these residents in general units. For example, residents in general units may have also been less likely to wander during mealtimes promoting consumption as compared to residents in dementia care units. However, these potential confounders are only hypotheses that cannot be justified without formal testing. Further research should examine this association, taking into account potential confounders, to determine if other persons in the dining area do promote consumption and the mechanism that is used (e.g. eating assistance) or if this association is a result of other characteristics that were not evaluated in M3.

The psychosocial environment minimally influenced intake and diet quality as indicated by the small R^2 values of the multivariate models. Rather, as with the physical environment, resident level characteristics, such as CPS score, explained more of the variance of these outcomes. Regardless of this finding, LTC homes should continue to enhance psychosocial environments during mealtimes as these aspects may have a greater influence on quality of life. The MTS social and PCC summative scales were significantly correlated ($p<0.05$) with nutritional status, further supporting the potential influence of the psychosocial environments on quality of life (138,139). Additionally, the resident level M-RCC was significantly correlated ($p<0.05$) with nutritional status supporting recommendations for the implementation of PCC/RCC practices in LTC dining rooms. Implementing culture change into LTC homes is challenging, therefore it is necessary that all levels of the home, from management to nursing staff, be involved in this process. The recommendations provided in this thesis could improve the psychosocial environments in LTC homes in both dementia care and general units by addressing the differing resident needs according to unit type.

As discussed earlier, the summative scales were not statistically different across unit types. Additionally, qualitative and statistical comparisons further demonstrate that the individual aspects of the psychosocial environment also minimally differed across units. The MTS social scale was positively associated ($p<0.05$) with social noise, number of residents that require eating assistance and the M-RCC ratio. The MTS PCC scale was positively associated ($p<0.05$) with lighting, excess noise and the M-RCC ratio. The similarities and differences between these two scales support their construct validation as it was expected that they would both evaluate PCC/RCC practices as measured by M-RCC, as a result of the social components of these practices. Additionally, the presence of variables in multivariate models that belong to other environments, for example lighting in the PCC model, is likely due to the influence that the physical environment has on PCC. The significant correlations across the summative scales support this, demonstrating that the physical, social and PCC environments influence each other. Further, the MTS social scale was associated with the dining room level M-RCC ratio; however, this scale was not associated with the resident

level M-RCC potentially because the MTS social scale is assessing the dining environment as a whole as intended, rather than individual social interactions. More in-depth evaluation of the psychosocial environment needs to be conducted that further details social interactions in the dining room. It is concluded that the social scale, the PCC scale and the resident level M-RCC checklist are construct valid, thus it is highly recommended that these instruments be utilized when evaluating the psychosocial environments in LTC dining rooms.

This thesis work has resulted in the provision of recommendations to enhance the psychosocial environment within LTC dining rooms during mealtimes. Recommendations in all units include:

- PCC/RCC practices be implemented during mealtimes

Recommendations specific to dementia care units include:

- Minimize the number of residents eating alone
- Further investigate if interventions such as flexible mealtimes promote food intake for these residents.

Recommendations specific to general units include:

- Other persons that enter the dining room should be further investigated to evaluate their role on intake and diet quality.

While intake and diet quality were minimally influenced by the psychosocial environments in this thesis, it remains important that these environments be enhanced due to the potential effects on resident quality of life. Further, it is recommended that dining rooms enhance social environments by:

- Increasing frequency of social interactions during mealtimes
- Staff meaningfully interact with residents requiring assistance

The PCC environment can be improved through:

- Provision of adequate lighting
- Adequate noise levels during mealtimes

It is also recommended that both the social and PCC environments be enhanced through:

- Provision of PCC and RCC practices

Improving the psychosocial environments may be difficult due to necessary culture change; however, management and staff in LTC homes should be involved in this process to promote sustainability of PCC and RCC practices. Additionally, policies should be implemented that address the psychosocial environments to promote consistency on a national level. Future research should consider organizational and staff factors that impact the psychosocial environment as there is limited understandings of provincial differences for home level characteristics which may influence food intake. Importantly, the social scale, PCC scale and M-RCC should be utilized when evaluating environments as these instruments exhibited construct validity in these studies.

Across the three studies it is clear that there are associations between the physical and psychosocial environments as suggested by the significant correlations between the DEAP, MTS and M-RCC scales (Chapters 4, 5 and 6). These correlations support the notion that interventions must be developed that address multiple components of mealtime, rather than focusing on a single area (177). The physical and psychosocial environments of mealtimes positively influence one another and contribute together to improve the overall mealtime experience. This finding is supported by the Five Aspects of Meal model as social interactions, the physical environment and staff training resulting in a PCC philosophy, interact with one another and contribute to the overall dining environment (68).

7.3 Comments on Measurement of the Physical and Psychosocial Dining Environments

While the DEAP, MTS and M-RCC exhibited construct validity this analysis also identified some limitations of these instruments. Some of these scales, specifically the DEAP homelikeness scale, the MTS social scale and the MTS PCC scale, may be prone to subjectivity due to the complexity of these concepts. To mitigate the effects of subjective bias, researchers must be trained before evaluating the physical and psychosocial environments. Examples of this subjectivity were noted in this analysis. There were inconsistencies across provinces resulting from the different instruments used. For example, while both the DEAP and resident level M-RCC identified Alberta homes as the least likely

to use restraints, the highest users of restraints in this study was identified as Ontario by the resident level M-RCC, but Manitoba was the highest user based on DEAP. As evaluated by the DEAP, Ontario had the second lowest prevalence of restraint use, which is much different from the findings of the resident level M-RCC. This discrepancy may be due to how restraint use data is collected with these two instruments or how a 'restraint' is determined. The DEAP requires asking staff members if restraints are used rather than directly observing this practice, as done with the M-RCC. Restraints in observation could be interpreted as gerichairs that limit mobility of residents, but also table placement over wheelchairs to make it challenging to self-mobilize.

Another example of potential inconsistency in measurement was social interactions. The resident level M-RCC observed Ontario as having the least social conversations between staff and resident participants, but the MTS social sound score, which includes interactions between all staff and residents, was lowest for Manitoba. This discrepancy may be due to the different perspectives of these instruments, as the residents included in the unit level observations may not reflect those who are more talkative and observed at the resident level. Further, the M-RCC at the resident level identified Manitoba as including residents in social conversations with staff the most, which directly contradicts findings from the MTS. This contradiction is likely due to these instruments being collected at different meals and days with different residents and staff present, and different assessors were used for the M-RCC and the MTS. Additionally, these discrepancies are likely due to differing focal points of the assessors, where the MTS provides an overview of the entire environment, the M-RCC as the outcome in Chapter 6 describes the dining experiences of individual residents. Within the MTS instrument, inconsistencies were also identified as the excess sound score was lowest in Ontario homes, but sound levels as measured with the environmental meter were lowest in New Brunswick. Objective measurement of continued and overall sound could potentially overcome this discrepancy, yet developing and validating such a measure and its scaling is required. Finally, while the summative scales of the DEAP did not differ across provinces, the MTS overall physical summary scale did. This could be due to potential subjectivity of the MTS as it rates the overall physical environment rather than specific concepts such as

homelikeness and functionality. Yet, the DEAP assesses physical traits that are relatively stable and the MTS evaluates characteristics that are constantly changing through mealtimes. Thus, it is recommended that both instruments be used when evaluating the dining environment, and that multiple MTS be completed to fully capture dining processes that affect ambiance.

The DEAP, MTS and M-RCC allow for observational evaluations of the physical and psychosocial environments rather than utilizing a tool that assesses perception (such as the staff PDC). This study demonstrated the importance of using observational measures to assess these environments as the staff PDC was not associated with the MTS PCC scale or the resident and dining room level M-RCC checklists. This suggests that care practices that staff perceives they are providing residents do not align with care practices being observed during mealtimes. Additionally, it is important to consider the focus of observations when deciding the appropriate instrument to be used. For example, while the resident level M-RCC and dining room level M-RCC are evaluating the same behaviours, their results depict different observations. This was evident as the means of these instruments differed across provinces, where the resident level M-RCC identified New Brunswick as exhibiting the greatest amount of PCC/RCC actions the dining room level M-RCC identified this as being highest in Ontario. While both these instruments are valuable to assess mealtime practices, the research objectives should inform the tool being used.

Upon analyzing the results from the DEAP, MTS and M-RCC, a few recommendations can be made regarding the tools themselves. It is recommended that the DEAP remove observations regarding restraint use and respecting/responding to residents' opinions as the protocol recommends completion when the dining room is empty. Staff need to be asked these questions to confirm occurrence. As both are sensitive topics, staff may present their dining area in a more positive light than is reality. Further, the staff that answers these questions would need to be fulltime and have good knowledge of actual practice, and not just the home policy. Finally, clarifying what is meant by respecting/responding to resident opinion and what is considered a restraint are recommended minimal changes to the protocol. Potentially, these variables may be more accurately collected when the dining room

is active, as meal-to-meal and day-to-day staff and residents change in these dining rooms. Additionally, while there were nominal differences in the overall DEAP score by unit type, all scales of the physical (including homelikeness and functionality), social and PCC environments were lower in dementia care units as compared to general units; however these differences were not statistically significant. This could suggest that the overall DEAP score, which was not further assessed in this thesis, may have limited utility. While research assistants were extensively trained on the DEAP and MTS prior to data collection, inconsistencies in the results may have been due to different assessors across provinces. It is likely that subjective biases skewed results, especially when completing the summative scales or when observing dining rooms that were different from those that assessors were trained in. Each of the provincial research assistants were trained in their own province, therefore training differences may also have occurred contributing to these inconsistencies. Additionally, the M-RCC evaluated actions by identifying whether the behaviour was absent or present. This becomes difficult to interpret at the dining room level, as certain actions may be both absent and present across a group of residents. For example, if some residents have restraints where others do not, restraint use would be considered both absent and present, essentially cancelling each other out when a ratio is used as the outcome. A new version of the MTS (MTS 2.0) had been created following the M3 study, which addresses this issue. On the MTS 2.0 each action is rated from 0-4 rather than evaluating each RCC action as absent or present; this version of the MTS should be used in future research for assessing RCC practices at the dining room level and is anticipated to be more responsive to change due to interventions. Additionally, the original version of the MTS used in this study minimally identified social interactions; interactions involving staff and residents are only assessed as they pertain to RCC/PCC practices or the overall social environment in the summary scale, which does not identify the type of interaction observed (e.g. social versus task focused). It is important that the social environment be further explored to gain a deeper understanding of the type of social interactions. To address this issue, the MTS 2.0 contains more in-depth questions regarding the social environment by assessing resident and staff interactions and specifies the type of interaction. This version of the MTS should be used to further quantify

the social environment. The MTS 2.0 also removed the measures that are collected using the environmental meter as this data does not aide in explaining the residents' experiences, rather these were replaced with a scale, adequate for all to adequate for none, to assess lighting. This thesis confirms this decision to remove the use the environmental meter.

7.4 Future Research and Implications for LTC

These studies provide researchers and stakeholders' with confidence that these instruments have construct validity for assessing the physical and psychosocial dining environments in LTC. These instruments can be used as outcomes in intervention research, as they capture differences. Importantly, these tools would also allow for accurate comparisons across dining environments, within and between homes and regions, potentially reflecting differences in practices and policies, especially if the same assessor is used. Upon evaluating dining environments, researchers and stakeholders can exchange information of the learnings and benefits of enhancing these environments. These analyses also demonstrate that energy and protein intake is minimally influenced by the individual aspects of the physical and psychosocial environments, yet summative scales were associated with nutrition risk and approached significance for intake. While not reported in this thesis, nutritional status, as assessed by the MNA-SF, was also evaluated as an outcome variable for examination of associations between individual items on the DEAP and MTS; consistent with dietary intake, nutritional risk was minimally positively influenced by the physical and psychosocial individual characteristics on these tools. It is unclear at this time why summative scales would be associated with nutritional status in a positive direction, but energy and protein intake are non-significant or even in a negative direction as identified for homelikeness. Potentially if energy and protein intake were categorized differently (e.g. meeting requirements of the individual), the result would have been different. Finally, only three days of intake for residents were measured which may not fully represent their nutritional status. For example, someone could be on a downwards trajectory with respect to intake, but their nutritional status has yet to significantly change with respect to body weight and other indicators used on MNA-SF that are used to determine nutrition risk. It is important to note that the M3 study was not an intervention study. Therefore it may be valuable to

implement interventions that target the physical and psychosocial environments, evaluate these environments using the DEAP, MTS and M-RCC and assess resident outcomes including food intake and nutritional status. While improvements to the physical and psychosocial environments can be completed by emphasizing the characteristics that were significantly associated with the summary scales from the DEAP and MTS, all characteristics from these tools should be considered as prior work demonstrates their relevance (9,19,24,25,27–29,31,34,36–38,104–106,113,118–120) to resident outcomes. Additionally, persons with dementia require supportive mealtime environments (85,87) therefore enhanced dining environments should be further investigated and additional efforts should be promoted to enhance these environments in dementia care units.

Future research should focus on further examining the benefits of the physical and psychosocial environments in LTC. This study has demonstrated that the DEAP, MTS and M-RCC are construct valid. Paired with qualitative data collection, these instruments could provide a deep understanding of how the mealtime environment impacts resident and staff outcomes, specifically quality of life. Further, this study supports that the physical and psychosocial environments are inter-related with one another, therefore interventions should be developed that target changes in each of these environments. The overall dining environment can only be enhanced if all the environments are altered due to components within these environments being dependent and interacting with one another. The DEAP, MTS and M-RCC could also be used to create and ensure consistent intervention implementation in research.

7.5 Conclusions

In conclusion, the elements of the physical and psychosocial environments explained little of the variance of energy and protein intake in both dementia care and general units. The covariate models in these analyses suggest that resident level characteristics may be more important in explaining this variation. The significant components of homelikeness, functionality, the physical environment, the social environment and PCC practices were outlined to provide stakeholders and researchers with a strategy to effectively promote homelike and functional dining spaces, as well as enhance the physical and psychosocial

environments. Additionally, it was determined that summary scales of the DEAP, MTS and M-RCC ratio are construct valid and can be used to effectively quantify these aspects of the dining environment. This conclusion was a result of the associations with characteristics of these instruments that are associated with the summary scales and the associations between the scales and data collection instruments that assess a variety of different concepts. Further, the DEAP, MTS and M-RCC instruments demonstrated that none of the provinces of Alberta, Manitoba, New Brunswick and Ontario are current leaders for promoting quality physical and psychosocial environments at mealtimes; all provinces should continue to improve these environments to enhance the well-being of their LTC residents. These environments were found to be inter-related while contributing to the overall dining environment suggesting that implementing interventions that improve the physical and psychosocial environments may promote consistency on a national level. Additionally, minor improvements of these measures have been suggested and a new version of the MTS has been created which addresses the shortcomings of the original version used in M3. Further, interventions should be implemented that target each of these environments due to their dependency on one another as indicated by significant associations between environments. These analyses will significantly contribute to the limited research that focuses on the physical and psychosocial environments, specifically during mealtimes in LTC, by enhancing current knowledge. Additionally, the large sample size and examination of multilevel determinants of food intake used in the M3 study has resulted in valid and reliable conclusions across these three studies. These studies will allow researchers to advance their knowledge in improving the mealtime experience which will promote interventions that address the needs of the LTC population in Canada.

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Appendix A

Mealtime Relational Care Checklist

For All Residents	
Negative Behaviours: Residents…	**Positive Behaviours: Residents…**
Are told where to sit/assigned seating	Are given choice/not assigned seating
Clothing protector is put on without asking	Request or are asked if they want a clothing protector
Are restrained	Are not restrained
Are not asked meal preference	Are asked meal preference
Have a long wait to get food	Are provided food quickly
Receive medications at meal	Do not receive medications at meals
Are not informed of actions before taken	Are informed of actions before taken
Are blatantly excluded from staff's process-related conversations	Are discreetly excluded from staff's process-related conversations
Are not included in social conversations with staff	Are included in social conversations with staff
Receive no nonverbal social interaction from staff	Receive nonverbal social interaction from staff
Do not talk to tablemates	Have some talk with tablemates
Are not addressed respectfully	Are addressed respectfully
Do not eat or ding at the table with staff	Eat or drink at the table with staff
Are forced/coerced to eat	Are allowed to determine if they want to eat
Are rushed to leave dining area	Are permitted to linger in dining area
Wait to get assistance to leave	Receive assistance when they want to leave
Are discouraged from mealtime tasks	Are allowed to be involved in mealtime tasks
For Residents Who Require Eating Assistance	
Wait for assistance with food in front of them	Do not wait for assistance with food in front of them

Have an apron or washcloth to wipe their mouth	Have a napkin used to wipe their mouth
Stop being assisted, staff leaves	Are continuously assisted
Several residents are assisted by the same staff at the same time	Received one-on-one assistance
Are assisted but rushed	Are given enough time when assisted
Are assisted but not told what they're eating	Are assisted and told what they're eating

Appendix B

Food and Food Service Satisfaction Survey

Food and Foodservice Satisfaction Survey: Aspects of Food

Question	Less than half the time	Half the time	Most of the time	Don't know	No response	Not applicable
1. Do you like the way the food served to you looks?	1	2	3	4	5	6
2. Are the hot foods served hot?	1	2	3	4	5	6
3. Are the cold foods served cold?	1	2	3	4	5	6
4. Does the food taste good to you?	1	2	3	4	5	6
5. Are the foods served to you easy to chew?	1	2	3	4	5	6
6. Overall, are you satisfied with the food?	1	2	3	4	5	6

Food and Foodservice Satisfaction Survey: Aspects of Foodservice Delivery

Question	Less than half the time	Half the time	Most of the time	Don't know	No response	Not applicable
7. Do you think the people who serve your meals have a good attitude?	1	2	3	4	5	6
8. Do the people who serve your meals have a neat and clean appearance?	1	2	3	4	5	6
9. Are the silverware, plates, cups, and glasses clean?	1	2	3	4	5	6

10. Do you have enough time to eat at each meal?	1	2	3	4	5	6
11. Overall, are you satisfied with the way food is served to you?	1	2	3	4	5	6

Food and Foodservice Satisfaction Survey: Quality of Life

Question	Less than half the time	Half the time	Most of the time	Don't know	No response	Not applicable
12. Are you hungry when you sit down to eat a meal?	1	2	3	4	5	6
13. Are you offered foods you like to eat?	1	2	3	4	5	6
14. Are you offered different foods on special occasions, such as holidays?	1	2	3	4	5	6
15. Are you satisfied with the amount of food offered to you?	1	2	3	4	5	6
16. Overall, are your meals enjoyable?	1	2	3	4	5	6
17. Does the dining room have good lighting?	1	2	3	4	5	6
18. Is the dining room clean?	1	2	3	4	5	6
19. Are the meals served when you want them?	1	2	3	4	5	6
20. Is the temperature of the dining room comfortable for you?	1	2	3	4	5	6
21. Are you able to sit with you friends at meals?	1	2	3	4	5	6

Appendix C

Depression Rating Scale

Indicator	Not present	Present but not exhibited in last 3 days	Exhibited on 1-2 of last 3 days	Exhibited daily in last 3 days
a. **Made negative statements** (e.g., *Nothing matters, Would rather be dead, What's the use, Regret having lived so long, Let me die*)				
b. **Persistent anger with self or others** (e.g., easily annoyed, anger at care received)				
c. **Expressions, including nonverbal, of what appears to be unrealistic fears** (e.g., fear of being abandoned, being left alone, being with others; intense fear of specific objects or situations)				
d. **Repetitive health complaints** (e.g., persistently seeks medical attention, incessant concern with body functions)				
e. **Repetitive anxious complaints / concerns (non-health-related)** (e.g., persistently seeks attention / reassurance regarding schedules, meals, laundry, clothing, relationships)				
f. **Sad, pained, or worried facial expressions**				

(e.g., furrowed brow, constant frowning)				
g. **Crying, tearfulness**				
h. **Recurrent statements that something terrible is about to happen** (e.g., believes he or she is about to die, have a heart attack)				
i. **Withdrawal from activities of interest-** (e.g., long-standing activities, being with family / friends)				
j. **Reduced social interactions**				
k. **Expressions (including nonverbal) of a lack of pleasure in life (anhedonia)** (e.g., *I don't enjoy anything anymore*)				

Appendix D

Mini Nutritional Assessment- Short Form

MINI NUTRITIONAL ASSESSMENT – SF

Area	Score Guide	Score	Source of Info
a) Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?	0 = Severe decrease in food intake 1 = Moderate decrease in food intake 2 = No decrease in food intake		Chart Staff Resident/Family
b) Weight loss during the past 3 months?	0 = Weight loss greater than 3 kg 1 = Does not know 2 = Weight loss between 1 and 3 kg 3 = No weight loss		Chart Staff Resident/Family
c) Mobility	0 = Bed or chair bound 1 = Able to get out of bed / chair but does not go out (of room) 2 = Goes out (of room)		Chart Staff Resident/Family
d) Has suffered psychological stress or acute disease in the past 3 months?	0 = Yes 2 = No		Chart Staff Resident/Family
e) Neuropsychological problems	0 = Severe dementia or depression 1 = Mild dementia 2 = No psychological problems		Chart Staff Resident/Family
f) Body Mass Index	0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater		Chart Staff Resident/Family
		Total Score:	

Appendix E

Dining Environment Audit Protocol

DINING ENVIRONMENT AUDIT PROTOCOL (DEAP)

Time: _____ **Unit/home code: _____**

UNIT AND DINING SPACE DESCRIPTION.

A1. Type of unit: Segregated Unit (e.g., dementia care)..... 1
Non Segregated Unit..... 0

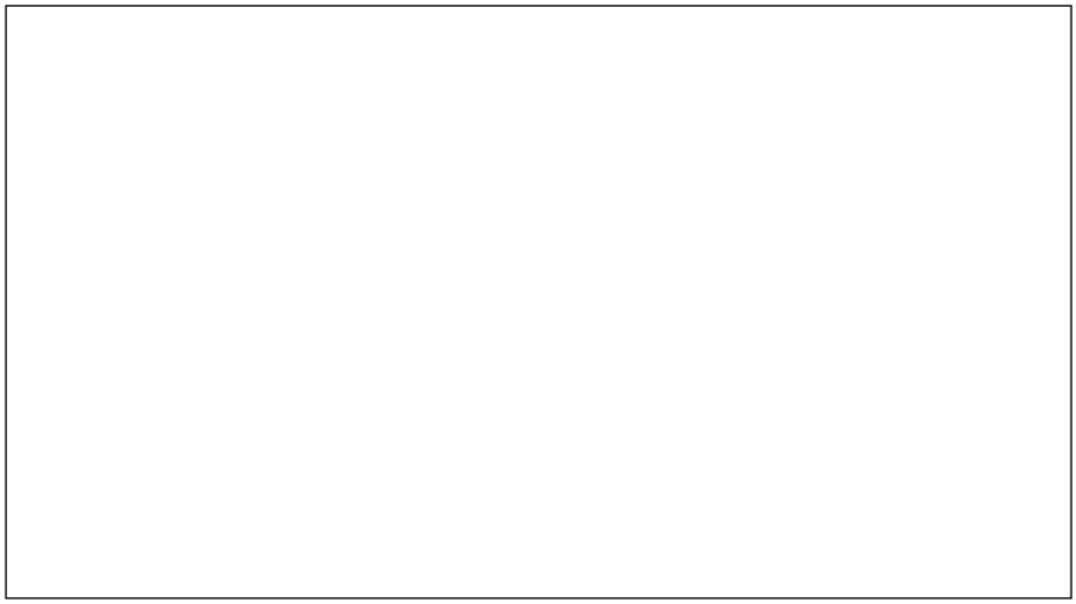
A2. General physical space

Component			**Component**		
a)	Tables	#	b)	Stools/chairs (for Staff)	#
c)	Chairs	#	d)	Entry ways/exits	#
e)	% of residents with a clear view of garden/outside 75% + =3 50-74% = 2 25-49% =1 24% or less =0				

Component		**Yes=1 No= 0**	**Component**		**Yes= 1 No= 0**
f)	Adjustable tables		g)	Contrast Table/Dishes	
h)	Contrast Table/Floor		i)	Rounded edges of furniture	
j)	Posted menu		k)	Detergent/non-edibles secured	
l)	Stove and other dangerous items secured		m)	Servery/pass through (residents/family cannot access food areas)	
n)	Television		o)	Clock	

p)	Dining room open between meals		q)	Adjacent family kitchen with residential appliances	
r)	Short distance from most bedrooms		s)	Private family dining area	
t)	Accessible washroom near dining room for residents		u)	Dining room visually accessible from most bedrooms	
v)	Accessible beverage service (open all the time)		w)	Accessible main kitchen/servery (residents/family can access; height of counters/sinks; not locked)	

A3. Draw the shape of the dining space showing the boundaries, servery, windows and the furniture layout:



SUPPORT FUNCTIONAL ABILITY

1. **Rate the "lighting intensity" in the dining room:**

Plenty (adequate natural lighting complemented with artificial lighting)…….2

Reasonable (heavy reliance on artificial lighting; inadequate in some areas)…….....1

Poor (mostly inadequate lighting)……...0

2. Is "glare" present in the dining room?

Minimum glare, lighting is fairly even, window curtains/drapes filter sunlight…….2

Some glare in certain areas (e.g., floor, windows, tables)…….....…….1

Strong glare from multiple sources (e.g., floor, tables, windows)……...……0

3. Are residents' opinions of the physical space respected and responded to (light, noise, temperature) ASK STAFF Yes _____ (1) No ____ (0) Unsure_____(9)

Size	Homelike scale (3) (i.e., <20 residents)	Moderately large space (2) (i.e., 20-30 residents)	Large institutional space (1) (i.e., 30> residents)
Pathway	Short pathways for meal delivery (3) (i.e., approx. <15 feet)	Moderate length of pathways (2) (i.e., approx. 15-25 feet)	Long pathways for meal delivery (1) (i.e., approx. 25> feet)
Obstacles/clutter	No clutter/obstacles (3)	Some clutter/obstacles (2)	Several obstacles and clutter for the size of space (1)

SAFETY AND SECURITY

4. Is there adequate space and absence of obstacle/clutter that allow ease of movement in the dining space? (circle one category in each row)

Add across categories to get Total Score _____

5. Which of the following describes the physical environment's support in staff supervision?

Staff can view all residents and get to individual residents easily and quickly.....2

Staff can view and/or easily access most of the residents except for a few.....1

Large dining room and/or awkward layout hinders staff supervision.....0

6. Are restraints used to keep resident in chairs e.g., gerichairs, tables secured in front

of resident? ASK STAFF

Yes _____ (1) No ____ (0) Unsure_____(9)

SOCIAL INTERACTION

7. Is there a mix of seating arrangements, i.e., different size and/or shape of tables?

Multiple (> 3) options of smaller and larger group seating.....2

A few (3 or less) seating arrangement options available…...……1

Only one option in seating arrangement..... 0

OVERALL HOMELIKE ENVIRONMENT OF THE DINING SPACE

8. On a scale of 1 to 8, provide your assessment of the home-likeness of the dining environment as it appeared during your observation.

Low		**Somewhat**		**Moderate**		**High**	
1	2	3	4	5	6	7	8
Institutional furniture and surroundings that are sparse or sterile-looking and absence of any homelike items.		Mix of mainly institutional furniture and some homelike items, pictures, and artifacts.		Presence of more homelike than institutional furniture, homelike finishes (e.g., flooring), and pictures, knick-knacks, etc.		Homelike furniture, such as family style large dining table(s), personally or culturally meaningful items such as pictures and residential artifacts, and non-institutional lighting, with an overall warm ambiance.	

COMMENTS:

OVERALL FUNCTIONAL ENVIRONMENT OF THE DINING SPACE

9. On a scale of 1 to 8, provide your assessment of the functional space of the dining environment as it appeared during your observation.

Low		**Somewhat**		**Moderate**		**High**	
1	2	3	4	5	6	7	8
Highly non-functional with inadequate contrast accessibility, lighting, arrangements and features.		Somewhat non-functional mix of mainly inadequate contrast, accessibility, lighting and arrangements, with some adequate features.		Moderately functional mix of mainly adequate contrast, accessibility, lighting and arrangements, with some inadequate features.		Highly functional with adequate contrast, accessibility, lighting arrangements and features.	

COMMENTS:

Appendix F

Mealtime Scan

Mealtime Scan for LTC

Meal: _____(B=1, L=2, D=3)

Unit/home code: _____ Meal Start: _____ Meal Ends: _____

A1: Environmental Measures

Measure	First Course		Second Course		AVERAGE
	Location 1	Location 2	Location 1	Location 2	
Time					
Light (lux)					
Temperature (C)					
Humidity (RH)					
Sound (db)					

*Measures taken in at least two locations in the dining area to determine a range, at table top level; Attempt to take measures when first course is being served and when second course is being served.

B1: Numbers of Persons in Dining Area

Type of Individual	Total
Residents	
a) Residents alone at a table	
b) Residents eating with others	
c) Residents requiring total physical assistance	
Staff	
a) Any staff involved in eating assistance (include agency)	
b) Staff **only** involved in plating, passing food	
Family/Volunteers	
Other persons – specify:	

B2. How many are eating in an adjacent area (lounge, café, family dining)? ASK STAFF

Residents: _____ Family members: _____ Staff: _____

B3. How many are eating in their rooms? ASK STAFF

Residents:_____ Family members:_____ Staff:_____

C1. Were there any unexpected food quality issues? ASK STAFF

No: ____ Yes: ____ If yes, describe:

_____

D1. Which of the following orientation cues are available?

	Yes	Some	No	COMMENTS
a) Food aroma ……...	2	1	0	
b) Decorations on table …….	2	1	0	
c) Meal menu on table ……..	2	1	0	
d) Table setting (e.g., place mat, utensils) …	2	1	0	
e) Tablecloth …….	2	1	0	

f) Condiment (e.g., salt, ketchup, sugar) …..	2	1	0
g) Contrast between plate and food …….	2	1	0

D2. Are residents involved in mealtime activities (e.g., setting the tables, clearing dishes)?

Yes.....1 No.....0

E1. Rate what you HEAR

0 indicates the noise was absent; 1 that the noise was minimal but didn't interfere with the mealtime experience; 2 that the noise was moderate, but minimally interfered with mealtime experience/ process, 3 noise was moderate and interfered with some mealtime experiences/ processes, and 4 noise was sufficiently distracting and potentially annoying to those present.

	Rate 0 (Low) to 4 (High)	**Comments**
a) Talk among residents		
b) Talk between residents/staff		
c) Resident screaming/calling out or making other noise		
d) Staff talking to other staff		
e) Staff calling out from a distance		
f) Hallway traffic, talk		
g) Med cart (e.g. grinding of meds)		
h) Food carts (noise)		
i) Loud speaker/intercom		
j) Alarm call bells		
k) Other equipment (microwave)		

E2. Is the TV turned off during mealtimes?

Yes.....1 No…..0 No TV in Dining Area….9

E3. Is the radio turned off during mealtimes?
Yes.....1 No…..0 No radio in Dining Area….9

E4. Is there music available during mealtimes?

Yes.....1 No Music….0

E5. What is the source of music during mealtimes?

|Radio station…1 | CD, MP3 or other music player...2 | Intercom...3 |

Not applicable…9|

E6. Is the music at a good level of loudness to allow for conversation?
Yes….1 No…0 Not applicable…9

E7. What type of music or radio station is playing?
Classical/instrumental…..1

Nature sounds…..2

Instrumental versions of popular tunes…..3

Cohort/resident specific music…..4

Other styles of music with lyrics…..5

Talk radio station (could also play music on station)…..6

Other, Specify…..7 _____

Not applicable…..9

F1. Person Directed Care

a) Rate what you see during your observations as it pertains to:

Residents…	**Y=1 N=0**	**Residents…**	**Y=1 N=0**
i) Are told where to sit/ assigned seating		Are given choice /not assigned seating	
ii) Clothing protector is put on (no asking) (if there are no protectors mark as "N/A")		Request or are asked if they want a clothing protector or if it should be put on (if there are no protectors mark as "N/A")	
iii) Are restrained		Are not restrained	
iv) Are not asked meal preference		Are asked meal preference	
v) Have a long wait to get food		Are provided food quickly	
vi) Receive medications at meals		Do not receive medications at meals	
vii) Are not informed of actions before taken		Are informed of actions before taken	
viii) Are blatantly excluded from staff's process-related conversations e.g., staff loudly discuss a resident's food selection or diet type		Are discreetly excluded from staff's process-related conversations e.g., staff quietly discuss a resident's food selection or diet type	
ix) Are not included in social conversations with staff e.g., staff ignore nearby residents during their conversations		Are included in social conversations with staff e.g., staff engage nearby residents during their conversations	
x) Receive no nonverbal social interaction from staff		Receive nonverbal social interaction from staff e.g., smile, touch hand	

xi) Do not talk to tablemates		Have some talk with tablemates	
xii) Are not addressed respectfully		Are addressed respectfully	
xiii) Do not eat or drink at the table with staff		Eat or drink at the table with staff	
xiv) Are forced/coerced to eat		Are allowed to determine if they want to eat	
xv) Are rushed to leave dining area		Are permitted to linger in dining area	
xvi) Wait to get assistance to leave (if no residents require assistance mark as "N/A")		Receive assistance when they want to leave (if no residents require assistance mark as "N/A")	
xvii) Are discouraged from mealtime tasks (including self-feeding)		Are allowed to be involved in mealtime tasks (including self-feeding)	

b) Rate what you see during your observation as it pertains to residents who require eating assistance: (Note: if no residents require assistance, mark each cell as "N/A").

Residents…	**Y=1 N=0**	**Residents…**	**Y=1 N=0**
i) Wait for assistance with food in front of them		Do not wait for assistance with food in front of them	
ii) Have an apron or washcloth used to wipe their mouth		Have a napkin used to wipe their mouth	
iii) Stop being assisted, staff leaves		Are continuously assisted	
iv) Several residents are assisted by the same staff at the same time		Receive one-on-one assistance	
v) Are assisted but rushed		Are given enough time when assisted	
vi) Are assisted but not told what they're eating		Are assisted and told what they're eating	
vii) Are assisted by staff using unsafe practices e.g., staff standing, resident in hunched over or reclined position, overloading spoon or fork, fast pace		Are assisted by staff using safe practices e.g., staff sitting, resident in upright position, reasonable amount of food on spoon or fork, relaxed pace	

c) Rate what you see during your observation as it pertains to mealtime clean-up:

	Y=1 **N=0**		**Y=1** **N=0**
i) Dishes piled on tables		Dishes removed when finished	
ii) Trolleys remove dishes during meal		General clean up left until end of meal	

G1. On a scale of 1 to 8, provide your global assessment of the PHYSICAL environment of the dining room as it appeared during your observation.

Low	Somewhat	Moderate	High
1 2	3 4	5 6	7 8
Poor lighting and orientation cues, loud, inappropriate temperature, congested.	Somewhat poor mix of mainly **inadequate** lighting, orientation cues, temperature and congestion, with some adequate features.	Moderately good mix of mainly adequate lighting, orientation cues, temperature and flow of persons in the space, with some inadequate features.	Pleasant to be in the dining area, not too loud, cold or hot, enough room, light and orientation cues.

COMMENTS:

G2. On a scale of 1 to 8, provide your global assessment of the SOCIAL environment of the dining room as it appeared during your observation.

Low	Somewhat	Moderate	High
1 2	3 4	5 6	7 8
Quiet, low engagement of residents, task-focused interactions, residents rushed.	Somewhat low mix of mainly **inadequate** interactions; task-focused engagement of residents, with some adequate aspects.	Moderately appropriate mix of mainly **adequate** interactions and engagement, with some inadequate aspects.	Appropriate level of interaction, residents engaged, meal a leisurely event.

COMMENTS:

G3. On a scale of 1 to 8, provide your global assessment of how PERSON CENTRED this meal was during your observation.

Low	Somewhat	Moderate	High
1 2	3 4	5 6	7 8
Very undignified, task-focused practices, no resident involvement in mealtime activities.	Somewhat undignified mix of mainly task-focused practices, low resident involvement, with some adequate practices.	Moderately dignified mix of mainly person-centred practices, fair resident involvement, with some inadequate practices.	Highly dignified person-centred care, residents involved in mealtime activities.

COMMENT:

Appendix G

Cognitive Performance Scale

1. COGNITIVE SKILLS FOR DAILY DECISION MAKING
Making decisions regarding tasks of daily life- e.g., when to get up or have meals, which clothes to wear or activities to do

0 **Independent –** Decisions consistent, reasonable, and safe

1 **Modified Independence –** Some difficulty in new situations only

2 **Minimally Impaired –** In specific recurring situations, decisions become poor or unsafe; cues / supervision necessary at those times

3 **Moderately Impaired –** Decisions consistently poor or unsafe; Cues / supervision required at all times

4 **Severely Impaired –** Never or rarely makes decisions

5 **No Discernible Consciousness / Coma *(Skip to section G)***