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# Retrospective and Forecasting Analysis of Increased Long Term Care Demand in Niagara

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Abstract

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MS, D'Youville College, 2015

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Doctoral Study Submitted in Partial Fulfillment

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## Abstract

A problem exists within the Canadian healthcare system as many patients experience longer lengths of stay (LOS) in acute care (AC) and complex care (CC) beds within hospitals because of a lack of long term care (LTC) facilities. The purpose of this study was to evaluate the extra days patients wait for placement and assess the benefits of increasing the number of LTC beds. The theoretical framework used was the four-level model of the health care system. Research questions involved 2017-2019 data for the number of LTC beds required to eliminate waits and evaluate beds needed in the future. This study involved using a retrospective quantitative study using hospital-acquired deidentified data from Ontario. Data were input into a forecasting model to assess the number of LTC beds required and forecast the number of beds needed to address future demand. Data demonstrated both a seasonal and periodic increase and indicated the problem would continue to escalate into 2027. In 2019, an average of 120 patients were waiting in hospital for an end destination LTC, and by 2027, if nothing changes, data showed that the number of patients waiting will increase to 509. Results showed that 12 of the 25 medical complexities patients had on their profile predicted extended waits in the hospital for a LTC bed. This study can impact positive social change by advocating for an increase in LTC beds, allowing patients who wait to discharge to appropriate settings timely and better allocation of healthcare dollars in Ontario.

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# Dedication

I would like to dedicate this dissertation to my grandmother Mildred, otherwise known as Nanny. Nanny you have shown me through example what a strong, independent, brave, caring, giving, and thoughtful woman is. You have taught me that nothing worthwhile is ever easy, the value of hard work, and to treat others the way you want to be treated. You are an amazing, loving, and God-fearing woman and I would not be here today achieving this milestone without you as an amazing example in my life. I love you a bushel and a peck and a hug around the neck, and you are my sunshine. Love you so much.

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# Section 1: Foundation of the Study and Literature Review

The purpose of this study was to analyze the number of patients who are waiting for a most appropriate discharge destination of (MADD) of long-term care (LTC) beds in acute care (AC) and complex care (CC) beds within the Niagara region. The analysis contributed to understanding the number of post-AC beds needed to better the Niagara region health system's financial stability. AC and CC are substantially more expensive than TCB and LTC beds from a government perspective (Rosella et al., 2014), and patients wait in AC or CC beds for a transfer to a lower level of care. This study will lead to positive social change by allowing the government to use its limited resources more efficiently, allowing funding to be diverted to other important healthcare-related areas.

Chapter 1 includes the problem statement, purpose of the study, research questions, theoretical foundation of the study, nature of the study, literature search strategy, literature review, definitions of key variables, assumptions, scope and delimitations, and significance, summary, and conclusions.

## Problem Statement

A problem exists involving prolongment of patient length of stay (LOS) in AC and CC beds within hospitals in the province of Ontario, as patients cannot transition to LTC facilities in a timely fashion. This study involved evaluating the increased need for LTC beds using a multivariate analysis and forecasting model. There has yet to be a study conducted to assess current and future implications of this issue. The lack of flow negatively impacts patients who the Canadian healthcare system can effectively and

efficiently treat, leading to issues such as ‘hallway healthcare’ (Bobrowski et al., 2018; Kriegel et al., 2015).

One of the significant factors impacting patient flow in the Canadian health system is the number of alternative levels of care (ALC) patients within medical, surgical, and complex care units (Kuluski et al., 2017). ALC patients no longer require the level of care they are receiving, but they are unable to return home (McCloskey et al., 2015). ALC patients add a financial burden to healthcare funding in the province of Ontario (Farmanova et al., 2016). According to Slaney et al. (2015), 5,200 beds a day in acute care are filled with designated ALC patients, and one of the precipitating factors secondary to the increase in the aging population.

The ALC category with the most prolonged LOS and one of the largest ALC categories is patients in hospital beds waiting for LTC placement (Kuluski et al., 2017). Some areas of the country see patients wait 262.8 days in either an AC or CC bed for placement in LTC (Slaney et al., 2015). With an average AC admission LOS being 6.9 days, 38 patients could have accessed that AC bed if that patient was not awaiting LTC in it (Canadian Institute for Health Information [CIHI], 2020). The Niagara Region is the fourth largest aging population in Canada according to the 2016 census, which has caused an increase in the demand for LTC beds in this region (Boyd, 2018).

A gap in literature existed directly relating the number of patients waiting in AC and CC beds for and most appropriate discharge destination (MADD) of LTC and corresponding bed demands required that would allow patients to go directly to an appropriate lower level of care without a prolonged wait. By analyzing the number of

patients who wait in both AC and CC for either TCBs or LTC, it would be possible to advocate for additional funding of LTC for the provincial government. This study is related to a healthcare administration issue as the universal healthcare system in Canada is being funded by taxpayers' dollars; therefore, the responsibility of the government is to ensure that funds are being allocated effectively (Martin et al., 2018). Specifically, in the province of Ontario, Local Health Integration Networks (LHINs) disperse funding at their discretion by reviewing the population they are serving, and as administrators, must make financial decisions based on research, census information, and data given to them by local health systems (Lee, 2018).

## Purpose of the Study

This study aimed to assess previous trends in the number of patients waiting with a MADD of LTC to forecast the number of LTC beds required currently and project number of beds needed for the future. Higher acuity care such as hospital-level care is more expensive than providing healthcare services at a lower level of care. With the proper balance between hospital beds and beds at lower level of care, the government stands to save money and redirect funding to other sources, such as preventative programs. Information in this study included number of patients waiting each week during the years 2017, 2018, and 2019 within AC and CC beds. I also evaluated the number of LTC beds required during that time in terms of seasonal and periodic trends and forecasted potential number of beds necessary in the future to eradicate this imbalance.

This study was a retrospective forecasting model study involving secondary data acquired from a local hospital system database. This included an analysis of the amount of money the Ontario government used to provide care in AC and CC for patients waiting with a MADD of LTC. The forecasting model provided by the excel program was also used to assess if this problem would continue to escalate in the future. I analyzed the number of patients who waited every week in AC and CC for with a MADD of LTC between 2017 and 2019, assessed seasonal and periodic shifts, and forecasted the potential intensity of the problem moving forward into the year 2027. This study also assessed if varying medical complexities increase a patients LOS while awaiting TCB or LTC

## Research Questions and Hypotheses

*RQ1:* Is there a periodic or seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019?

$H_0 1$: There is no periodic or seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019.

$H_a 1$: There is a periodic and seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019.

*RQ2:* Using the forecasting model, will a continued increase in need for LTC beds be shown in the Niagara Region?

$H_0 2$: The forecasting model will not show an increased need for LTC beds in the Niagara Region.

*$H_a2$:* The forecasting model will show an increased need for LTC beds in the Niagara Region.

*RQ3:* Do medical complexities have a statistically significant relationship with patient LOS and MADD of LTC?

*$H_0 3$:* Medical complexities do not have a statistically significant relationship with patient LOS and MADD of LTC.

*$H_a 3$:* Medical complexities have a statistically significant relationship with patient LOS and MADD of LTC.

## Theoretical Foundation

The theoretical framework for this study was the four-level model of healthcare. The first level is the patient, while the second is the team providing care to the patient, including physicians, nurses, therapists, families, and other clinicians. The third level is the organization caring for the patient, from clinics to hospitals to LTC. The fourth level, which is the level that is addressed in this study, is the economic and political environment under which the other three levels operate. The fourth level includes financial, regulatory, and payment (National Academy of Engineering and Institute of Medicine, 2005).

The fourth level involves economic and financial implications of regulations such as funding structures. It deals directly with the research questions' variables as this level deals with financial implications of regulations. The current funding structure within the Niagara LHIN has a high emphasis on the funding of AC and CC, not on the expansion of needed LTC beds. If this study demonstrated current and forecasted needs for LTC

beds, financial and care imbalances taking place within AC and CC systems, and needs for more cost-efficient options, the LHIN would shift the funding structure in order to create more LTC beds.

## Nature of the Study

I used the quantitative research method to analyze current and future needs for LTC beds and financial implications for patients in AC and CC while waiting for a MADD of LTC. The number of patients waiting in the hospital per week with a MADD of LTC 2017 and 2019 was inputted into a forecasting model. I was then able to analyze how many patients were waiting during those years for an end destination of LTC on a crisis basis, increasing trends, and if the forecasting model projected this problem will continue to increase. Data regarding the number of patients waiting in hospital per week also provided insight into the fragile Canadian healthcare system's current and future financial implications. A quantitative approach was the most appropriate style for this study. The purpose of quantitative research is to collect and analyze data or test a theory (Aydelotte et al., 2015). A multivariate analysis was used. The results of this study will allow the Hamilton Niagara Haldimand Brant (HNHB) LHIN to shift financial resources to allow for expansion of LTC in the Niagara Region. The HNHB LHIN is the governing body for four large regions within the province of Ontario

## Literature Search Strategy

The search engines used for the purpose of this study were Google Scholar and ProQuest via the Walden Library, and ResearchGate. Sources were published primarily between 2010 and 2020, with a few exceptions because there was little current research

in certain areas. Keywords used were *alternative level of care*, *long term care rise*, *Canada census elderly healthcare*, *baby boomers and long-term care*, skilled nursing facility, hospital acquired infections, in hospital complication, epidemic of aging, increase in the aging population, universal healthcare Canada, increasing complexities of long term care residents, licencing of long term care homes, and *hallway medicine Canada*.

## Literature Review Related to Key Variables and Concepts

The main areas of focus in this literature review were financing of the Canadian and Ontario healthcare systems, costs of AC, CC, and LTC beds, ALC, capital investments in the opening of LTC beds, the increasing aging population in Canada, requirements for LTC placement, TCBs, and Meditech.

### Canadian Healthcare

Canada has a universal healthcare system, which means that taxes finance healthcare which is supplied universally to all Canadian citizens (Martin et al., 2018). From a financing perspective, the healthcare budget is provided by the national government, but funding is divided and given to different provinces and territories to provide to their populations. Although the national government finances healthcare, healthcare is provided individually by provinces and territories (Glied, 2008). For example, the province of Ontario has a provincial healthcare plan called Ontario Health Insurance Plan (OHIP). The province of Ontario has chosen to subdivide the government's monetary allotment that they receive even further into LHINs. Ontario has 14 LHINs across the province. The government distributes funding to LHINs based on

the number of people served and size of geographical location (Lee, 2018). The LHIN can then decide how to use the budget that has been given to them based on specific needs of populations (Bhandari & Snowdon, 2012).

**Increase in the Aging Population**

According to Statistics Canada (YEAR?), the proportion of seniors has been steadily increasing since the 1960s. In the 1960s, only 8% of the population was over the age of 65. In 2009, that number was 14%. By 2036, the proportion of people expected to be over the age of 65 is 25% and will rise to 28% by 2061. The increase in the aging population is thought to be due to many different factors, including but not limited to Baby Boomers aging and medical advances allowing people to live longer (Taylor, 2020).

With an increase in the aging population comes an increase in chronic conditions and comorbidities. The increase in chronic conditions has been shown to increase the cost of healthcare in Canada substantially. Denton and Spencer (2010) suggested expanding LTC homes to handle the medical complexity of elderly patients and take some of the hospital system's burdens. The Niagara region has the second-largest senior population proportion of the 11 major regions of Ontario (Benner, 2017). It is projected by 2031 that over 27% of the Niagara population will be over 65 (Forsyth, 2008).

**Building LTC Homes**

In 2019, the Ontario government updated the Construction Funding Subsidy Policy for Long-Term Care Homes under the Ministry of Health and Long-Term Care. This included an update of the construction funding subsidy. The construction funding

subsidy can be applied for by privately owned or not-for-profit companies wishing to open or expand the number of LTC homes. The subsidy is based on the number of beds being constructed and percentage of rooms being created. Three different rooms are available for construction: a four-bed ward room, semi-private room, and private room. The per-diem rate is a per bed per day rate of between $18.03 and $23.03 depending on basic accommodation ratios (Ministry of Health and Long-Term Care, 2019). The government has made available for not-for-profit companies interested in building LTC homes a one-time $250,000 planning grant (Ministry of Health and Long-Term Care, 2019).

An exhaustive search was completed. No research has been conducted regarding the financial burden that TCB or LTC patients waiting in AC and CC has on the Canadian healthcare system.

**Cost of AC, CC, and LTC**

The cost of healthcare is dependent on the level at which care is being provided. If a patient receives a higher level of care, the cost is generally higher than if the patient were to receive a lower level of care. For example, an intensive care admission within the hospital system is the highest cost ratio per day at $3,600 a day, as there are a substantial resources focused on one person (David-Cummings, 2019). As a patient travels through the continuum of care and the intensity of resources they require lessens, as do costs. On average, within Ontario's province, the per-day cost of an AC admission is $1,700 (David-Cummings, 2019). In CC, the cost is even less, as the unit is typically overseen by a nurse practitioner instead of a physician, and the staffing ratio of registered

practical nurses to registered nurses is much higher (Hutchison et al., 2011). The average cost of an inpatient complex continuing care per day is $800 (Home Care Ontario, 2019). The per-day cost from a government perspective for placing a patient in LTC is $112 (Home Care Ontario, 2019)

Cloutier-Fisher (2000) assessed the overall restructuring of LTC within the province of Ontario as a whole, as well as its implications within a small rural community. The rapid increase in Canada's aging population required drastic and aggressive strategies (Katz, 2011). One of the concerns was large deficits that could ensue if the government did not substantially expand the province's number of LTC beds. Cloutier-Fisher recommended a financial analysis of the burden of patients needing to be placed in LTC homes, and homes not being available for patients to access readily.

**Patients Who Require LTC from Hospitals**

Costa et al. (2012) assessed the proportion of the ALC population that awaited LTC from the hospital and which factors determined if patients were required to wait in the hospital for LTC. Although only 8.8% of the ALC population was waiting for LTC in Canada in 2011, patients awaiting LTC accounted for 41.5% of days waiting with an ALC status. Numerous different factors influenced this, including but not limited to mobility, confusion, exit-seeking behaviors, frequent falls, lack of family support, morbid obesity, diagnosis of psychiatric illness, or abusive behaviors (Costa et al., 2012). The three most significant factors that contributed to prolonged LOS in the hospital while awaiting LTC were morbid obesity, diagnosis of a psychiatric disorder, and abusive behaviors (Costa et al., 2012). For patients that are waiting in hospital for placement in a

long term care facility, it is both a negative experience for their quality of life, and a burden to the Canadian healthcare system as a whole (Meadus, 2014).

**Niagara Region Aging Population**

The largest generational cohort is Baby Boomers, or individuals born between 1947 and 1966, many of whom have recently left the workforce, or in the near future will retire (Fields et al., 2014). When assessing sizeable shifts in the overall population, eventually changes will be required to national policies due to the strain that aging will put on different systems such as healthcare (Phillips & Durant, 2017). Niagara will be impacted heavily because this region has one of the most senior populations in Canada (NAME OF AUTHOR, YEAR). In Ontario alone, Niagara has the second-largest proportion of individuals over 65 (19.2%). One of the factors which affects the large aged population in Niagara directly is the cost of living, which is among the most reasonable in the province (Phillips & Durrant, 2019).

In areas with high proportions of seniors in Canada, strains on the hospital system are not seen to the same degree with younger populations. With shortages in both affordable retirement home options as well as LTC beds, there will inevitably be a backlog in the hospital system. This leads to bottlenecking in the emergency department, which has been seen throughout the Niagara Health System (NH) for many years (Blomqvist & Busby, 2012).

**Quality of Life in LTC**

In a hospital setting, the primary focus of healthcare is patients' biological, chemical, and physical health; however, when transitioning to a LTC facility, this is

expanded to include psychological health from an overall quality of life (QOL) perspective (Ersek & Carpenter, 2013). Robichaud et al. (2006) said the most important QOL indicators were being treated with respect, sympathetic involvement in relationships, perceived competency in nursing acts, and continuing sense of identity involving opportunities to engage in essential activities, even on a modified basis. QOL can only occur when staff takes the time to get to know residents personally, which is not often possible in hospital settings due to time restraints (Robichaud et al., 2006).

Coughlan and Ward (2007) said examined what residents in LTC felt made their experience high in quality. One of the specific examples provided by residents included when staff members were able to get to know them on a personal basis and find out what was important to them. LTC is better suited to this due to the staff they employ, including recreational therapists, occupational therapists, and dietary aids (Coughlan & Ward, 2007). Other ways that have shown to increase a resident's quality of life in LTC is through personalizing their space, feeling engaged in meaningful activities, and lastly feeling safe that the staff can manage their medical complexities (Carpenter & Hirdes, 2013)

**Potential Risks of Prolonged Hospitalization**

Several potential risks exist involving prolonged hospitalization. Risks include adverse events, a hospital-acquired infections, and delirium (Baker et al., 2004). Baker et al. (2004) said 7.5% of patients admitted to an AC facility in Canada experienced one or more adverse events. An adverse event is an unintended injury or complication that could result in death, disability or prolonged hospitalization. As the amount of time spent in the

hospital increases, the likelihood of suffering an adverse event also increases (Hammond, Pinnington, & Phillips, 2009).

One of the other potential complications accompanying prolonged hospital stay is being diagnosed with hospital-acquired antibiotic-resistant microorganisms. Such infections include methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant Enterococcus (VRE), multiresistant pseudomonas aeruginosa, and ESBL causing Escherichia coli and Klebsiella (Taylor et al., 2016). These varying microorganisms that can be found in hospitals make certain types of antibiotics not useful, should they ever have an infection that requires that type of antibiotic. Hospital-acquired antibiotic-resistant microorganisms can be potentially life-threatening should a patient be diagnosed with a specific type of infection that a particular antibiotic can only treat, and that patient is resistant to that antibiotic due to a hospital-acquired superbug they acquired from a previous admission (Warnke et al., 2013).

The last potential complication of prolonged hospital admission discussed in this study is increased delirium incidence in dementia patients. When patients with dementia suffer from medical complications such as hip fractures or pre-existing comorbid conditions such as congestive heart failure, they are admitted to the hospital for longer, and will likely suffer from delirium and not return to preadmission levels of cognition. Delirium has multiple potential implications, one of which being the patient's inability to re-enter communities or previous locations such as home, and require placement in a LTC home (Fick et al., 2013).

## Case Managers/Discharge Planners' Effect on TCB and LTC Processes

Hospitals employ case managers/discharge planners on most units throughout hospitals within Ontario. The terms case manager and discharge planner are synonymous. Case managers can have varied professional backgrounds but must be registered with a professional college. For example, if a patient is in a low-intensity rehabilitation bed, but is not making enough functional gains to return home, then the case manager schedules a family meeting to discuss with the patient and family a change in disposition or end destination. The case manager is aware of what exclusion criteria are in place from varying TCB locations. Therefore, if TCBs are not an option for patients, they would be listed at the highest priority for placement in LTC from the hospital (Collier & Harrington, 2005). Case managers have the knowledge to move patients from the hospital to either TCBs or LTC.

## Definitions

*Acute Care (AC):* A branch of secondary healthcare where a patient receives active but short-term treatment for a severe injury or episode of illness, urgent medical condition, or during recovery from surgery (Bridges et al., 2010). For this study, acute care will reference medical and surgical units.

*Alternate Level of Care (ALC):* A patient occupies a bed in a hospital and does not require the intensity of resources/services provided in this care setting (Walker & Lead, 2011).

*Case Manager/Discharge Planner:* Hospital administrators who assess treatment needs, develop, monitor, and evaluate treatment plans and progress, facilitate

interdisciplinary approaches and identify patients who may need post-acute care, create care plans, facilitate their choice of post-acute provider, and oversee transfers to post-acute care (Collier & Harrington, 2005).

*Complex care (CC):* Provides continuing, medically complex, and specialized services to both young and old individuals, sometimes over extended periods. CC is provided in hospitals for people who have long-term illnesses or disabilities, typically requiring skilled technology-based care, rehabilitation, palliative care services, and medically complex needs such as IV antibiotics (Ministry of Health and LTC, 2019b).

*Hallway Healthcare:* When patients are waiting for a hospital bed in an unconventional or unexpected location. This could include a hallway or other space within the facility that was not originally intended for patient use (Bobrowski et al., 2018).

*Long Term Care (LTC):-* Also known as a nursing home or skilled nursing facility, an LTC facility provides 24/7 nursing, personal support, and primary care. Patients can require LTC for various reasons, including physical and cognitive difficulties (Ontario LTC Association, 2019).

*Meditech:* An EHR system that provides clinical charting for healthcare professionals at midsized and community hospitals.

*Most Appropriate Discharge Destination (MADD) of LTC:* In the Meditech EHR system within Niagara Health, this is when a case manager along with the interdisciplinary team, patient, and family have determined the patient will require placement in a LTC facility imminently.

*Senior:* Any person over the age of 65.

*Transitional Care Beds (TCBs):* A setting in which patients can transition out of the hospital into a congregate environment (i.e., retirement home) with the LHIN providing 24/7 personal support into these beds. Patients within the TCB program receive heightened priority for placement in order for expedited placement in an LTC facility (Hamilton Niagara Haldimand Brant Local Health Integration Network, 2019).

## Assumptions

For this study, I assumed that the case manager working with patients and their family assessed if other alternatives were available for patients outside of waiting in either AC or CC for with a MADD of LTC facility. Other options include but are not limited to returning home with additional home care supports or trial rehabilitation to increase mobility. The second assumption is the case manager puts in the ALC designation in a timely fashion for the provincial government to track this data.

The third and last assumption of this study is that if the patient becomes medically unstable at any time while holding an ALC designation, the case manager cancels the ALC due to a change in medical status. To be ALC, a patient must be able to move immediately to the appropriate bed; therefore, if the patient becomes medically unstable at any point during their ALC designation, the ALC should be canceled to reflect that so data are not skewed.

## Scope and Delimitations

Current and future projected needs for additional LTC beds in the Niagara region has not been studied. Since patients are coded within the Meditech system as MADD

LTC, the coding can show whether the patient was in an AC or CC bed, there were no threats to this study's internal validity. Patient data involving only ALC patients and were coded as awaiting a MADD of LTC. Therefore, all other ALC patients were excluded, including patients awaiting rehabilitation on an AC floor. Since I only assessed data from the Niagara region, this limits the generalizability of the study. However, the research still shows the overall cost-effectiveness of expansion of LTC beds within other Ontario and Canada areas, though not to the same extent as Niagara.

## Significance, Summary, and Conclusions

This study involved addressing patients waiting for TCB and LTC within the AC and CC for a MADD of LTC, seasonal changes, periodic increases in number of patients between 2017 and 2019, and forecasted continued increases in terms of the number of patients in AC and CC to allow for redirection of healthcare dollars to cost-effective care such as LTC. This study is important because there is limited research in this area, yet there is a problem that is potentially causing a significant economic imbalance within an already fragile healthcare system. With this research, there is potential for better enhancing care for the elderly population by allowing funding to go to appropriate areas and other areas of improvement within this population.

With AC being the costliest form of care and LTC being significantly less expensive from a government perspective, Worrall and Chaussalet came to a conclusion that LTC beds should be funded and created if there is increased demand (2015). This research supports the professional practice by informing policy and funding decisions made by the LHIN. By informing the LHIN of the financial imbalance of patients

awaiting TCB and LTC in AC and CC and redistribution of funding, Niagara Region citizens will be better able to access care they need at the level they require. This study has the potential to lead to positive social change by decreasing hallway healthcare and moving patients to appropriate beds quickly, which increases quality of life.

Significant areas of focus in the literature include increases in the aging population leading to an increase in LTC bed needs. However, no study has specifically looked at the cost of this burden of patients waiting in hospital for TCBs or LTC, as well as the number of beds that would need to be created to eradicate that burden. This study will fill this gap by assessing seasonal, periodic, and forecasting trends of patients who wait in AC and CC for a MADD of LTC as well as financial burdens that are caused by this, and assess what would happen if the expansion of LTC is not made a priority. By accessing data from the hospital system within one of the largest aging populations in Ontario, there is the opportunity to advocate for redistribution of funding to expand LTC throughout the province of Ontario, as the increase is being seen province wide

## Section 2: Research Design and Data Collection

This study involved analyzing patients who had a MADD of LTC in AC and CC beds within the Niagara region. and CC are substantially more expensive than LTC beds from a government perspective (Rosella et al., 2014). This study will lead to positive social change by allowing the government to efficiently use its limited resources and then fund other important healthcare-related areas.

Section 2 includes the research design and rationale, methodology, which included the population, sampling and sampling procedures, instrumentation and operationalization of constructs, threats to validity, ethical procedures, and a summary.

### Research Design and Rationale

This study involved using a forecasting model with retrospective secondary data to analyze future demand of LTC beds that would have been needed in the Niagara region up to the year 2027. In this study, the independent variable is the number of patients per week who waited with a MADD of LTC within AC and CC between 2017 and 2019. This variable was inputted into a forecasting model to visualize trends retrospectively and forecast the intensity of the potential problem moving forward. The research design was an exploratory forecasting design that will inform future studies looking at ramifications of this problem and costs to the Niagara LHIN for patients awaiting a MADD of LTC. The data then allowed me to determine demand for LTC beds that are required moving forward towards and until 2027.

A constraint was the timeliness of Niagara Health in terms of providing requested datasets. Decision support at Niagara Health said this process can take anywhere from a

few days if data is already tracked and a file already exists to 6 weeks if data need to be pulled from the system directly. A recommendation was made to complete an application for the Hamilton Integrated Research Ethics Board (HiREB) in preparation of the proposal defense. From approval of the study by HiREB to having organizing data in spreadsheets took 8 weeks total. A forecasting study was completed to assess the extent of the problem periodically throughout the data set and in the future. Presentation of data and findings will allow shifting funding to less costly forms of care such as LTC.

## Methodology

### Population

The population in this study were patients who have been designated ALC within the Meditech system at Niagara Health between 2017 and 2019 with a MADD of LTC.

### Sampling Procedures

To assess the financial imbalance that is occurring in the hospital system in terms of patients waiting for a MADD of LTC in hospitals, the LOS for these patients was calculated. All patients with a MADD of LTC show that they require urgent placement in LTC. However, there are a few options of how a patient is to get to the end destination of LTC. This is assessed by a case manager, and varying coding is used to decipher the route. However, this research study's main goal was to evaluate the problem as a whole, and therefore assesses the data globally. The case manager responsibility is to input the date that the patient was determined to be ALC, and upon the date of discharge, they are discharged out of Meditech, and a destination is added. I was then able to determine how many patients per week were waiting for TCB and LTC. The population used for this

study were all patients deemed ALC with a MADD of LTC within Niagara Health between 2017 and 2019. Patients designated ALC between 2017 and 2019 who were waiting for a destination other than MADD of LTC were excluded.

To access this data, an application to HiREB was completed. Once this in-depth application process was completed, HiREB committee members reviewed my application who sit on the board. Once my application was discussed, my application was accepted with recommendations and then accepted. When my HiREB application was approved, I was contacted by decision support staff to confirm what information must be collected. Once the file was put together with needed information, it was transferred to an encrypted file on Niagara Health's source net page, to which only I had access. Fifty data points is the minimum required to run a forecasting model within SPSS, and this study far exceeded that by having 156 data points.

**Instrumentation and Operationalization of Constructs**

The instrument used for this study was EHR Meditech created by Medical Information Technology Incorporated, which Niagara Health uses for all patient information and tracking. Within the Meditech system, case managers are responsible for the proper delineation of ALC patients, coding them correctly, and removing them from the system upon discharge. LOS and delineation of TCBs and LTC, as well as patient-specific medical complexities within Meditech are tracked. Niagara Health has a review board that reviews data extrapolation requests, which is called the HiREB. Once my application to HiREB was completed and reviewed, NH data support created an encrypted document that only I had access to via Sourcenet.

Data points are considered reliable because each patient in every hospital is rounded upon every day, and when an interdisciplinary team feels a patient should be made ALC, the case manager does so and designates accordingly. Therefore, the data provided by NH were reliable. Data included LOS of all patients from 2017 to 2019 who waited in a hospital for either TCBs or LTC.

This study's independent variable was the number of patients that who per week with a MADD of LTC in AC or CC. Data support provided this information include start dates and mapping calendars until discharge. For LOS specifically, if a patient made ALC on April 1 and was discharged to a to a MADD of LTC on June 10, the patient would have waited 30 days in April, plus 31 days in May and 10 days in June. The calculation would be a total LOS of 71 days. The dependent variables in this study were cost per day and ALC costs overall. For example, for a patient who waited in an AC bed for 71 days, given an approximate cost of $1,700 a day, $120,700 would be incurred by the HNHB LHIN for this patient instead of $7952, which would be the government cost to LTC at a rate of $112 a day. The cost difference of $112,748. Data were then analyzed using a simple linear regression in order for a p-value to be calculated. The information that I received was recorded on an encrypted Excel spreadsheet. I used Excel for the forecasting model and ANOVA for calculating p values.

*RQ1:* Is there a periodic or seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019?

*$H_0 1$:* There is no periodic or seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019.

*$H_a1$:* There is a periodic and a seasonal effect in data for patients waiting with a MADD of LLTC between 2017 and 2019.

*RQ2:* Using the forecasting model, will a continued increase in need for LTC beds be shown in the Niagara Region?

*$H_0$2:* The forecasting model will not show an increased need for LTC beds in the Niagara Region.

*$H_a$2:* The forecasting model will show an increased need for LTC beds in the Niagara Region.

*RQ3:* Do medical complexities have a statistically significant relationship with patient LOS and MADD of LTC?

*$H_0$3:* Medical complexities do not have a statistically significant relationship with patient LOS and MADD of LTC.

*$H_a$3:* Medical complexities have a statistically significant relationship with patient LOS and MADD of LTC.

The encrypted data that NH was providing included the following information: a unique number for patient identifiers made by a data analyst at NH, the hospital site where patients were located, whether they were on an AC or CC floor, patient destination detail dates, ALC discharge dates, coding for destination detail, the MADD, and medical complexities.

When a patient is waiting for a TCB bed, they are coded as TCB.RETH in Destination Detail and LTC in MADD. When the patient is waiting in the hospital for LTC, both the discharge destination and MADD will state LTC. I added a column and

calculated LOS between original ALC dates and the dates of discharge for each patient. Another variable was cost of each patient's ALC stay for either TCBs or LTC. Prices vary depending on the location of patients being in an AC or CC bed. The forecasting model allowed me to assess trends in terms of the number of patients waiting for TCB and LTC between 2017 and 2019 and forecast future projections of the number of LTC beds required in the Niagara Region.

**Threats to Validity**

Three types of potential threats to validity existed in this study. The first threat is the extent of generalizability of the study in regard to geographical location. Because data were only taken from the Niagara region hospital system, and because Niagara has currently the second-largest aged population in Ontario, it limits the generalizability of this information to other regions across the province and Canada as a whole. However, due to the increasing aging population across Canada, it will not be long before other areas win Canada will find themselves in similar or worse situations.

Internal validity is the extent to which a study can solidify relationships between variables and there are no other alternative explanations for connections. For this study, the forecasting model had internal validity in terms of predicting future trends. Should patients' medical stability change, their ALC is canceled and therefore not counted during ALC days and counted as acute days in the hospital. During this study, threat of mortality was accounted for as the ALC is canceled if there is a change in patients' medical status. Therefore, not being able to move into appropriate beds (TCB or LTC) should it become available.

Construct validity involves whether or not a test is measuring what it claims to be measuring. Regarding the number of ALC patients waiting for a MADD of LTC, threats to construct validity involved per-day costs of either AC or CC beds can vary per day based on patients' care needs. For example, a patient has medical conditions such as a trach with deep suctioning, vac, or complicated dressings, the costs per day may vary. However, this study only had one cost per day for either AC or CC as there is no way for me to obtain medical variations with regards to medical idiosyncrasies on a patient-by-patient basis.

**Ethical Procedures**

I inquired during the proposal phase to NH regarding their protocols to obtain secondary data from Meditech. NH is a part of the HiREB with the institutional review board (IRB) responsible for approving all data for research within NH, St. Joseph's Healthcare, and Hamilton Health Sciences. The HiREB committee meets biweekly to review applications from students and staff regarding these organizations and students in postsecondary institutions to ensure they meet ethical and scientific standards. Once an application is submitted to HiREB, it is reviewed, and then the request is either accepted, denied with recommendations for change, or entirely rejected with reason. The HiREB application is entirely online. No ethical concerns regarding recruitment exist as all patients in the data set are not recruited but deemed ALC by an interdisciplinary team. All data was kept in an encrypted file, and there were no patient identifiers in the data.

## Summary

This study was a retrospective forecasting model study involving assessing the number of patients waiting per week for a MADD of LTC in either AC or CC using anonymous secondary data from the years 2017, 2018, and 2019 from Meditech. The purpose of this study was to analyze the number of LTC beds that were needed moving in 2027 using a forecasting model, and the extent to which this problem would continue to grow. This study will allow for the advocacy of more LTC beds. This study also involved analyzing seasonality and periodic changes in data sets between 2017 and 2019. Lastly, I assessed medical complexities of patients waiting with a MADD of LTC and if there was a statically significant relationship between LOS and the 25 complexities, or the number of complexities identified.

## Section 3: Presentation of the Results and Findings

This research study involved analyzing data between 2017 and 2019 regarding patients waiting in hospital beds with a MADD of LTC within the Niagara region. Data were used to assess how many LTC beds would have been required to eradicate the Ontario government's financial burden. First, I assessed if there were seasonal and periodic changes in data between 2017 and 2019. Second, this study involved using a forecasting model to predict if there will be an increased need for LTC beds by 2027. Last, I assessed if medical complexities increase patients' LOS. This section includes information regarding data collection and results, as well as a summary.

### Data Collection of Secondary Data Set

Secondary data sets included all ALC patients with a MADD of LTC. Data involved patients with a designation date between 2017 and 2019 as well as patients who were discharged within that time frame. A designation date is a date that the case manager determines when the patient gets to LTC. Data involved all patients waiting in the hospital within this time frame, even if they were designated earlier than 2017.

In reviewing the data set, I found two discrepancies that I did not expect to encounter. The first discrepancy was there were duplicate entries noted within the dataset. Because each duplicate needed to be assessed individually and I had not requested identifiable data, data analysts at Niagara Health who provided me the data suggested that they make a unique data code for each patient. Unique data codes allowed duplicates to be assessed individually. Most duplicate entries were due to errors in the initial data entry. All duplicates were scrubbed appropriately.

There were also some varying destination details that I did not expect to encounter. I inquired to clerical support at Niagara Health for further clarification regarding five destination details. The first was patients designated either with no tolerance long duration (NTLD) or low tolerance long duration (LTLD). NTLD and LTLD designations are used for ALC patients waiting for medically complex care or low-intensity rehabilitation. Clerical support stated these patients' designations must be changed to either NTLD or LTLD if they are off service into complex care beds from acute medical beds. Complex care beds have a lower per-day cost than acute medical beds, and if there are no appropriate patients to put into complex care beds, the flow manager will allocate off-service patients for these beds.

The Home with CCAC (HME.CCAC) designation is used when patients access CCAC services, better known as home and community services. The HME.CCAC designation was expected to be seen for only the Home 1st program, which involves a patient returning to their home environment with added support from home care to await placement in LTC, which is seldomly used as a plan, as there must be a backup for hours if home care cannot fill the hours. Clerical support stated that varying case managers used this designation to indicate LHIN Care Coordinators completing and then waiting for transitional care beds between 2017 and 2019.

Patients with a palliative or end of life (PAL) as their designation detail as well as a MADD of LTC were expected to expire within 90 days in an end-of-life (EOL) program. However, these patients did not expire within 90 days, and therefore, conversations were had by case managers with the family about discharge planning. For

these patients, their end destination was LTC, but they still received PAL support until and throughout their transition to LTC. An example of a community organization is a public guardian or trustee who makes treatment decisions or handles finances in situations where patients have no power of attorney or a willing substitute decision-maker. After reviewing and assessing all discrepancies in data, all patients, regardless of destination detail variations, had the same MADD of LTC and waited in hospital beds.

There were 2,128 participants in data, duplicates included. After cleaning duplicate data, there were 1,921 patients between 2017 and 2019 who waited in AC or CC with a MADD of LTC. AC beds at the St. Catharine's site (SCS) had 404, Greater Niagara Falls General (GNG) had 234, and Welland County General (WHS) had 424 for 1,062 patients. At complex care sites, the Greater Niagara Falls General had 333, Welland County General had 192, Port Colborne General (PCG) had 179, and Douglas Memorial Sites (DMH) had 155 for a total of 859 (see Appendix A). Because the data set encompasses the entire population of patients waiting in the hospital with a MADD of LTC, there are no external validity threats.

**Results.**

A total of 1,921 patients waited for LTC between 2017 and 2019. These patients' LOS varied from 1 to 711 days, or just under 2 years in a hospital. The total LOS for all 1,921 patients equaled 77,471 days. At the GNG site in AC beds, there was a total LOS of 5,506 days, and within CC, the number was 11,928. At the WHS in AC beds, there was a LOS of 12,206, and within CC beds, the number was 11,615. The SCS, which only

has AC and mental health beds, had a LOS of 16,352. At the PCG and DMH sites who both only have CC beds, the numbers were 9,444 and 10,316 LOS, respectively.

RQ1 was: Is there a periodic or seasonal effect in data for patients waiting with a MADD of LTC between 2017 and 2019? In order to assess this, a multiple regression analysis was completed using dummy variables in SPSS. The dummy variables that were created were season (winter, spring, summer, and fall) and year (2017, 2018, and 2019). While completing the multiple regression analysis, the season winter and year 2017 were omitted from the data. Table 1 shows data which is evenly distributed across 3 years.

**Table 1**

*Descriptive Statistics for RQ1*

| | Mean | Std. Dev | N |
|---|---|---|---|
| # of patients waited | 77.24 | 12.387 | 156 |
| Spring | 0.2500 | 0.43441 | 156 |
| Summer | 0.2692 | 0.44499 | 156 |
| Fall | 0.2500 | 0.43441 | 156 |
| 2018 | 0.3333 | 0.47292 | 156 |
| 2019 | 0.3333 | 0.47292 | 156 |

A Pearson correlation coefficient was used to assess the linearity of season to season or year to year. Therefore, when assessing the seasons, summer has a slightly negative relationship with spring at -0.350, which means that there are less patients in hospital in summer with a MADD of LTC, with fall being also worse that summer at -0.333. Spring had a negative relationship with summer and fall, and fall had slightly negative relationship with spring and fall. 2018 and 2019 both show a moderate negative relationship with each other, with both showing a value of -0.500.

**Table 2**

*Pearson Correlation for RQ1*

| | Spring | Summer | Fall | 2018 | 2019 |
|---|---|---|---|---|---|
| Spring | 1.000 | -0.350 | -0.333 | 0.000 | 0.000 |
| Summer | -0.350 | 1.000 | -0.350 | 0.000 | 0.000 |
| Fall | -0.333 | -0.350 | 1.000 | 0.000 | 0.000 |
| 2018 | 0.000 | 0.000 | 0.000 | 1.000 | -0.500 |
| 2019 | 0.000 | 0.000 | 0.000 | -0.500 | 1.000 |

The Durbin Watson analysis is used to assess the presence of autocorrelations in regression analysis. SPSS determined a value of 0.311, which indicates that there is a positive autocorrelation. Also found in the model summary is an R squared value of 0.131. An R squared value indicated the proportion of the variance that can be explained by the independent variable. The value if 0.131, meaning approximately 13% of movement in the index is completely explained by seasonality or periodic change.

**Table 3**

*Model Summary SPSS Output for RQ1*

| R | R Square | Sig. F Change | Durbin Watson |
|---|---|---|---|
| 0.362 | 0.131 | 0.001 | 0.311 |

Table 5 includes ANOVA statistics. The most important of those statistics are a statistically significant relationship of periodic changes throughout the time frame between 2017 and 2019.

**Table 4**

*ANOVA SPSS Output for RQ1*

| | Sub of Squares | Df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| Regression | 3121.576 | 5 | 624.315 | 4.533 | 0.001 |
| Residual | 20660.648 | 150 | 137.738 | | |
| Total | 23782.224 | 155 | | | |

Table 5 includes further descriptive statistics involving the number of patients who waited per week between 2017 and 2019. The mean of the number of patients that waited was 77.24, with a standard error value of .992. The confidence interval that was selected for the purpose of this study was 95%. The lower bound was found to be 75.28, and the upper bound was 79.20. Table 6 shows the Collinearity Statistics as were provided through SPSS analysis. The Sig. shows that there is statistically significant increase in the number of patients that waited with a MADD of LTC in the fall compared to the spring, and to a lesser degree the summer. This is shown by fall having a significance value of .000, and spring being .465, and summer .057 respectively. Therefore, I rejected the null hypothesis that neither season nor the periodic nature of the data effects are seen in this data, and accept the hypothesis that there are periodic and season changes in the number of patients waiting for a most appropriate discharge destination of LTC.

**Table 5**

*Descriptive Statistics for Number of Patients Who Waited*

| | Statistic | Std. Error |
|---|---|---|
| Mean | 77.24 | .992 |
| 95% Confidence Interval of the Mean- Lower Bound | 75.28 | |
| 95% Confidence Interval of the Mean- Upper Bound | 79.20 | |

**Table 6**

*Collinearity Statistics SPSS Output for RQ1*

| | Unstandardized Coefficients | | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|
| Model | B | Std. Error | T | Sig. | Tolerance | VIF |
| (Constant) | 71.808 | 2.365 | 30.366 | .000 | | |
| Spring | 1.987 | 2.713 | .733 | .465 | .640 | 1.562 |
| Summer | 5.119 | 2.666 | 1.920 | .057 | .632 | 1.583 |
| Fall | 10.115 | 2.713 | 3.729 | .000 | .640 | 1.562 |
| 2018 | -1.269 | 2.302 | -.551 | .582 | .750 | 1.333 |
| 2019 | 4.346 | 2.302 | 1.888 | .061 | .750 | 1.333 |

The SPSS system was used to create a histogram, normal p-plot of regression standardized residual, and scatter plot all involving the dependent variable of number of patients who waited for research question 1 (see Figure 1).

**Figure 1**

*Histogram of RQ1*

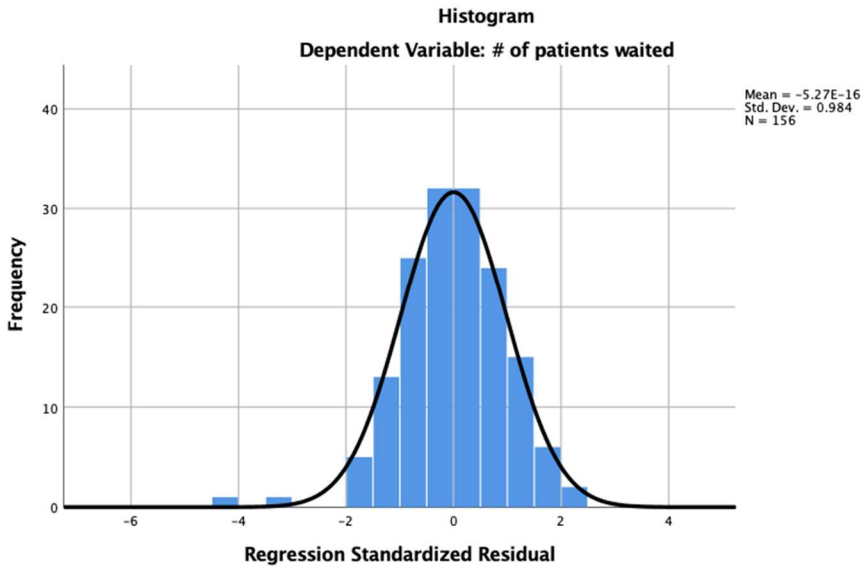



Figure 2 shows the normal p-plot of regression standardized residuals for patients who waited between 2017 and 2019. This chart shows cumulative distributions of standardized residuals and compares them to what would be expected if there was a normal distribution. As can be seen in Figure 2, data were normally distributed.

**Figure 2**

*Normal P-Plot of Regression Standardized Residuals for RQ1*

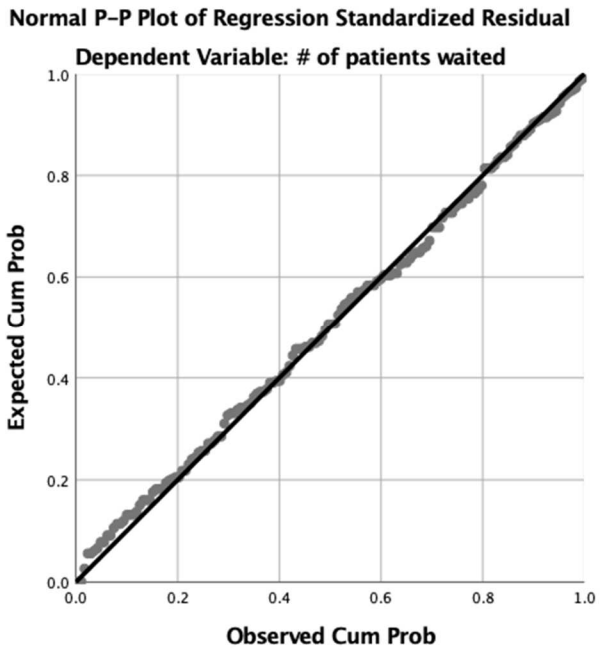
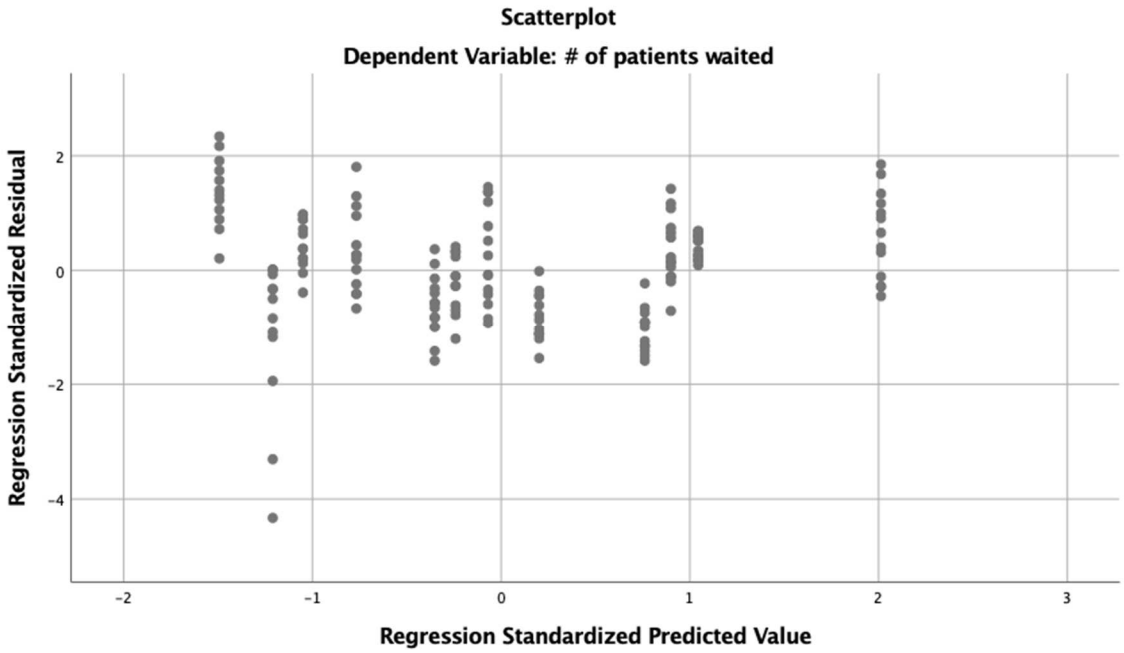


**Figure 3**

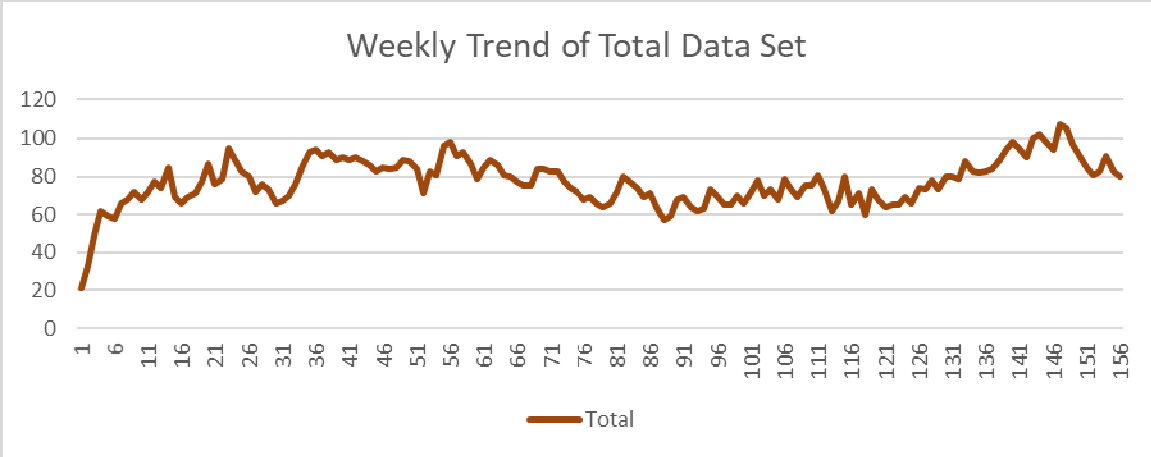
*Scatterplot of RQ1*




RQ2 was: Using the forecasting model, will a continued increase in need for LTC beds be shown in the Niagara Region? Using the forecasting model, I assessed if there would be a continued increase in LTC bed need in the Niagara region. A week calculator was used to forecast this information based on designation date and date of discharge for a total of 156 weeks. All varying designation details were added together in order to determine a weekly total of how many patients waited within the system for an end destination of LTC (see Appendix A).

**Figure 4**

*Line Graph for Total Week Count 2017-2019*




After calculating the number of patients who waited per week, a forecasting model was used based on the total number of patients (Table 7). As shown in Table 7, the forecasting model shows a projection till the end of 2027, which shows 509 patients waiting in the hospital, with a MADD of LTC (Figure 4). The current funded bed capacity of the Niagara Health System is under 600 beds. With this information, if the existing bed funding structure were carried forward to 2027, 84% of the entire system's capacity would be unavailable to acutely ill patients. Therefore, the null hypothesis is rejected that the forecasting model would not show an increase in the need for LTC beds in the Niagara region, and the alternative hypothesis is accepted, which is that the forecasting model would show an increase in the demand for LTC beds in the Niagara region. The P value and R squared were also calculated for this forecasting model which can be seen in Table 8. The R value was found to be 0.9919, which shows an almost perfect liner relationship. The p value was found to be 0.00087, which with an alpha rate

of 0.01 there is found to be a statistically significant increase in the number of patients that are projected to wait in hospital with a MADD of LTC.

**Table 7**

*Forecasting Model for Patients Waiting for a LTC Destination*

| Years | # of pts projected to wait per week |
|---|---|
| 2019 | 80 |
| 2021 | 237 |
| 2023 | 328 |
| 2025 | 418 |
| 2027 | 509 |

**Figure 5**

*Line Graph for Forecasting Weekly Total*

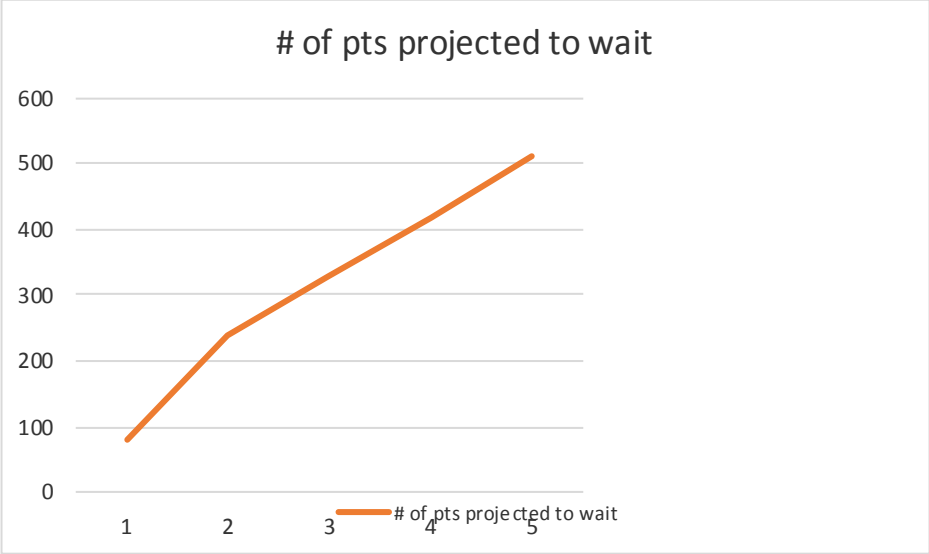


**Table 8**

*P-Value and R-Squared Table for Forecasting Model*

| Analysis | Figure |
|---|---|
| Count | 5 |
| CORREL/R | 0.9919 |
| STDEV/SX | 164.438 |
| STDEV/SY | 165.621 |
| b | 0.99903 |
| Syx | 24.2837 |
| Sb | 0.07383 |
| t | 13.5300 |
| df | 3 |
| P value | 0.00087 |
| Alpha | 0.05 |
| t-crit | 3.18244 |
| sig | yes |
| Lower CI | 0.76405 |
| Upper CI | 1.23405 |

RQ3 was: Do medical complexities have a statistically significant relationship with patient LOS and MADD of LTC? An ANOVA was calculated using dummy variables in the software system R (see Appendix B). Twenty-five medical complexities can be identified as a case manager according to a list available on Meditech (see Table 8).

**Figure 6**

*Medical Complexities Key*

| Code | Medical Complexity |
|---|---|
| BA | Bariatric |
| DL | Dialysis |
| ES | Equipment/Structural |
| FD | Feeding |
| ML | Meds/Labs/Therapy |
| NE | Neurological |
| RE | Respiratory (excludes Ventilation) |
| BS | Behavioral Requirements-1:1 Support |
| BG | Behavioral Requirements-Aggressive Behaviors |
| BX | Behavioral Requirements- Sexualized Behaviors |
| BE | Behavioral Requirements- Unspecified |
| IC | Infection Control- Requiring Isolation |
| OD | Infection Control-Outbreak at Discharge Destination |
| OR | Infection Control- Outbreak at Facility |
| DR | Developmental Requirements |
| WC | Wound Care Requirements |
| MA | Mental Health- Addictions |
| MD | Mental Health- Concurrent Disorders |
| MH | Mental Health- Unspecified |
| ABI | Neurological Requirements- Acquired Brain Injury |
| NE | Neurological Requirements- Unspecified |
| SF | Social Requirements- Financial Constraints |
| SH | Social Requirements- Housing/Homelessness |
| SS | Social Requirements- Lack of Social Support |
| SL | Social Requirements- Legal Concerns |
| SR | Social Requirements- Unspecified |

The medical complexities were converted into a dummy variable by a score of 1, indicating that the complexity was identified or a 0 if it was not. Two ANOVAs were calculated, the first assessing if the total number of medical complexities and a patient's LOS were considered statistically significant. As seen in Table 9 and 10, the total number

of complexities and a patient's LOS were considered statistically significant with a p-value of <2.2e-16, less than 0.001.

**Table 9**

*Total Number of Complexities*

| | Df | Sum Sq | Mean Sq | F Value | Pr(<F) |
|---|---|---|---|---|---|
| Total Conditions | 1 | 333296 | 333296 | 114.88 | <2.2e-16 |

**Table 10**

*Medical Complexities with Corresponding F and P values for RQ3*

| Complexity Code | Df | Sum Sq | Mean Sq | F Value | Pr(<F) |
|---|---|---|---|---|---|
| RE | 1 | 9 | 9 | 0.0034 | 0.9535 |
| OD | 1 | 905 | 905 | 0.3261 | 0.5680078 |
| NE | 1 | 36414 | 36414 | 13.12 | 0.0002989 |
| MD | 1 | 475 | 475 | 0.1711 | 0.6791689 |
| DL | 1 | 19889 | 19889 | 7.1695 | 0.0074793 |
| BX | 1 | 245 | 245 | 0.0883 | 0.7663228 |
| BS | 1 | 7373 | 7373 | 2.6577 | 0.1032184 |
| MA | 1 | 3 | 3 | 0.0010 | 0.9749874 |
| FD | 1 | 9047 | 9047 | 3.2613 | 0.0610929 |
| OF | 1 | 3389 | 3389 | 1.2216 | 0.2691879 |
| ML | 1 | 1139 | 1139 | 0.4107 | 0.5216929 |
| SS | 1 | 53505 | 53505 | 19.2874 | 1.187e-05 |
| SR | 1 | 27951 | 27951 | 10.0755 | 0.0015267 |
| SL | 1 | 688 | 688 | 0.2480 | 0.6185280 |
| SH | 1 | 25505 | 25505 | 9.1922 | 0.0024634 |
| BG | 1 | 114986 | 114986 | 41.4497 | 1.529e-10 |
| ES | 1 | 74 | 74 | 0.0268 | 0.8699738 |
| MH | 1 | 101320 | 101320 | 36.5235 | 1.812e-09 |
| BE | 1 | 38259 | 38259 | 13.7916 | 0.0002102 |
| BA | 1 | 5709 | 5709 | 2.0580 | 0.1515744 |
| DR | 1 | 3939 | 3939 | 1.4200 | 0.2335546 |
| SF | 1 | 84384 | 84384 | 30.4183 | 3.961e-08 |
| WC | 1 | 11074 | 11074 | 3.9920 | 0.0458588 |
| IC | 1 | 27162 | 27162 | 9.7912 | 0.00178208 |
| ABI | 1 | 70431 | 70431 | 5.132E-07 | 5.132e-07 |

Regarding the 25 individual medical complexities, 12 were considered to have a statistically significant relation to LOS (see Table 10). These complexities were: dialysis, neurological, behavior requirements- aggressive behaviors and unspecified, infection control/ isolation requirements, wound care, mental health unspecified, neurological requirements- acquired brain injury, neurological requirements- unspecified, social

requirements- financial constraints, housing/homelessness, lack of social support, legal concerns, and unspecified. The analysis allows me to reject the null hypothesis that medical complexities do not have a statically significant relationship with a patient's LOS with a MADD of LTC and accept the alternative hypothesis that some medical complexities have a statistically significant relationship with LOS.

## Summary

The data I were able to obtain answered each of the research questions. Firstly, there was found to be a seasonal shift in the number of patients waiting with a MADD of LTC, as well as an increase periodically. Secondly, research showed via a forecasting model that the need for LTC beds will continue to rise into the end of 2027 to a projected total of 509 patients waiting in hospital per week with an end destination of LTC. Lastly, 12 medical complexities and the total number of complexities per patient were found to have a statistically significant relationship to a patient's LOS. In Chapter 4, the above answers will be analyzed for their implications for professional practice and social change.

Section 4: Application to Professional Practice and Implications for Social Change

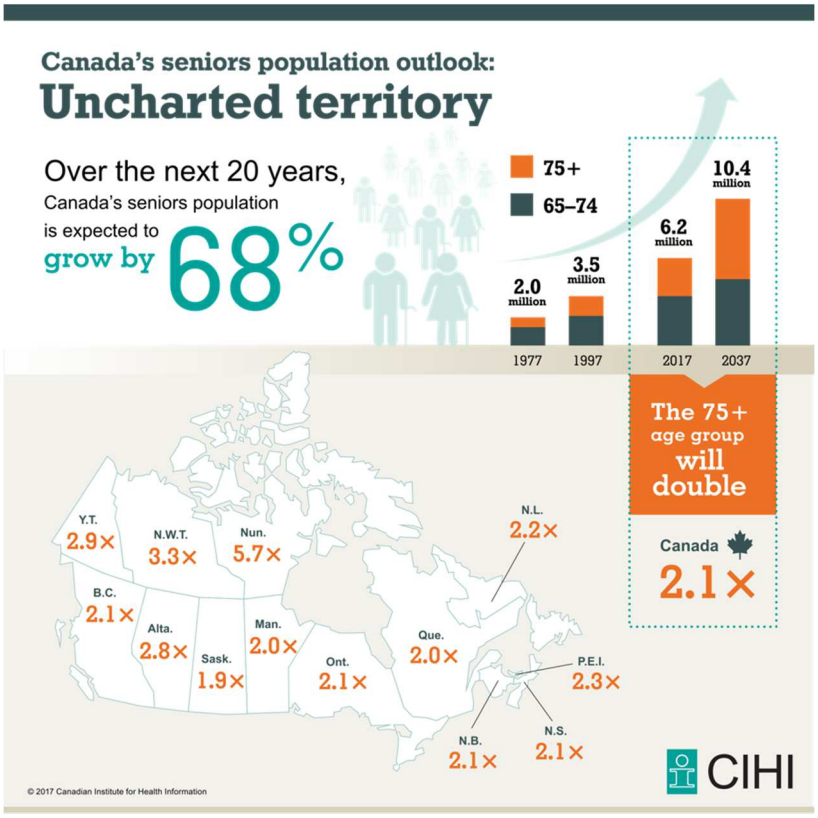
The purpose of this research project was to evaluate the increased demand for patients awaiting a MADD of LTC in the Niagara region and assess the benefits of increasing the number of LTC beds. Three key findings of this study are related to the research questions. The first key finding that there is a periodic increase and seasonality differences in terms of data seen between 2017 and 2019. The second key finding is that the forecasting model projects 509 patients waiting in the hospital per week for an end destination of LTC by the end of 2027. This is 84% of AC and CC units' current bed availability within the entire NH system. The last key finding was related to medical complexities that case managers can identify. Twelve of the 25 medical complexities identified by case managers had a statistically significant relationship with LOS, in addition to the total number of complexities a patient has on their profile being statistically significant in terms of LOS.

## Interpretation of the Findings

The data from this study confirms an increase in the aging population, and this increase is seen in the Niagara region, which is causing an increase in the need for LTC. This will become an escalating issue over the next 10 years. This increase in the aging population will continue to escalate into 2037 (Taylor et al., 2017).

**Figure 7**

*Canada's Senior Population Outlook*




Advocacy for increases in LTC beds can be extended due to the following factors. The first is the increase in the aging population that will be continuing into 2037, alongside data showing the number of patients requiring LTC increasing over the 3-year data collection period. Secondly, the forecasting model has shown a potentially devastating financial impact on the hospital system. This is causing a financial burden on an already fragile system.

In order to expand knowledge regarding financial imbalances that were occurring for patients waiting in AC and CC for a MADD of LTC, I calculated a total LOS which was 34,064 days in AC, and in CC, this number was 43,303. The average cost was $1,700

for an AC bed, $800 for a CC bed, and $112 for a LTC bed (David-Cummings, 2019). I calculated how much it costs the government for these patients to be occupying hospital beds instead of LTC beds. With a LOS within AC of 34,064 and a cost of $1,700 a day, accrued costs to the healthcare system totaled $57,908,800, compared to patients were in LTC, where costs would have been $3,815,168. Total spending by the government on AC between 2017 and 2019 was $54,093,632. With a LOS within CC of 43,303 and a cost of $800 a day, accrued costs to the healthcare system totaled $34,642,400; compared to if patients were in LTC, this price would have been $4,849,936. Spending by the government for CC beds between 2017 and 2019 was $29,725,464. The total cost difference between AC and CC across Niagara Health was $83,886,096 for patients waiting for a MADD of LTC between the years 2017-2019 (see Table 10).

**Table 11**

*Costs to the Healthcare System for Patients between 2017 and 2019*

| Type of Bed | LOS | Cost to Occupy the bed | Cost if in LTC bed | Total Cost in overspending |
|---|---|---|---|---|
| AC | 34,064 | $57,908,800 | $3,815,168 | $54,093,632 |
| CC | 43,303 | $34,642,400 | $4,849,936 | $29,792,464 |
| Total | | | | $83,886,096 |

This study also involved expanding knowledge regarding number of LTC beds that need to be built and how many may be needed in the future. A minimum of 1,921 LTC beds should be commissioned by the Ontario government and HNHB LHIN in the Niagara region. $83,000,000 has been misdirected by the government to house these patients in hospital as opposed to LTC. By the end of 2027, there will be a projected

424% increase, from 120 to 509 patients projected to be waiting in hospital per week. Therefore, the number of LTC beds that should be built in Niagara by 2027 to keep up hospital flow and decrease or eradicate the financial burdens should be 6,224.

RQ3 assessed number of medical complexities patients had, or if certain medical complexities were found to have a statistically significant relationship with increased LOS. Overall, as the total number of complexities increased, there was found to be an increase in patients' LOS. There were also 12 medical complexities that had a statistically significant relationship with increased LOS. With patients are becoming increasingly complex, and this has ramifications for LTC in terms of accreditation, regulation, staffing, and financing.

With limited funds, patients require placement in what is considered a basic, 4 bed ward, accommodation level. Basic is the only accommodation level where the government will provide a subsidy if income falls below the basic rate, which is $1,891. The number of beds that should be expanded upon most are at a basic four bed ward accommodation levels.

The theoretical framework of this study is the four-level model of healthcare. The fourth level is the level that is associated with this study. The Ontario government has chosen to focus on AC and CC funding, instead of expanding LTC beds.

This study has shown that the Ontario government has overspent in Niagara alone, over $83,000,000 over 3 years because of this regulatory decision. This study under this theoretical framework allowed me to advocate for the cost-efficient option of expanding LTC beds. Advocation for an increase in LTC beds holds even more weight as

the forecasting model shows that this problem will continue to worsen, and the government will have a more severe financial imbalance moving forward if they do not invest money into the expansion of LTC beds.

## Limitations of the Study

The most significant limiting factor of this study is because the data set was only specific to the Niagara region, and therefore the generalizability of the severity of the findings within this data is in some ways, limited to this region. However, the increase in the aging population is not only limited to the Niagara region but is happening all over Ontario and Canada. Therefore, the severity of the problem may not be seen across the province of Ontario or across Canada yet, the problem will either start to develop or expand in magnitude across this country. A second limiting factor that is not examined by this study is the fact that I am unaware of why a LTC bed has opened up. Whether it was a patient who no longer required the intensity of services, a patient required an increased intensity of services that could not be matched in LTC, or a resident expiry.

The third limitation that I came across after assessing the secondary data set from Niagara Health are the duplicates in the data. Even though I did clean and attempt to assimilate the duplicate entries' information, there is no way to know that I interpreted those duplicates correctly without having identifiable data and going back through the patient's chart.

## Recommendations

Several different recommendations for future research that have come out of this study. The first is that this data set purposely did not include any data that the COVID-19

pandemic may have impacted. The COVID-19 pandemic has had a significant impact on LTC within both Ontario and the Niagara region specifically. The two most essential impacts are deaths related to outbreaks of COVID in LTC homes and the associated decrease in the capacity that the Minister of Health and LTC implemented during the first wave of the pandemic. The decreased capacity was all four-bed ward rooms were forced to change to two-bed wards. The move to two-bed ward rooms was instituted as the Ministry saw that most of the deaths recorded were housed in 4-bed ward rooms and was instituted as a part of Directive #3 (Ministry of Health and LTC, 2020).

With both factors in mind, the increase in deaths in LTC as well as the decrease in capacity, it would be interesting to perform a future research study to assess if there was any change to the number of patients waiting in hospital for LTC, but also to assess the number of patients on the waitlist for LTC in the community. This is because the COVID pandemic discouraged patients from accessing hospitals as the fear of COVID increased.

The second recommendation for future study would be to perform an in-depth analysis of the patients who waited the longest for placement in LTC. Although case managers' medical complexities give us some insight into why these patients waited longer, it would be interesting to pull individual charts to assess the barriers for those patients.

The third recommendation is to assess if there is an economic advantage to repurposing already existing infrastructure. Examples of this would be older hospitals or other medical facilities as they would have existing supplies, such as oxygen already available. Repurposing older facilities would be in comparison to building new facilities

from the ground up. The last recommendation for future research would be expanding this study to include data from all of Ontario, but still subdivide by region. Expanding the data collection across the province would allow for further generalizability of this data and problem. The fourth recommendation for future study is to assess why a bed in LTC has become available to add more depth to future study.

## Implications for Professional Practice and Social Change

Several possible implications for professional practice with regards to social change that can be made with the results of this study. The first is the advocation for an increase in the number of LTC beds. The avocation for more LTC beds will provide positive social change by allowing precious healthcare dollars in the future to fund other needed programs. A number of other positive benefits for patients being in the appropriate bed were elaborated on in the first chapter. Some of these benefits include increased quality of life for the patient and the family as there is decreased stress.

This research study has also increased knowledge for the types of beds most required by assessing the medical complexities identified by case managers. The first medical complexity examined will be patients that require dialysis. These are not specific beds that have dialysis attached to the LTC home, but the Ministry of Health and LTC needs to provide additional financial resources for homes to offer transportation subsidies for patients that require dialysis to entice LTC homes to accept these patients.

The next area that needs to be expanded within LTC is not a specific bed type, but the complexities of patients that LTC is willing to take. The complexities that were identified, such as neurological, infection control, and wound care, show a change in the

complexities of patients requiring LTC. As patients become increasingly complex, fewer LTC homes are willing to accept them as they are more work than other simpler patients that take less time from a care perspective.

Other medical complexities that were considered to share a statistically significant relationship with LOS were mental health diagnosis or acquired brain injury. The increase LOS for these patients may be due to the lack of education of staff surrounding these diagnoses and therefore might dissuade an administrator from accepting this patient into an available bed. This can be improved upon with an increase in education on how to appropriately interact with patients with these diagnoses and administrators to feel comfortable accepting patients with these diagnoses.

The last of the medical complexities with a statistically significant relationship with LOS were related to social requirements. These included financial constraints, housing/homelessness, lack of social support, legal concerns, and other unspecified social constraints. The most modifiable of these areas from a LTC perspective is with regard to financial constraints. I understand this because the patients per month income falling below the basic rate for LTC and the patients requiring a subsidy upon admission to LTC. With this knowledge in hand, the expansion of basic rooms within LTC should be one of the focuses.

The final area that will be impacted for professional practice and social change is the potential benefit to hospital flow. If patients are not waiting in hospital beds for an end destination of LTC then the flow throughout the system improves. Increasing flow at the end of the AC and CC system could improve wait times all the way up to emergency

departments assisting in ending what is known as ‘hallway healthcare’. This is because patients could be moved effectively and efficiently through the system from emergency to medical, medical to complex care, and complex care to LTC.

## Conclusion

This research study has shown the inefficiencies of the current funding format from the Ontario government through the Ministry of Health and LTC. The data has shown that there is a financial burden to the funding structure currently in place, and the forecasting model shows that the problem will continue to grow, potentially crippling the hospital system within the region of Niagara if immediate action is not taken. The medical complexities that shared a statistically significant relationship with LOS show what areas of LTC require the largest expansion and offer ideas and insight into ways of improving LOS and outcomes for these patients.

# References

Affleck, A., Parks, P., Drummond, A., Rowe, B. H., & Ovens, H. J. (2013). Emergency department overcrowding and access block. *Canadian Journal of Emergency Medicine*, *15*(6), 359-370.

Ahmed, D. (2019). *The challenge of alternate level of care (ALC) facing older adults in Ontario: Implications for government and policy makers using a descriptive data analytics approach* (Doctoral dissertation Waterloo University).

Aydelotte, W. O., Fogel, R. W., & Bogue, A. G. (2015). *The dimensions of quantitative research in history*. Princeton University Press.

Baker, G. R., Norton, P. G., Flintoft, V., Blais, R., Brown, A., Cox, J. ... O'Beirne, M. (2004). The Canadian adverse events study: The incidence of adverse events among hospital patients in Canada. *Complete Full Name of Journal*, *170*(11), 1678-1686.

Bender, D., & Holyoke, P. (2018, July). Why some patients who do not need hospitalization cannot leave: A case study of reviews in 6 Canadian hospitals. *Healthcare Management Forum, 31*(4), 121-125.

Benner, A. (2017, May 3). Niagara aging population booming. *Niagara Falls Review*. https://www.niagarafallsreview.ca/news/niagara-region/2017/05/03/niagara-aging-population-booming.html#:~:text=Information%20from%20the%202016%20census,per%20cent%20of%20the%20population.&text=That's%2095%2C845%20Niagara%20residents

Bhandari, G., & Snowdon, A. (2012). Design of a patient-centric, service-oriented health care navigation system for a local health integration network. *Behaviour & Information Technology*, *31*(3), 275-285.

Blomqvist, A., & Busby, C. (2012). Long-term care for the elderly: Challenges and policy options. *CD Howe Institute Commentary*, (367).

Bobrowski, D., Elfassy, M. D., & Bobrowski, A. (2018). Hallway healthcare: Solving acute care overflow from the community. *University of Toronto Medical Journal*, *95*(3), 50-53.

Boyd, M. (2018). The aging of the population and generational shifts: Canada 2067. *Canadian Issues*, 32-37.

Bridges, J., Flatley, M., & Meyer, J. (2010). Older people's and relatives' experiences in acute care settings: Systematic review and synthesis of qualitative studies. *International Journal of Nursing Studies*, *47*(1), 89-107.

Canadian Institute for Health Information (2020). Inpatient hospitalizations: Volumes, length of stay and standardized rates. *Quick Stats Metadata.* https://www.cihi.ca/sites/default/files/document/dad-quickstats-metadata-inpatient-acute-en.pdf

Carpenter, I., & Hirdes, J. P. (2013). Using interrail assessment systems to measure and maintain quality if long term care. *A good life in old age,* 17, 93-139.

Coughlan, R., & Ward, L. (2007). Experiences of recently relocated residents of a long-term care facility in Ontario: assessing quality qualitatively. *International Journal of Nursing Studies*, *44*(1), 47-57

Chappell, N. L., & Hollander, M. J. (2011). An evidence-based policy prescription for an aging population. *Health Pap*, *11*(1), 8-18.

Cloutier Fisher, D. S. (2000). *Long -term care restructuring in rural Ontario: Retrieving community narratives through a case study approach* (Order No. NQ55620). Available from ProQuest Central; ProQuest Dissertations & Theses Global. (304609372). Retrieved from https://ezp.waldenulibrary.org/login?qurl=https%3A%2F%2Fwww.proquest.com%2Fdocview%2F304609372%3Faccountid%3D14872

Collier, E. J., & Harrington, C. (2005). Discharge planning, nursing home placement, and the Internet. *Nursing Outlook*, *53*(2), 95-103.

Costa, A. P., Poss, J. W., Peirce, T., & Hirdes, J. P. (2012). Acute care inpatients with long-term delayed-discharge: evidence from a Canadian health region. *BMC health services research*, *12*(1), 172.

David-Cummings. (2019). Canadian Hospital Rates. http://www.david-cummings.com/documents/canadian_hospital_rates.htm

Denton, F. T., & Spencer, B. G. (2010). Chronic health conditions: changing prevalence in an aging population and some implications for the delivery of health care services. *Canadian Journal on Aging/La Revue Canadienne du Vieillissement*, *29*(1), 11-21.

Ersek, M., & Carpenter, J. G. (2013). Geriatric palliative care in long-term care settings with a focus on nursing homes. *Journal of Palliative Medicine*, *16*(10), 1180-1187.

Farmanova, E., Kirvan, C., Verma, J., Mukerji, G., Akunov, N., Phillips, K., & Samis, S. (2016). Triple Aim in Canada: Developing capacity to lead to better health, care and cost. *International Journal for Quality in Health Care*, *28*(6), 830.

Fields, N. L., Anderson, K. A., & Dabelko-Schoeny, H. (2014). The effectiveness of adult day services for older adults: A review of the literature from 2000 to 2011. *Journal of Applied Gerontology*, *33*(2), 130-163.

Fick, D. M., Steis, M. R., Waller, J. L., & Inouye, S. K. (2013). Delirium superimposed on dementia is associated with prolonged length of stay and poor outcomes in hospitalized older adults. *Journal of hospital medicine*, *8*(9), 500-505.

Forsyth, P. (2008, May 16th). *Seniors Population to Soar in Niagara by 2031*. Niagara This Week. https://www.niagarathisweek.com/news-story/3289151-seniors-population-to-soar-in-niagara-by-2031/

Glied, S. A. (2008). *Health care financing, efficiency, and equity* (No. w13881). National Bureau of economic research.

Hamilton Niagara Haldimand Brant Local Health Integration Network. (2019) *Transitional Care Bed Program- Planning Your Care.* http://healthcareathome.ca/hnhb/en/news/Documents/PLANNING%20YOUR%20CARE_TRANSITIONAL%20CARE%20BED%20PROGRAM.pdf

Hammond, C. L., Pinnington, L. L., & Phillips, M. F. (2009). A quanitative examination of inappropriate hospital admissions and lengths of stay. *BMC health services research,* 9(1), 1-9.

Home Care Ontario (2020, June 2). *Facts and Figures- Publicly Funded Home Care.* https://www.homecareontario.ca/home-care-services/facts-figures/publiclyfundedhomecare

Hutchison, B., Levesque, J. F., Strumpf, E., & Coyle, N. (2011). Primary health care in Canada: systems in motion. *The Milbank Quarterly*, *89*(2), 256-288.

Hutchison, B., & Glazier, R. (2013). Ontario's primary care reforms have transformed the local care landscape, but a plan is needed for ongoing improvement. *Health Affairs*, *32*(4), 695-703.

Katz, P.R. (2011). An internation perspective on long term care: focus on nursing homes. *Journal of the American Medical Directors Association,* 12(7), 487-492

Kriegel, J., Jehle, F., Dieck, M., & Tuttle-Weidinger, L. (2015). Optimizing patient flow in Austrian hospitals–improvement of patient-centered care by coordinating hospital-wide patient trails. *International Journal of Healthcare Management*, *8*(2), 89-99.

Kuluski, K., Im, J., & McGeown, M. (2017). "It's a waiting game" a qualitative study of the experience of carers of patients who require an alternate level of care. *BMC health services research*, *17*(1), 318.

Lee, G. E. (2018). The establishment of Ontario's local health integration networks: A conflation of regionalization with integration of health services. *Health Reform Observer–Observatoire des Réformes de Santé*, *6*(2).

Manton, K. G., Singer, B. H., & Suzman, R. M. (Eds.). (2012). *Forecasting the health of elderly populations*. Springer Science & Business Media.

Musau, J., Baumann, A., Kolotylo, C., O'shea, T., & Bialachowski, A. (2015). Infectious disease outbreaks and increased complexity of care. *International Nursing Review*, *62*(3), 404-411.

Martin, D., Miller, A. P., Quesnel-Vallée, A., Caron, N. R., Vissandjée, B., & Marchildon, G. P. (2018). Canada's universal healthcare system: achieving its potential. *The Lancet*, *391*(10131), 1718-1735.

McCloskey, R., Jarrett, P., & Stewart, C. (2015). The untold story of being designated an alternate level of care patient. *Healthcare Policy*, *11*(1), 76.

Meadus, J. E. (2014, July). Waiting from placement Discharge from hospital to long term-care in Ontario. In *Healthcare Management Forum* (Vol. 27, No.2, pp.69-72). Sage CA: Los Angeles, CA: SAGE Publications

Ministry of Health and Long-Term Care (2019a). Construction Funding Subsidy Policy for Long-Term Care Homes, 2019. http://health.gov.on.ca/en/public/programs/ltc/docs/policy_funding_constructioncosts.pdf

Ministry of Health and LTC (2019b). Hospital Chronic Care Co-Payment: Questions and Answers. http://www.health.gov.on.ca/en/public/publications/chronic/chronic.aspx#chroniccare

Ministry of Health and Long Term Care (2020). Directive #3Long Term Care Visitors and Admissions. https://health.gov.on.ca/en/pro/programs/ltc/directive3_faq_20200616.aspx

National Academy of Engineering and Institute of Medicine. (2005). Building a Better Delivery System: A New Engineering/Health Care Partnership. Washington, DC: *The National Academic Press.* https://doi.org/10.17226/113878

Ontario Long Term Care Association (2019). *This is Long Term Care 2019.* https://www.oltca.com/OLTCA/Documents/Reports/TILTC2019web.pdf

Robichaud, L., Durand, P. J., Bédard, R., & Ouellet, J. P. (2006). Quality of life indicators in long term care: Opinions of elderly residents and their families. *Canadian Journal of Occupational Therapy*, *73*(4), 245-251.

Ronksley, P. E., McKay, J. A., Kobewka, D. M., Mulpuru, S., & Forster, A. J. (2015). Patterns of health care use in a high-cost inpatient population in Ottawa, Ontario: a retrospective observational study. *CMAJ open*, *3*(1), E111.

Rosella, L. C., Fitzpatrick, T., Wodchis, W. P., Calzavara, A., Manson, H., & Goel, V. (2014). High-cost health care users in Ontario, Canada: demographic, socio-economic, and health status characteristics. *BMC health services research*, *14*(1), 532.

Slaney, H., MacAulay, S., Irvine-Meek, J., & Murray, J. (2015). Application of the Beers criteria to alternate level of care patients in hospital inpatient units. *The Canadian journal of hospital pharmacy*, *68*(3), 218.

Statistics Canada. (2016). *An Aging Population.* Retrieved from: https://www150.statcan.gc.ca/n1/pub/11-402-x/2010000/chap/pop/pop02-eng.htm

Taylor, G., Gravel, D., Matlow, A., Embree, J., LeSaux, N., Johnston, L., … & Wong, A. Assessing the magnitude and trends in hospital acquired infections in Canadian

hospitals through sequential point prevalence surveys. *Antimicrobial Resistance & Infection Control,* 5(1), 1-7.

Taylor Jackson, J. C., & Palacios, M. (2017). Canada's Aging Population and Implications for Government Finances.

Taylor, D. W. (2003, April). 2020 Healthcare Management in Canada: A New Model Home Next Door. In *Healthcare management forum*. Sage CA: Los Angeles, CA: SAGE Publications.

Walker, D., & Lead, P. A. (2011). *Caring for our aging population and addressing alternate level of care*. Ontario Ministry of Health and Long-Term Care.

Warnke, P. H., Lott, A. J., Sherry, E., Wiltfang, J., & Podschun, R. (2013). The ongoing battle against multi-resistant strains: in-vitro inhibition of hospital-acquired MRSA, VRE, Pseudomonas, ESBL E. coli and Klebsiella species in the presence of plant-derived antiseptic oils. *Journal of Cranio-Maxillofacial Surgery*, *41*(4), 321-326.

Worrall, P., & Chaussalet, T. J. (2015). A structured review of long-term care demand modelling. *Health Care Management Science*, *18*(2), 173-194.

Appendix A: Number of Patients Who Waited Per Week by Designation and Total

| Week | TCB | LTC | Off Service | HME.CCAC | HME.COMM | UNK/Pal | Total |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 6 | 2 | 13 | 0 | 0 | 21 |
| 2 | 2 | 6 | 1 | 23 | 1 | 0 | 33 |
| 3 | 6 | 8 | 1 | 31 | 3 | 0 | 49 |
| 4 | 8 | 9 | 1 | 39 | 5 | 0 | 62 |
| 5 | 7 | 10 | 1 | 32 | 9 | 0 | 59 |
| 6 | 4 | 10 | 1 | 34 | 9 | 0 | 58 |
| 7 | 5 | 14 | 1 | 38 | 8 | 0 | 66 |
| 8 | 6 | 12 | 2 | 41 | 7 | 0 | 68 |
| 9 | 6 | 13 | 2 | 43 | 8 | 0 | 72 |
| 10 | 6 | 10 | 2 | 43 | 7 | 0 | 68 |
| 11 | 5 | 10 | 1 | 48 | 8 | 0 | 72 |
| 12 | 5 | 9 | 0 | 49 | 14 | 0 | 77 |
| 13 | 7 | 10 | 0 | 47 | 10 | 0 | 74 |
| 14 | 7 | 18 | 0 | 45 | 15 | 0 | 85 |
| 15 | 7 | 18 | 0 | 37 | 7 | 0 | 69 |
| 16 | 6 | 17 | 0 | 36 | 7 | 0 | 66 |
| 17 | 6 | 14 | 0 | 41 | 8 | 0 | 69 |
| 18 | 9 | 14 | 0 | 38 | 10 | 0 | 71 |
| 19 | 9 | 14 | 4 | 42 | 8 | 0 | 77 |
| 20 | 9 | 15 | 4 | 48 | 11 | 0 | 87 |
| 21 | 7 | 10 | 3 | 46 | 10 | 0 | 76 |
| 22 | 10 | 9 | 1 | 48 | 11 | 0 | 79 |
| 23 | 12 | 11 | 1 | 53 | 18 | 0 | 95 |
| 24 | 14 | 9 | 2 | 50 | 14 | 0 | 89 |
| 25 | 13 | 8 | 3 | 43 | 16 | 0 | 83 |
| 26 | 12 | 9 | 1 | 42 | 16 | 0 | 80 |
| 27 | 11 | 8 | 2 | 37 | 14 | 0 | 72 |
| 28 | 11 | 8 | 2 | 40 | 15 | 0 | 76 |
| 29 | 10 | 9 | 1 | 41 | 12 | 0 | 73 |
| 30 | 7 | 8 | 1 | 37 | 13 | 0 | 66 |
| 31 | 8 | 9 | 0 | 36 | 14 | 0 | 67 |
| 32 | 11 | 9 | 0 | 38 | 12 | 0 | 70 |
| 33 | 11 | 10 | 0 | 40 | 15 | 0 | 76 |
| 34 | 11 | 12 | 0 | 45 | 18 | 0 | 86 |
| 35 | 11 | 12 | 2 | 47 | 21 | 0 | 93 |
| 36 | 13 | 12 | 2 | 47 | 20 | 0 | 94 |
| 37 | 15 | 7 | 2 | 49 | 18 | 0 | 91 |
| 38 | 17 | 7 | 2 | 47 | 20 | 0 | 93 |
| 39 | 14 | 7 | 2 | 46 | 20 | 0 | 89 |
| 40 | 11 | 11 | 2 | 49 | 17 | 0 | 90 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 41 | 12 | 12 | 3 | 48 | 14 | 0 | 89 |
| 42 | 13 | 13 | 3 | 50 | 11 | 0 | 90 |
| 43 | 13 | 13 | 2 | 48 | 12 | 0 | 88 |
| 44 | 12 | 12 | 2 | 48 | 12 | 0 | 86 |
| 45 | 12 | 16 | 2 | 43 | 10 | 0 | 83 |
| 46 | 12 | 14 | 4 | 44 | 11 | 0 | 85 |
| 47 | 10 | 17 | 3 | 42 | 12 | 0 | 84 |
| 48 | 14 | 16 | 1 | 42 | 12 | 0 | 85 |
| 49 | 14 | 17 | 3 | 42 | 13 | 0 | 89 |
| 50 | 12 | 16 | 4 | 44 | 12 | 0 | 88 |
| 51 | 11 | 15 | 1 | 44 | 13 | 0 | 84 |
| 52 | 7 | 14 | 1 | 39 | 10 | 0 | 71 |
| 53 | 12 | 14 | 1 | 45 | 11 | 0 | 83 |
| 54 | 12 | 14 | 3 | 42 | 10 | 0 | 81 |
| 55 | 14 | 15 | 6 | 52 | 9 | 0 | 96 |
| 56 | 14 | 15 | 5 | 54 | 10 | 0 | 98 |
| 57 | 10 | 13 | 5 | 53 | 10 | 0 | 91 |
| 58 | 7 | 10 | 6 | 58 | 11 | 1 | 93 |
| 59 | 8 | 9 | 5 | 53 | 11 | 1 | 87 |
| 60 | 9 | 8 | 4 | 47 | 11 | 0 | 79 |
| 61 | 10 | 8 | 4 | 51 | 12 | 0 | 85 |
| 62 | 10 | 11 | 5 | 53 | 10 | 0 | 89 |
| 63 | 13 | 11 | 4 | 50 | 8 | 0 | 86 |
| 64 | 15 | 12 | 4 | 43 | 7 | 0 | 81 |
| 65 | 16 | 10 | 4 | 44 | 6 | 0 | 80 |
| 66 | 15 | 9 | 4 | 43 | 6 | 0 | 77 |
| 67 | 12 | 9 | 2 | 46 | 6 | 0 | 75 |
| 68 | 12 | 8 | 2 | 48 | 5 | 0 | 75 |
| 69 | 14 | 9 | 1 | 54 | 6 | 0 | 84 |
| 70 | 11 | 10 | 3 | 54 | 6 | 0 | 84 |
| 71 | 13 | 7 | 4 | 53 | 6 | 0 | 83 |
| 72 | 14 | 7 | 3 | 50 | 9 | 0 | 83 |
| 73 | 10 | 8 | 3 | 48 | 8 | 0 | 77 |
| 74 | 8 | 10 | 2 | 47 | 7 | 0 | 74 |
| 75 | 6 | 9 | 3 | 47 | 7 | 0 | 72 |
| 76 | 5 | 7 | 4 | 47 | 5 | 0 | 68 |
| 77 | 6 | 5 | 5 | 46 | 7 | 0 | 69 |
| 78 | 11 | 5 | 5 | 38 | 7 | 0 | 66 |
| 79 | 13 | 3 | 5 | 39 | 4 | 0 | 64 |
| 80 | 14 | 3 | 4 | 39 | 6 | 0 | 66 |
| 81 | 13 | 3 | 5 | 41 | 10 | 0 | 72 |
| 82 | 15 | 2 | 5 | 47 | 11 | 0 | 80 |
| 83 | 16 | 2 | 4 | 43 | 12 | 0 | 77 |
| 84 | 16 | 3 | 3 | 41 | 11 | 0 | 74 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 85 | 13 | 3 | 3 | 39 | 11 | 0 | 69 |
| 86 | 12 | 3 | 3 | 41 | 12 | 0 | 71 |
| 87 | 12 | 3 | 2 | 37 | 10 | 0 | 64 |
| 88 | 11 | 3 | 2 | 33 | 8 | 0 | 57 |
| 89 | 12 | 3 | 4 | 29 | 11 | 0 | 59 |
| 90 | 13 | 3 | 3 | 36 | 13 | 0 | 68 |
| 91 | 13 | 5 | 4 | 34 | 13 | 0 | 69 |
| 92 | 9 | 4 | 4 | 31 | 16 | 0 | 64 |
| 93 | 12 | 4 | 4 | 26 | 16 | 0 | 62 |
| 94 | 9 | 5 | 4 | 29 | 16 | 0 | 63 |
| 95 | 13 | 4 | 6 | 34 | 16 | 0 | 73 |
| 96 | 12 | 4 | 5 | 35 | 14 | 0 | 70 |
| 97 | 12 | 4 | 5 | 31 | 13 | 0 | 65 |
| 98 | 12 | 6 | 6 | 29 | 11 | 1 | 65 |
| 99 | 14 | 6 | 3 | 33 | 13 | 1 | 70 |
| 100 | 15 | 5 | 2 | 32 | 12 | 0 | 66 |
| 101 | 18 | 5 | 3 | 36 | 8 | 2 | 72 |
| 102 | 22 | 5 | 3 | 36 | 9 | 3 | 78 |
| 103 | 22 | 5 | 3 | 30 | 8 | 2 | 70 |
| 104 | 26 | 5 | 4 | 31 | 6 | 1 | 73 |
| 105 | 28 | 4 | 4 | 24 | 7 | 1 | 68 |
| 106 | 28 | 6 | 3 | 34 | 7 | 1 | 79 |
| 107 | 23 | 6 | 2 | 34 | 7 | 1 | 73 |
| 108 | 24 | 6 | 0 | 29 | 9 | 1 | 69 |
| 109 | 23 | 7 | 0 | 35 | 9 | 1 | 75 |
| 110 | 20 | 5 | 0 | 41 | 8 | 1 | 75 |
| 111 | 18 | 5 | 0 | 48 | 10 | 0 | 81 |
| 112 | 16 | 4 | 0 | 43 | 10 | 0 | 73 |
| 113 | 12 | 4 | 0 | 35 | 11 | 0 | 62 |
| 114 | 13 | 5 | 0 | 39 | 10 | 0 | 67 |
| 115 | 16 | 7 | 0 | 44 | 13 | 0 | 80 |
| 116 | 15 | 6 | 0 | 33 | 11 | 0 | 65 |
| 117 | 19 | 10 | 1 | 29 | 12 | 0 | 71 |
| 118 | 18 | 10 | 2 | 22 | 8 | 0 | 60 |
| 119 | 24 | 8 | 2 | 28 | 11 | 0 | 73 |
| 120 | 21 | 6 | 2 | 26 | 13 | 0 | 68 |
| 121 | 17 | 6 | 2 | 28 | 11 | 0 | 64 |
| 122 | 18 | 7 | 2 | 29 | 9 | 0 | 65 |
| 123 | 14 | 7 | 2 | 32 | 10 | 0 | 65 |
| 124 | 16 | 9 | 0 | 33 | 11 | 0 | 69 |
| 125 | 13 | 7 | 0 | 36 | 10 | 0 | 66 |
| 126 | 18 | 6 | 0 | 35 | 15 | 0 | 74 |
| 127 | 17 | 5 | 1 | 34 | 16 | 0 | 73 |
| 128 | 19 | 6 | 0 | 31 | 22 | 0 | 78 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 129 | 18 | 4 | 0 | 27 | 24 | 0 | 73 |
| 130 | 21 | 4 | 0 | 27 | 28 | 0 | 80 |
| 131 | 18 | 9 | 0 | 26 | 27 | 0 | 80 |
| 132 | 16 | 8 | 0 | 24 | 31 | 0 | 79 |
| 133 | 19 | 8 | 0 | 24 | 37 | 0 | 88 |
| 134 | 15 | 10 | 0 | 24 | 34 | 0 | 83 |
| 135 | 12 | 11 | 0 | 26 | 33 | 0 | 82 |
| 136 | 20 | 11 | 0 | 25 | 27 | 0 | 83 |
| 137 | 20 | 13 | 0 | 26 | 25 | 0 | 84 |
| 138 | 22 | 14 | 0 | 30 | 23 | 0 | 89 |
| 139 | 23 | 16 | 0 | 34 | 21 | 0 | 94 |
| 140 | 25 | 17 | 0 | 33 | 23 | 0 | 98 |
| 141 | 29 | 17 | 0 | 26 | 23 | 0 | 95 |
| 142 | 25 | 15 | 0 | 28 | 22 | 0 | 90 |
| 143 | 31 | 16 | 0 | 27 | 26 | 0 | 100 |
| 144 | 34 | 16 | 0 | 27 | 25 | 0 | 102 |
| 145 | 37 | 14 | 0 | 24 | 23 | 0 | 98 |
| 146 | 34 | 12 | 0 | 26 | 22 | 0 | 94 |
| 147 | 38 | 12 | 0 | 26 | 31 | 1 | 108 |
| 148 | 36 | 11 | 0 | 27 | 31 | 1 | 106 |
| 149 | 36 | 11 | 0 | 23 | 26 | 1 | 97 |
| 150 | 33 | 9 | 1 | 22 | 25 | 0 | 90 |
| 151 | 31 | 9 | 2 | 17 | 26 | 0 | 85 |
| 152 | 26 | 9 | 2 | 16 | 28 | 0 | 81 |
| 153 | 31 | 8 | 2 | 17 | 23 | 2 | 83 |
| 154 | 40 | 7 | 2 | 17 | 20 | 5 | 91 |
| 155 | 37 | 7 | 2 | 14 | 16 | 7 | 83 |
| 156 | 38 | 6 | 2 | 14 | 13 | 7 | 80 |

Appendix B: Number of Patients Who Waited by Site

| Site | Total LOS |
|---|---|
| GNG Acute | 234 |
| GNG Complex | 333 |
| WHS Acute | 424 |
| WHS Complex | 192 |
| SCS | 404 |
| PCG | 179 |
| DMH | 155 |
| Total | 1,921 |

Appendix C: Correlation Sig 1 for RQ1

| | Spring | Summer | Fall | 2018 | 2019 |
|---|---|---|---|---|---|
| Spring | . | .000 | .000 | .500 | .500 |
| Summer | .000 | . | .000 | .500 | .500 |
| Fall | .000 | .000 | . | .500 | .500 |
| 2018 | .500 | .500 | .500 | . | -.000 |
| 2019 | .500 | .500 | .500 | -.000 | . |

Appendix D: R Coding and Output ANOVA Analysis

```
BAnalysis=read.csv(file.choose())

attach(BAnalysis)

ic<-as.factor(IC)
wc<-as.factor(WC)
sf<-as.factor(SF)
dr<-as.factor(DR)
ba<-as.factor(BA)
be<-as.factor(BE)
abi<-as.factor(ABI)
mh<-as.factor(MH)
es<-as.factor(ES)
bg<-as.factor(BG)
sh<-as.factor(SH)
sl<-as.factor(SL)
sr<-as.factor(SR)
ss<-as.factor(SS)
ml<-as.factor(ML)
of<-as.factor(OF)
fd<-as.factor(FD)
ma<-as.factor(MA)
bs<-as.factor(BS)
bx<-as.factor(BX)
dl<-as.factor(DL)
md<-as.factor(MD)
ne<-as.factor(NE)
od<-as.factor(OD)
re<-as.factor(RE)

model=lm(LOS~Tconditions+re+od+ne+md+dl+bx+bs+ma+fd+of+ml+ss+sr+sl+sh+bg+
es+mh+be+ba+dr+sf+wc+ic+abi)

anova(model)

Analysis of Variance Table

Response: LOS
          Df       Sum Sq          Mean Sq         F value    Pr(>F)
re          1          9                          9  0.0034        0.9535431
od          1     905     905  0.3261 0.5680078
ne          1   36414   36414 13.1263 0.0002989 ***
```

```
md          1     475     475  0.1711 0.6791689
dl          1   19889   19889  7.1695 0.0074793 **
bx          1     245     245  0.0883 0.7663228
bs          1    7373    7373  2.6577 0.1032184
ma          1       3       3  0.0010 0.9749874
fd          1    9047    9047  3.2613 0.0710929 .
of          1    3389    3389  1.2216 0.2691879
ml          1    1139    1139  0.4107 0.5216929
ss          1   53505   53505 19.2874 1.187e-05 ***
sr          1   27951   27951 10.0755 0.0015267 **
sl          1     688     688  0.2480 0.6185280
sh          1   25500   25500  9.1922 0.0024634 **
bg          1  114986  114986 41.4497 1.529e-10 ***
es          1      74      74  0.0268 0.8699738
mh          1  101320  101320 36.5235 1.812e-09 ***
be          1   38259   38259 13.7916 0.0002102 ***
ba          1    5709    5709  2.0580 0.1515744
dr          1    3939    3939  1.4200 0.2335546
sf          1   84384   84384 30.4183 3.961e-08 ***
wc          1   11074   11074  3.9920 0.0458588 *
ic          1   27162   27162  9.7912 0.0017802 **
abi         1   70431   70431 25.3887 5.132e-07 ***
Residuals 1894 5254160    2774
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> anova(model1)
Analysis of Variance Table

Response: LOS
             Df  Sum Sq Mean Sq F value    Pr(>F)
Tconditions   1  333296  333296  114.88 < 2.2e-16 ***
Residuals  1918 5564735    2901
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```