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

By Didi Ahmed, PharmD

A Thesis Submitted to the School of Graduate Studies

in Partial Fulfillment of the Requirements

for the Degree

Master of Science in eHealth

McMaster University MASTER OF SCIENCE IN EHEALTH (2019) Hamilton, Ontario

TITLE: 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

AUTHOR: Didi Ahmed, BPSc, PharmD

SUPERVISOR: Dr. Manaf Zargoush, Assistant Professor, DeGroote School of Business

NUMBER OF PAGES: xv, 114

Supervisory Committee

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

By Didi Ahmed, PharmD

Supervisory Committee

Dr. Manaf Zargoush, Ph.D. – **Supervisor**
Assistant Professor, Department of Health Policy and Management, DeGroote School of Business

Dr. Norm Archer, Ph.D. – **Committee Member**
Professor Emeritus, Department of Information Systems, DeGroote School of Business

Dr. Khaled Hassanein, Ph.D. – **Committee Member**
Professor, Department of Information Systems, DeGroote School of Business
Associate Dean, Graduate Studies and Research
Director of the McMaster Digital Transformation Research Center (MDTRC)

ABSTRACT

Introduction: Alternate Level of Care (ALC) patients are those who are kept hospitalized although they are medically well enough to be discharged. Those patients wait in acute care because they cannot access an appropriate alternative level of care outside the hospital. ALC leads to the improper consumption of valuable resources that are needed for patients waiting in other departments such as emergency rooms. This reflects poor quality outcomes of the healthcare system and represents a significant economic burden. Moreover, particularly when it concerns older adults, longer stay in hospital results in worsening their health outcomes, declining their functional status and increasing their needs for long-term care. Therefore, ALC is costly from both patient and health care system perspective.
Objectives: The main objective of this study was to assess the impact of the Home First strategy on the incidence of ALC. Moreover, the study addressed both the specialized clinical needs (such as dialysis, chemotherapy and mechanical ventilation) and socioeconomic status of ALC patients in order to unveil their association with the ALC length of stay.
Methods: This study involved a secondary analysis of data from the Institute for Clinical Evaluation (ICES). The analyzed dataset included a cohort of 6,059,033 hospitalization records of Ontario citizens, aged 65 years and older, who were admitted to an acute care facility between April 2004 and March 2017. The study involved descriptive analytics grouping the dataset into ALC and non-ALC subsets and examined the percentage of ALC hospitalizations, ALC days and reported odds ratios across several patients' characteristics.
Results: From 2004 until 2016, ALC patients waited to access an appropriate destination for 10.7 million days. Those numbers represented 19.7% of all hospitalization days across Ontario. ALC was more likely among seniors aged 75-84 (OR 1.36, 95% CI 1.35-1.36), aged 85-94 (OR 2.16, 95% CI 2.15-2.17), aged 95+ (OR 2.46, 95% CI 2.40-2.50), females (OR 1.37, 95% CI 1.35-1.36), those who were hospitalized 90 days prior to their current admission (OR 1.22, 95% CI 1.21-1.22), and those who were admitted to hospital through Emergency Department (OR 2.64, 95% CI 2.62-2.67). Moreover, ALC was 10 times more likely in the subgroup of patients who were discharged to long-term care (LTC) (OR 9.71, 95% CI 9.66-9.77). For the socioeconomic characteristics, this study showed that patients were more likely to have ALC days when they lived in urban areas, had a lower income, and were highly unstable and dependent. Furthermore, patients with special clinical needs spent from 10% to 25% of their total hospitalization length of stay waiting to be discharged to an appropriated alternative level of care. Finally, the study revealed that although the implementation of a Home First strategy resulted in a 26% reduction of ALC hospitalizations and a 13% decrease in ALC days, the percent of patients discharged to LTC did not change. For the subgroup having the highest percentage of ALC hospitalizations (53.4%) and ALC days (40.3%), this reflects a partial failure of the Home First strategy in achieving its main objective of facilitating the discharge of patients to their homes.
Conclusions: Policy makers and health care practitioners may benefit from the findings of this study by considering the needs of the ALC patients while planning, allocating resources, and developing polices for discharge, LTC and community care. However, more work is required to quantify the impact of the ALC determinants suggested in this study and assess the efficiency of the current policies and procedures.

ACKNOWLEDGMENT

My sincere thanks go to

My thesis supervisor Dr. Manaf Zargoush for his patient guidance, encouragement, and advice. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded to my questions and queries so promptly. He helped me achieve a dream by allowing this thesis to be my own work and he did his best to put me on the right track, my gratitude is beyond words.

Dr. Khaled Hassanein for his trust and constant support. The door to Dr. Hassanein office was always open whenever I ran into a trouble spot and he helped me in overcoming what seemed like insurmountable obstacles, my appreciation is immeasurable.

Dr. Norm Archer for his guidance, expertise, time and patience. I really appreciate his commitment and dedication to students. Dr. Archer read every single word in my thesis and provided me with detailed, valuable feedback when I knew how hard it was for him to do. Words cannot express how grateful I am.

The eHealth program administrator Mrs. Iris Kehler for her support and guidance throughout the eHealth program, her kindness is immensely appreciated.

Dr. David Chan for sharing his experience and giving me insights that helped me while identifying the recommendations of my study.

My friend Marwa Fawzi for her great help proofreading this manuscript.

My eHealth friends, especially Alma, Marwa, Jawairia, Prathiba, Sahar, Sidra and Yemi for walking beside me during the eHealth journey.

My friends Ibtesam and Somiraa for being there for me throughout this process and giving me lots of advice and support.

I am blessed and very grateful to have had the ongoing support of these people as I worked on this project.

This study made use of de-identified data from the ICES Data Repository, which is managed by the Institute for Clinical Evaluative Sciences with support from its funders and partners: Canada's Strategy for Patient-Oriented Research (SPOR), the Ontario SPOR Support Unit, the Canadian Institutes of Health Research (CIHI) and the Government of Ontario. The opinions, results, and conclusions reported are those of the author. No endorsement by ICES or any of its funders or partners is intended or should be inferred. Parts of this material are based on data and information compiled and provided by CIHI. However, the analyses, conclusions, opinions, and statements expressed herein are those of the author, and not necessarily those of CIHI.

This study was supported by funding from the Labarge Center for Mobility in Aging within the McMaster Institute for Research on Aging at McMaster University.

DEDICATION

To my mother,
Thank you for your endless encouragement and support – you were with me every step of the way and I appreciate everything that you have done for me.

To my father,
Thank you for allowing me to fly chasing my dreams and achieving my goals – you are missed dad, I wish you were here.

To my brothers and my family
Thank you for supporting me in all of my pursuits – your genuine love and care is truly rare.

To May,
Thank you for being my home away from home.

To Hala,
Thank you for always having my back.

To all my friends,
Thank you for always being just a phone call away any time of the day and for being a walking judgement-free zone.

To my teachers and mentors,
Thank you for the knowledge you have imparted to me – your guidance and support are really appreciated.

Thank you all for being my support system – you provided the words of love and encouragement that I needed to get through the rough patches and you assured me that I was doing the right thing.

You're such a great blessing and every day I thank God for your mere existence.
The journey would not have been possible without you.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ALC: Alternate Level of Care

ALC/ECU: Alternate level of care/Extended Care Units

ATC: Access to Care

CCACs: Community Care Access Centers

CCC: Complex Continuing Care

CCO: Cancer Care Ontario

CHCs: Community Health Centers

CI: Confidence Interval

CIHI: Canadian Institute for Health Information

DAD: Discharge Abstract Database

ECUs: Extended Care Units

ED: Emergency Department

GAUs: Geriatric Assessment and Treatment Units

HHS: Halton Healthcare Services

HiREB: Hamilton Integrated Research Ethics Board

HQO: Health Quality Ontario

ICDs: Intermediate Care Departments

ICES: Institute for Clinical Evaluation

IDAVE: ICES Data & Analytic Virtual Environment

LHINs: Local Health Integration Networks

LHINC: Local Health Integration Networks Collaborative

LTC: Long-term Care

MH CCAC: Mississauga Halton Community Care Access Center

MH LHIN: Mississauga Halton Local Health Integration Network

MOHLTC: Ministry of Health and Long-Term Care

NHS: UK National Health Service

OHA: Ontario Hospital Association

OHQC: Ontario Health Quality Council

OR: Odds Ratio

UK: United Kingdom

US: United States

WTIS: Ontario's Wait Time Information System

DECLARATION OF ACADEMIC ACHIEVEMENT

The following is a declaration that the work presented in this thesis was completed by Didi Ahmed. Guidance at all stages of the research conducted for this thesis was provided by Dr. Manaf Zargoush, Dr. Norm Archer, and Dr. Khaled Hassanein. Didi Ahmed was responsible for writing this manuscript and the thesis committee contributed to manuscript review and revisions.

CHAPTER 1: INTRODUCTION

Delayed discharge is the situation where a patient is kept hospitalized although they are medically well enough to be discharged. Wasting many resources, delayed discharge represents a significant economic burden all over the world (Bryan, 2010). In addition to its negative implications on the health care system, delayed discharge is associated with deterioration of patients' quality of life; because prolonged hospitalization leads to many complications such as nosocomial infections, pressure sores, and deep vein thrombosis (Lim, Doshi, Castasus, Lim, & Mamun, 2006). Particularly when it concerns older adults, longer hospital stays result in worsening health outcomes of seniors, declining in their functional status, and increasing their need for long-term care (Morse, 2016).

In Canada, delayed hospital discharge is known as Alternate Level of Care (ALC) (Kuluski, Im, & McGeown, 2017). The Canadian Institute for Health Information (CIHI) defines ALC patients as those admitted to hospitals and occupying a bed without the need for the intensity of provided services (Lavergne, 2015). In 2008, 14% of acute hospital days across Canada were consumed by ALC patients, accounting for about 7500 acute care beds each day (Sutherland & Crump, 2011). Such numbers are increasing significantly, for instance, from March 2015 to March 2016, numbers of ALC patients increased by 23% (Burr, Elaine Dickau, 2017).

Statistics show that the elderly population is growing and expected to represent about one-fourth of Canada's population by 2056 (Public Health Agency of Canada, 2012). As the Canadian population ages, the numbers of ALC patients are expected to rise significantly, therefore, the need for services to support ALC seniors will increase dramatically and meeting those needs is considered one of the main priorities of the Canadian health organizations (Basu, Livadiotakis, & Tanguay, 2016).

Keeping seniors in a health care setting that is not aligned with their needs reflects poor quality outcomes of the health care system (Kuluski et al., 2017). ALC leads to the improper consumption of valuable resources (including beds, staff time, and equipment) that are needed for patients waiting in other departments such as emergency rooms (Sutherland & Trafford Crump, 2013). Therefore, ALC has negative effects not only on seniors but also on other patients who wait to access the appropriate health care services.

Being costly from both patient and health care system perspective (ALC Task Group, 2008), many initiatives have been taken across Canada to address the ALC challenge, e.g., by providing a clear definition, describing the situation, recommending opportunities for improvement, and putting policies and procedures in place. However, little detail is available about the determinants of ALC, such as individual characteristics or medical conditions of patients who are designated as ALC (Costa, A P; Hirdes, 2010; McCloskey, Jarrett, Stewart, & Nicholson, 2014). Moreover, to our knowledge, there has been no study conducted to assess the impact of the initiatives taken by Ontario government to manage the ALC challenge such as the Home First strategy.

To fill in the above-mentioned research gaps, the main objectives of this thesis are:

1. Assessing the impact of the Home First strategy which was implemented in 2011 to manage the ALC challenge across Ontario hospitals.
2. Study if the specialized clinical interventions received by patients is associated with the incidence of ALC.
3. Exploring the socioeconomic status of the ALC patients, using the so-called Ontario Marginalization Index.

By achieving the above objectives, this thesis aims at guiding future research work by highlighting important ALC determinants, in addition to informing better policy planning and resources allocations, particularly for patients receiving specialized clinical interventions.

Figure 1 describes the systematic approach followed in an attempt to achieve the objectives of this research. First, conducting a thorough literature review, the research gaps were identified. Then a conceptual framework was designed to describe the ALC patient's journey. Guided by the ALC patient's journey and the available data, the variables of interest were specified to conduct the required descriptive analytics. Finally, the results were represented, discussing the factors associated with the ALC incidence and assessing the impact of the Home First strategy on it.

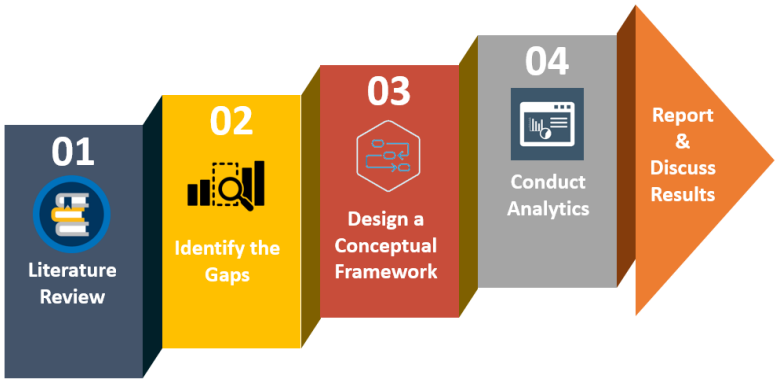

Figure 1. Research Approach.

The following chapters proceed as:

1. Literature review (Chapter 2) which includes the definition of ALC, its implications for patients, impacts on the health care system, and its scale both in Canada and worldwide. This chapter also describes the characteristics of ALC patients and discusses the factors which were found contributing to the increased incidence of ALC. Moreover, it provides an explanation of how ALC patients are allocated in hospitals, followed by a discussion of the initiatives that have been taken

by policy planners to effectively manage such a challenge. The literature review chapter ends by shedding light on the current ALC situation in Ontario (being the region of interest for this research), highlighting the research gaps, and listing the objectives of this research work.

2. Methods (Chapter 3) which describes the methods followed by the researcher to design the ALC conceptual framework and conduct the descriptive analytics. It includes a description of the dataset as well as the tools and techniques, which were used to conclude the findings of this research.

3. Results (Chapter 4) which reports the findings of the research.

4. Discussion (Chapter 5) which interprets the results and compares them with the existing literature. It also highlights the limitations of this thesis and work to be conducted in the future to overcome those limitations.

5. Conclusion (Chapter 6) which summarizes the findings of this thesis.

CHAPTER 2: LITERATURE REVIEW

A thorough literature review was conducted to explore the ALC challenge both in Canada and worldwide. The following search engines were used to access primary and tertiary resources: PubMed, McMaster University Online Library, Google Scholar and the Cochrane Library. The search keywords used were: "alternate level of care", "alternative level of care", "delayed hospital discharge", "delayed discharge", "delayed discharge and elderly"," delayed discharge and old people", "bed blocker", "bed blocking", "long-term care", "long term care transition", "elderly patients transition", "delayed discharge and cancer", "delayed discharge and chemotherapy", "alternate level of care and cancer", "alternate level of care and chemotherapy", and "delayed discharge and specialized interventions".

After reviewing the abstracts of search results, 50 papers were selected to be included in the literature review chapter (see Figures 2 and 3). Those papers were found to be the most informative and relevant to the research topic among others. Out of the 50 papers, there were 24 reports[1] that shed light on the issue in Canada, the UK, the Netherlands, and Australia. Additionally, four systematic reviews were found, two of which included worldwide literature, while the other two summarized results from the English and the Irish literature. Regarding data analytics, there were 22 papers that included descriptive and/or predictive analytics within their methodologies, of which 14 papers involved the study of various Canadian populations (see Appendix B).

This literature review chapter starts by defining ALC, mentioning different synonyms which were used to refer to the same concept around the world, and explaining the negative impact of ALC and its consequences on patients, health care providers, and the health care system. The

[1] One of the reports (Beland et al., 2006) includes results from a randomized control trial.

chapter highlights the scale of the ALC challenge by summarizing statistics from different countries. It also describes the profile of ALC patients by identifying their demographics and clinical characteristics. Besides, this chapter provides a discussion for the factors that may influence the ALC issue and the proposed solutions and best practices that were put into place to tackle such a problem. Finally, the chapter focuses on the alternate level of care provincial definition and governance in Ontario. It ends by identifying research gaps and listing the objectives of this thesis.

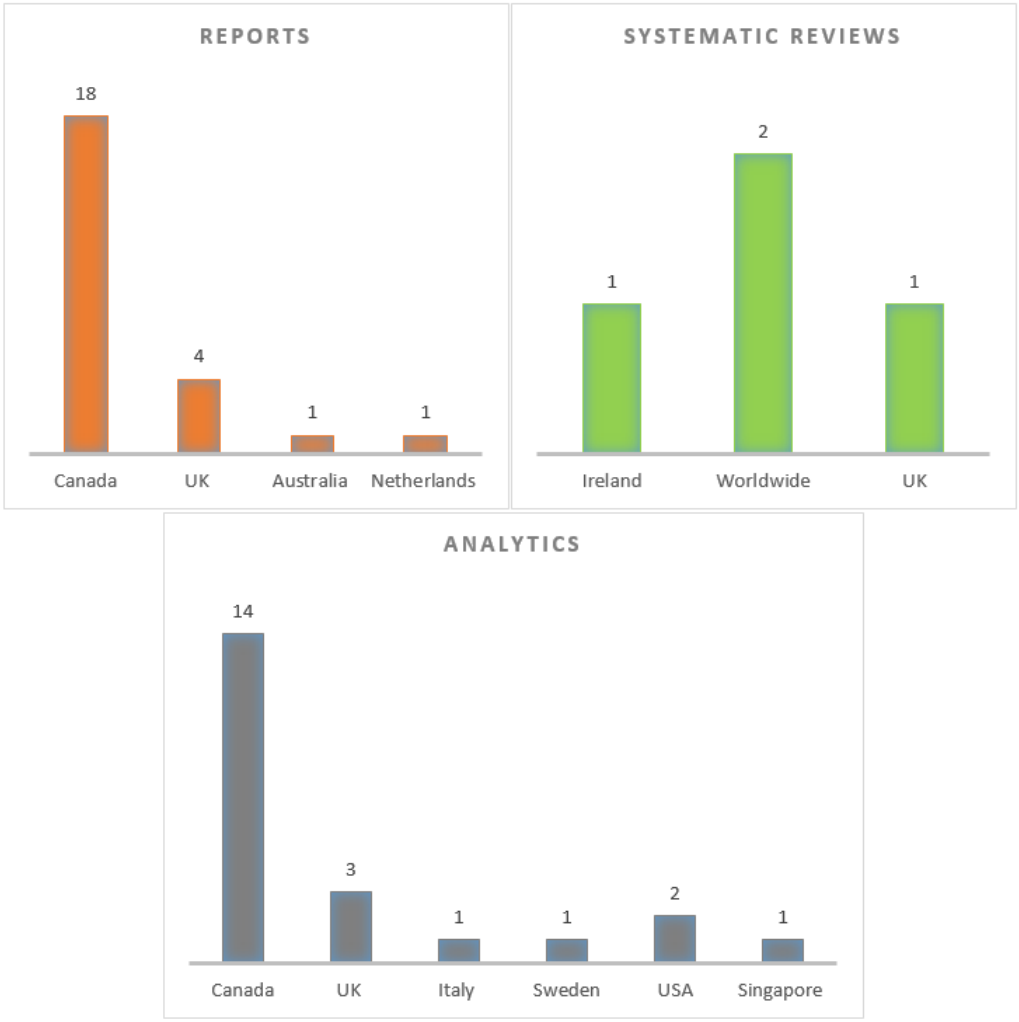

Figure 2. Numbers of search results categorized by the type of paper and the country of the included population.

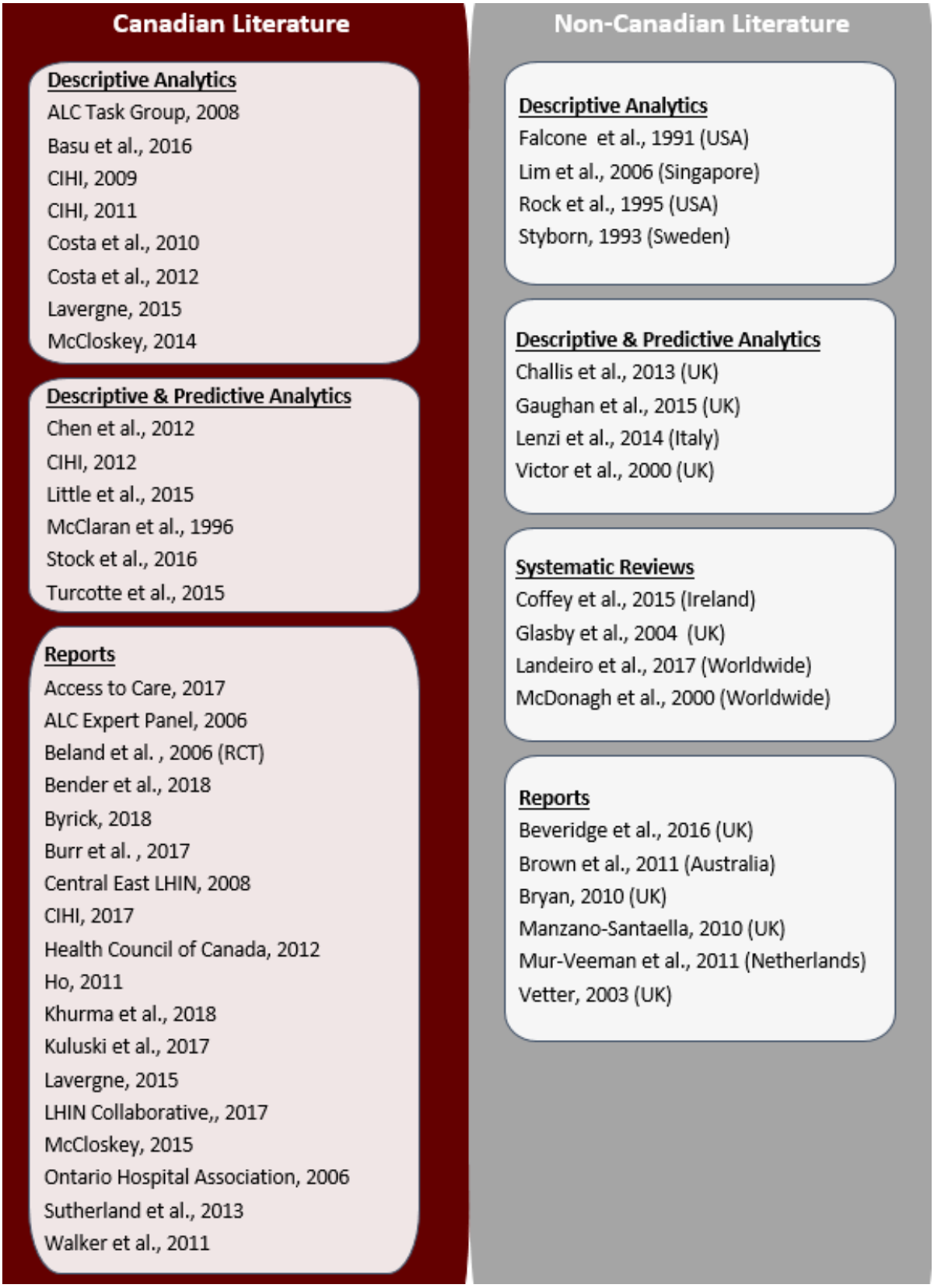

Figure 3. ALC selected search results categorized by paper type and country.

2.1 Definition of Alternate Level of Care

The term “alternate level of care” or ALC was introduced by the Canadian Institute for Health Information Discharge Abstract Database (DAD) in 1989, to refer to patients who are occupying an acute care bed despite the end of their acute care phase of treatment (Lavergne, 2015). Those patients do not need an intensive level of care, but still require a lower level of care which could be provided in another facility such as a rehabilitation hospital or a long-term care (LTC) facility (ALC Expert Panel, 2006). Having patients hospitalized in a setting that does not match their needs, could be seen as an indicator of inappropriate utilization of health care resources, and leads to poor patient outcomes. Alternate level of care is a serious problem with consequences at various levels; it impacts not only patients but also health care providers and policymakers (Kuluski et al., 2017).

ALC is particularly associated with older people and the onset of this issue coincided with the changing role of hospitals with respect to geriatric patients (Bryan, 2010). Although ALC is prevalent in the Canadian health care system, it is not confined to Canada and is recognized in other countries such as the United Kingdom (UK), Sweden, Norway, New Zealand, Australia, Singapore and the United States (US). While the term “alternate level of care” is commonly used in Canada (Sutherland & Trafford Crump, 2013), other terms including “delayed discharge”, “delayed transfer”, “long-stays” and “bed blocking” are used in Europe and other countries (Manzano-Santaella, 2010). The “bed blocker” term originated in the UK in the late 1950s. This term is deemed offensive for patients, as it seems to blame them for unnecessarily occupying hospital beds, as if patients themselves were responsible for that. Therefore, in the recent years, the use of term “bed blocker” and its derivatives "blocked bed" and "bed blocking" has become

obsolete and is considered inappropriate (Brown, Laurie Abellp, Annie Thurecht, 2011; McDonagh, Marian Smith, David Goddard, 2000).

Despite the conceptual differences among the synonyms mentioned above, they have similar meanings and they are applied not only to acute hospital beds but also to beds in psychiatric, geriatric, and other health and social care institutions (Vetter, 2003). For instance, Brayan (2010) mentioned that delayed discharge, as used in the UK, is a situation where a patient is found to be medically well enough for discharge, but they cannot leave the hospital because arrangements for continuing care are not yet completed. Similarly, the Department of Health in the UK introduced the term "delayed transfer" and captured its occurrence when a patient is ready to be transferred but they still occupy a hospital bed (Manzano-Santaella, 2010). In the following chapters, the term "alternate level of care", its acronym "ALC", and "delayed discharge" will be used interchangeably to refer to the same concept.

2.2 Consequences of Alternate Level of Care

Delayed discharge is a serious system-wide issue that threatens both patients and the whole health care system (ALC Expert Panel, 2006). This section highlights the negative consequences of ALC on the health care system as well as on patients, families, and health care providers.

2.2.1 ALC Impact on the Health Care System

When a patient waits too long to be transferred to another facility for the appropriate level of care, this could be considered as an indicator of significant issues related to patient flow, access to care, capacity, resources, and system integration. Consequently, numbers of ALC days as a percent of total hospital days are used as an essential key performance indicator of the health care system (Beveridge et al., 2016).

At the micro level, ALC increases wait times for new admissions. It creates a domino effect, because when ALC patients wait for a long duration in acute care to receive the appropriate level of care, other patients wait in emergency rooms for an inpatient bed, paramedics wait for emergency stretchers to offload ambulance patients and elective surgeries are cancelled waiting for postoperative beds (ALC Expert Panel, 2006).

At the macro level, ALC increases health care costs because occupying a bed in the hospital is more expensive than occupying a bed in another setting such as residential care (Mur-Veeman, Ingrid Govers, 2011). For example, it costs an average of $1,100 per day to provide acute care for a patient in a Canadian hospital, while providing the needed home care services for the same patient costs less than $100 per day (Home Care Ontario, 2017).

2.2.2 ALC Impact on Patients, Families, and Health Care Providers

Along with seriously harming the health care system, delayed discharge puts patients and families under intense pressure. ALC patients and their families experience anxiety and depression being in an uncertain and confusing situation waiting for an alternative level of care (ALC Expert Panel, 2006). Families complain that once patients are designated as ALC, although it is not the fault of patients, the health care providers pay no attention to them and ignore their non-medical needs, which results in worsening patient's general health condition (Kuluski et al., 2017).

The delayed discharge of patients, particularly older adults, has harmful implications on their health status. It is associated with a 5% functional decline per each hospitalization day and an increased risk of fractures, acute renal failure, drug reactions, infectious diseases, confusion, depression, and mortality. Therefore, the longer the duration elderly people spend in the hospital,

the higher is their probability of becoming disabled and deconditioned and in need of LTC (Burr, Elaine Dickau, 2017; Landeiro, Roberts, Gray, & Leal, 2017).

Likewise, health care providers find themselves in a stressful and frustrating situation when they are pushed to discharge ALC patients before finding them a suitable destination. At the same time, they are being accused by families of not providing appropriate care for their patients (Bender & Holyoke, 2018).

Finally, patient care staff who deal with ALC patients are at increased risk of serious injuries. The main cause of such injuries is lifting and transferring patients. ALC patients are usually mixed with others in general medical nursing units, which are inadequately equipped to support such activities. Furthermore, health care providers may suffer injuries while interacting with patients suffering from dementia, who may be violent (Ostry et al., 2003).

2.3 Scale of Alternate Level of Care

There is a consensus in the literature on the significance of the ALC issue. This problem exists in most countries and is associated with high costs. Moreover, regardless of the initiatives taken to face the ALC challenge, the numbers of ALC patients are increasing dramatically due to the increasing numbers in the elderly population which amplifies the scale of the issue (Basu et al., 2016).

2.3.1 ALC Worldwide Scale

Based upon a systematic review which included 64 studies published between 1990 and 2015, Landeiro et al. (2017) concluded that the ability to measure the full impact of delayed discharge is limited by the lack of standardization of study methodologies and the variability in the prevalence and availability of data. They found a wide variation in the delayed discharges proportions even within the same country, with values of 58.4%, 43.0%, 49.7%, 70.3% and 56.8% in the UK, Spain, Italy, Canada, and the Netherlands, respectively.

Most of the published studies tackling the ALC challenge are from the UK, where delayed discharge was recognized as a system-level issue that led to inefficiencies in hospital beds utilization. Glasby et al. (2004) summarized findings from 21 studies published since 1993. Their summary revealed that the proportions of delayed discharges of the elderly in UK hospitals varied between 8% and 66%. The proportions were different based upon the study location, the included population, and the methodology used. In 2000, the National Audit Office estimated that delayed discharge of elderly patients in acute care cost the UK National Health Service (NHS) about £170 million (about $375 million CDN equivalent at that time) a year (Bryan, 2010). However, between 2013 and 2015, there was a 31% increase in acute hospital bed days consumed by delayed discharge patients. This increase was associated with a significant growth in costs which reached about £820 million per year (Beveridge et al., 2016). Taking into consideration the cost of providing acute beds, delayed discharge costs the NHS around £900 million a year (about $1,930 million CDN at that time) (Triggle, 2016).

In Ireland, while assessing the utilization of acute hospital beds in 2007, Coffey et al. (2015) found that 13% of hospital beds were occupied by patients who were well enough for discharge. Thus, the Irish Health Service Executive considered plans for managing delayed discharge as key priorities. On the other hand, Mur-Veerman et al. (2011) reported that in 2006, only 6.1% of Netherlands hospital days were ALC days.

Regarding the ALC condition in the US, in addition to the two systematic reviews that were conducted by Landeiro et al. (2017) and McDonagh et. al. (2000), which included in their findings few American studies, I could only find two studies: one discussed the use of a computerized database to manage ALC (Falcone, Bolda, & Leak, 1991) and the other studied the determinants of ALC (Rock et al., 1995). Hence, in attempting to describe the situation of ALC in the US, no

statistics could be found. This might be interpreted as the US has a health care system that differs from other countries, in a way that it does not support the stay of ALC patients in hospitals after the end of their treatment phase. This could lead to the apparent lack of data reported on ALC occurrences within the American system.

2.3.2 ALC Canadian Scale

The most recent data available about ALC in Canada are from March 2015 to March 2016, when it was reported that the numbers of ALC patients had increased by 23% (Burr, Elaine Dickau, 2017).

In 2009, CIHI released their first report about ALC, in which more than 74,000 ALC hospitalizations were captured in Canada (excluding Quebec and Manitoba), representing 5% of total hospitalization in 2008. Such ALC hospitalizations resulted in the consumption of more than 1.7 million hospital days (14% of acute hospital days). By that time, the lowest ALC rate (2%) was reported in Saskatchewan and Prince Edward Island and the highest rate (7%) was in Ontario and Newfoundland and Labrador (Canadian Institute for Health Information, 2009).

Within Atlantic Canada during 2009–2010, 9,254 ALC cases were captured in acute care hospitals, which represented 4% of all hospital discharge records by that time (Canadian Institute for Health Information, 2011).On the other hand, Ontario hospitals had a higher percentage of ALC patients that doubled from 7% in 2009 to 14% in 2017 (Bender & Holyoke, 2018; Canadian Institute for Health Information, 2009)

2.4 ALC Patients Profile

Some of the studies which were conducted to study ALC issues were aimed at investigating demographics, socioeconomic factors, and clinical characteristics of ALC patients. Considering

these aspects helps policy planners and decision makers to better understand the issue. Moreover, it offers insights towards finding tailored solutions.

Generally, frail older people, particularly those with chronic illnesses demonstrated higher ALC rates (Manzano-Santaella, 2010). In 2006, CIHI reported that 82% of ALC designated patients were over the age of 65 with a mean age of 75.4 years (ALC Expert Panel, 2006). The same average age was reported by other countries such as Australia, where people aged 65 years and over had longer hospital stays and higher rates of delayed discharge (Brown, Laurie Abellp, Annie Thurecht, 2011)**.**

Regarding their clinical condition, the majority of ALC patients were hospitalized to receive treatments for trauma, neurological and mental disorders, and cardiovascular diseases. Many of them suffered from dementia and stroke. Moreover, morbid obesity and psychiatric diagnoses such as schizophrenia and bipolar disorder were among the characteristics of ALC patients who were kept hospitalized for a long time (Costa, Poss, Peirce, & Hirdes, 2012; Lenzi et al., 2014).

Studying sex as a factor associated with the incidence of ALC, a few studies reported that the odds of delayed discharge were higher among female patients (Chen, Zagorski, Chan, Parsons, & Laan, 2012; Falcone et al., 1991). Similarly, national reports from Canada showed that ALC patients tended to be more predominantly females (Lavergne, 2015). For example, in 2008, 58% of the Canadian ALC patients were females (CIHI, 2009)

Another remarkable characteristic of ALC patients is their method of hospital admission. Lavergne (2015) found that patients who needed an alternate level of care typically were admitted at the Emergency Department (ED). Similar findings were reported by Bender et al. (2018), who studied six Canadian hospitals and observed that ED visits were triggered by both the acute health care status of the patient and the inefficient management of their cases by caregivers at home.

The destination of delayed discharge patients was comprehensively studied in the reviewed literature. There was a general agreement that waiting for admission to a residential care facility increased the odds of ALC. A study conducted in an American hospital revealed that the majority of ALC patients were discharged to nursing homes (Rock et al., 1995). Upon leaving the hospital, 39% of Canadian ALC patients were transferred to LTC facilities, 10% went to inpatient rehabilitation centers, and 33% were discharged home (ALC Task Group, 2008). Although those going to LTC settings were more likely to become ALC patients, those waiting to get home care services experienced longer ALC wait times (CIHI, 2017; Kuluski et al., 2017).

The characteristics discussed above were found to be associated with higher rates of ALC. On the contrary, being married or having a primary caregiver such as a child or a child-in-law living with the patient, facilitated patient discharge to home with or without the need for social services. This subsequently decreased the incidence of ALC (Costa & Hirdes, 2010).

2.5 Factors Influencing Alternate Level of Care

ALC is a long-existing issue in many countries (Bryan, 2010; Vetter, 2003) and its underlying causes still persist and represent a great challenge in the health care sector (Beveridge et al., 2016). Many factors can contribute to the ALC problem. Those factors are strongly related to the characteristics of patients discussed in the above section and will be deliberated in this section from a different perspective. The factors affecting the occurrence of ALC could be categorized into three groups: individual factors, organizational factors, and system structure factors.

2.5.1 Individual Factors

At an individual level, the specific needs of certain groups of patients such as those suffering mental disorders may remain ignored by caregivers. Accordingly, those frail old patients tend to wait longer than others for the appropriate alternative level of care (Glasby, Littlechild, & Pryce,

2004). Also, the absence of a family member living with the patient at home and the special arrangements needed to discharge that patient, tend to result in increasing their hospital length of stay and their probability of becoming ALC (Bender & Holyoke, 2018).

Another individual characteristic is that discharge planners struggle with patients and their families' arguments regarding possible discharge arrangements. Patients may prefer to stay in a convenient acute care hospital instead of moving to their home or a less desirable long-term care facility, which add more obstacles to a smooth discharge process (Bryan, 2010).

2.5.2 Organizational Factors

At an organizational level, delayed discharge could be an outcome of delays in providing the required hospital services such as diagnostic investigations, consultants decisions and specialists assessments (Brown, Laurie Abellp, Annie Thurecht, 2011). Moreover, the complexity of discharge assessment criteria, the lack of discharge planning, the short notice of discharge, and inadequate consultation with patients and their caregivers are all considered major organization challenges that contribute significantly to the delayed discharge of patients (Landeiro et al., 2017).

2.5.3 Structural Factors

At a structural level, the main causes of the ALC problem are related to inefficient communication between the health and social care sectors, in addition to many obstacles in accessing post-acute care services (Manzano-Santaella, 2010). Waiting for the most appropriate destination remains the major reason for delayed discharge (Bender & Holyoke, 2018).

For instance, in the UK, the two key bottlenecks in the discharge process were found to be the bureaucracy getting approval for public financing of social care services and the arrangements for placement in residential care homes (Bryan, 2010). Between 2013 and 2015, the number of

hospital days spent by English patients waiting for a home care package doubled from 89,000 to 182,000 days and waiting for nursing home placement increased by 63% (Beveridge et al., 2016).

In summary, the causes of delayed discharge are immensely different, ranging from internal hospital issues to waiting for social care arrangements and from factors related to patients and their families to those related to health care providers. Definitely, the diversity of causes discussed above emphasizes the need for a whole system approach to be able to tackle such a complex and multi-faceted issue.

2.6 ALC Models of Care

In addition to a discussion of ALC definition, consequences, scale, ALC patients' profile, and associated predisposing factors, the placement of ALC patients differs from one hospital to another. Ostry et al. (2003) were able to identify four models for distributing ALC patients among Canadian hospitals. Their models are explained briefly in this section.

Typically, ALC patients are mixed with others in existing medical nursing units. Occasionally, because of the bed shortage, ALC patients are placed in surgical nursing units. In this model, the medical or surgical nursing units are categorized into low-mix ALC nursing units, which have 15% or fewer of their patients designated as ALC, and high-mix ALC nursing units, with more than 15% ALC patients.

Another model for hospitalizing ALC patients involves ALC/Extended Care Units (ALC/ECU). These units are located in buildings specially designed to provide care for the elderly. They tend to have better lifting equipment than other nursing units and are operated under a philosophy of extended care. The ALC/ECU unit is characterized as having staff trained to provide care for old people. Other hospitals may have dedicated ALC Units which differs from ECUs in that ECUs are operated with a philosophy of acute care.

The last model has dedicated Geriatric Assessment and Treatment Units (GAUs) which exist in some hospitals. These are departments that have been built to serve ALC patients and are operated by a geriatrician with support from a specialized team. ALC patients are placed in the GAUs until they are stabilized. Then they are transferred to other dedicated ALC units or ALC/ECUs within or outside the hospital.

2.7 Managing the Alternate Level of Care Challenge

ALC negatively influences not only older adults but also younger patients who wait in queues to get appropriate health care services. Delayed discharge results in many health care system challenges including emergency department overcrowding, prolonged ambulance offloading times, elective surgical cancellations, and acute care bed availability (McCloskey, Jarrett, & Stewart, 2015). Hence, the urgency of tackling ALC is obvious and it can be considered an essential strategy for improving the performance of the health care system with respect to waiting times (ALC Expert Panel, 2006).

Organizational adjustments such as the earlier involvement of social workers, improving the flow of information, and coordinated communication with community care can improve the discharge process and decrease hospital ALC stays (Khurma, N Salmati, F Pasek, 2013).

The literature review revealed that there is no single solution for the ALC problem, and its management requires a combination of many procedures and good practices. This section provides some examples of ALC proposed solutions implemented by policy planners in many countries and highlights the advantages and limitations of each option.

2.7.1 Building More Acute Care Beds

Expanding acute care capacity by building more hospitals is considered an obvious option that can improve access to hospital beds. The extra beds lead to increasing efficiency, speed and

numbers of admissions from the ED and allow ALC patients to stay in hospitals without blocking the admission of others. Consequently, the build more approach enhances patient flows through the ED and surgery departments and decreases their wait times (Sutherland & Trafford Crump, 2013).

On the other hand, evidence showed that increasing the numbers of hospital beds is a temporary and costly solution. Without finding an appropriate treatment for the core problem of safely transferring ALC patients to post-acute care in a timely manner, increasing the capacity of acute care could exacerbate the problem by leading to more beds being occupied by delayed discharge patients (Manzano-Santaella, 2010).

2.7.2 Building More Post-Acute Care Beds

Delayed discharge reflects a shortage of alternative forms of care. Similar to building more hospital beds, increasing the capacity of post-acute care by offering more beds in long-term care or chronic continuing care facilities could be seen as an optimum solution (Burr, Elaine Dickau, 2017).

A study conducted in England showed that increasing nursing home beds by 10% was associated with a 6-9% decrease in delayed discharges (Gaughan, James Gravelle, Hugh Siciliania, 2015). Nevertheless, constructing more post-acute care settings to overcome ALC pressure is not a financially feasible approach for the health care system because many ALC patients could receive appropriate care at their home, getting support from community services, which costs much less than getting the same care in a long-term care facility. Additionally, it needs careful planning to effectively support patients who have different needs and require diverse types of services (ALC Task Group, 2008).

Discharge planners spend 80% of their time working with the 20% of patients who have specialized needs such as patients on dialysis, patients with chronic mental illness, gastrostomy tube feeding and patients on ventilators. These patients are labelled as "hard-to-place population" and represent a challenge for discharge planners because they require special arrangements to be discharged (Ontario Hospital Association, 2006). Therefore, planning for post-acute care expansion requires careful considerations regarding the proper identification of the most needed types of services to best utilize the resources and avoid over or under-estimation of ALC patients future needs (Sutherland & Trafford Crump, 2013).

2.7.3 Establishing Specialized Hospital Departments

One of the solutions proposed for the ALC problem is the dedication of certain hospital departments or areas for those patients. In Austria, these areas are called “After Care Areas”, while hospitals in the Netherlands established nursing departments called “Intermediate Care Departments (ICDs)” and used them as a buffer for delayed discharge patients when the hospital was overcrowded. Although the establishment of ICDs in the Dutch hospital led to a 15% reduction in delayed discharge days, another problem appeared as a result; namely queues for admission to the ICDs. By causing the same problem they were expected to solve, the ICDs seems to be an inadequate solution (Mur-Veeman, Ingrid Govers, 2011).

In the UK, intermediate care units were established to help a smooth transfer of older people from acute care to home and to ensure that patients were not discharged to residential care before having fully recovered. However, it is crucial to ensure that services provided through intermediate care will support older people with specialized needs such as those with mental health problems (Bryan, 2010).

Similarly, in Canada, facing the challenge of ALC, some hospitals allocate ALC patients to units specially designed to provide care for older adults. These units which are called "Geriatric Assessment and Treatment Units (GAUs)", are operated by a specialized team and managed by a geriatrician. Other hospitals established what are called "Extended Care Units". These are units fully equipped to meet the needs of elderly patients, are operated by a psychologically prepared and trained staff, and are capable of safely and efficiently providing care to elderly patients with medically stable conditions (Ostry et al., 2003).

Ellis et al. (2011) included in their systematic review 22 randomized controlled trials, which investigated whether GAUs were better for patient's outcomes than conventional care service provided in an acute care hospital. They found that receiving coordinated care in GAUs improved the chances of seniors to live independent in their homes. Moreover, those geriatrics care specialized units were found to reduce hospital-acquired disability, thus decreased the probability of seniors to be admitted to a long-term care facility after their discharge from an acute care unit (John, 2016).

2.7.4 Providing Financial Incentives

The incorporation of financial incentives to improve the process of patient transfer between health care and social care was successful in Nordic countries and resulted in reducing the days of delayed discharge (Mur-Veeman, Ingrid Govers, 2011). In contrast, the English health care providers reported that the main driver of decisions taken regarding patient discharge is patient care and safety, rather than financial considerations. Thus, the financial incentives option failed to help to solve the ALC problem in the United Kingdom (Beveridge et al., 2016).

In Canada, activity-based funding is a method of funding health care providers for the care and services they provide, based on the volume and type of patients treated (Canadian Institute for

Health Information, n.d.). Such initiatives have recently targeted hospitals of two Canadian provinces (British Columbia and Ontario) to encourage the transfer of patients from acute care to post-acute care. However, these policies necessitate careful implementation to protect against inappropriate patient discharge for the sake of incentives (Sutherland & Trafford Crump, 2013).

2.7.5 Supporting Independence through Community Care

Aging adults experience a higher risk of chronic diseases such as heart disease, cancer, stroke and Alzheimer's disease (Office of Disease Prevention and Health Promotion, 2014). This makes them more vulnerable and requires support from family caregivers and home care services to enable them to live at home (Health Council of Canada, 2012).

Helping seniors to stay at home as long as possible improves their quality of life, reduces their risk of hospital-acquired illness, increases the capacity of acute care beds and decreases the demand for residential care (LHIN Collaborative, 2011). Therefore, providing frail old people with the appropriate community services that enable them to live independently at their homes is considered a cost-effective strategy to manage the patient transition and overcome the ALC challenge.

In order to meet the evolving needs of patients at home, the collaboration of family caregivers with a flexible interprofessional community team is crucial. Furthermore, it is important to consider the integration of technology such as tele-homecare and remote patient monitoring to allow better communication, to enable close monitoring of patients when necessary and to enable continuous patient assessments with care plan adjustments (Bender & Holyoke, 2018). Without providing adequate community services, people would stay longer in hospitals and create bottlenecks in the system waiting for the appropriate ALC (ALC Task Group, 2008).

It is important to address the specialized needs of some patients while planning for their post-acute care. Upon their discharge, patients who require special care such as chronic respiratory care, dialysis, mental health care, and rehabilitation would suffer from the lack of appropriate community care services that support their discharge to home (Bender & Holyoke, 2018).

Although it seems impossible for patients with specialized clinical needs to leave hospitals, some innovative solutions have empowered them to live seemingly normal lives and enabled some seniors to remain in the community longer. An example of a successful initiative that supports the independent living of elderly with specialized needs is the dementia villages such as those in the Netherlands. The dementia village has cameras everywhere to monitor residents, who suffer from dementia or Alzheimer's disease, while they are staying in their homes or wandering the streets. It has a specially designed security system to maintain the safety of the community. The geriatrics nurses and specialists who provide care for patients hold occupations in the village like cashiers, grocery store attendees and post office clerks, which simulates a real life environment for the residents (Planos, 2015).

Similarly, in Canada, government and private sectors initiated some projects that involved the establishment of houses specially designed to support independent living of seniors with dementia (Canadian Institute for Health Information, 2017). For instance, in Vancouver, Providence Health Care adopted a pilot project that used a $3.3 million private donation to build 12 residents each to simulate dementia village households where seniors share a common bond. Moreover, in Langley, a private village was developed based on the design of the Netherlands village, to provide retirement housing for seniors suffering from Alzheimer’s and dementia(O'Brien, 2019).

In Canada, Home First is a transition management strategy introduced in the province of Ontario, to encourage keeping seniors safe at their homes with community support. It includes services such as nursing, personal support, physiotherapy, occupational therapy, speech therapy, social work, adult day programs, assisted livings, and convalescent care beds, equipment and supplies. When hospitalization brings patients in to receive acute care services, Home First applies to all such patients, aiming to support their discharge to home instead of a long-term care facility (Ho, 2011).

While applying Home First strategy in discharging patients from acute care facilities, admission to a long-term care home is considered only if all other community options are carefully assessed and found inappropriate for the patient (LHIN Collaborative, 2011). Ontario's Home First program engages patients and their families in decision making regarding the hospital discharge process and post-acute care, facilitates timely discharge from hospital after receiving the acute care treatment and reduces ALC length of stay and the demand for long-term care beds (Canadian Institute for Health Information, 2011).

2.7.6 Increasing the Awareness of Patient, Family, and Health Care Providers

The fact that hospitals are neither safe nor appropriate for patients, particularly frail seniors who are stable and are no longer in a need of acute care, should be communicated to all patients and their families (LHIN Collaborative, 2011).

Getting patients and family members engaged in the discussion about the possibility of becoming an ALC patient, explaining the potential discharge destinations, highlighting what community supports are available and how they could be accessed helps to facilitate a smooth and safe patient transition (McCloskey et al., 2015). Providing the above information to patients and their families can be done through around-the-clock specialized staff resources in each hospital

Emergency Department to inform clients with regard to the available options that can support them to make the appropriate decisions (ALC Task Group, 2008).

ALC awareness campaigns should also target health care providers to explain the ALC concept. This should teach them how to adopt best practices to overcome related challenges and inform them about policies and procedures to be followed to predict the demand for LTC and facilitate safe and proper discharges (Ontario Hospital Association, 2006).

2.7.7 Early Geriatrics Assessment

Among the worthy practices to be followed by health and social care providers to manage ALC, is the early assessment of patients. The assessment aims at identifying patients' needs once they are admitted to the hospital or even at their homes whenever possible (Beveridge et al., 2016). Using standard tools for risk screening and assessment of people in emergency departments prevents unnecessary hospitalization and decreases the incidence of ALC.

Prompt geriatric assessment helps the early identification of those at higher risk for medically unnecessary hospital admission and facilitates the timely involvement of community services to prevent hospitalization (ALC Task Group, 2008). Moreover, it is recommended to reassess ALC patients during their hospital stay on a regular basis. The continuous assessment allows status updates and helps to detect the support needs of patients, which could be developed during their hospital stays. Regular patient reassessment accompanied by providing patients with adequate care to maintain their function and independence, can promote the safe return of patients to their homes (Bender & Holyoke, 2018).

2.7.8 Promoting the Delivery of Integrated Health Care

Tackling the ALC problem requires a whole system approach that overcomes the boundaries between health and social care (Bender & Holyoke, 2018). Improving the

communication among providers and the coordination of services are cornerstones for an integrated and efficient health care system. For example, when a patient returns home from the hospital, their primary care providers should make appropriate arrangement for their needed post-acute care services. Failure in achieving proper communication and coordination expose patients to the risk of not getting the needed care and returning to the hospital (Health Quality Ontario, 2015).

Integrated care is a multi-level, multi-model patient-centered strategy, which aims at addressing complex and costly health care needs by improving the coordination of services across the entire care system. It includes suitable practices of system performance optimization to achieve higher-quality patient outcomes. Although there is a rising consensus that health system integration is a must for better performance of health care organization, there is no one best way to build an integrated care system (Kodner, 2009).

Integrated care for elderly people denotes a paradigm shift from providing fragmented, short-term acute care services, to comprehensive, long-term continuing care. All outstanding integrated care programs that target seniors use multidisciplinary management approaches which target frail seniors and support them by accessing a variety of health and social services. Those programs include in their infrastructure several decision tools, assessment methods, planning approaches, and integrated data systems (Macadam, 2008).

Moreover, the integrated care programs emphasize the importance of transitional care interventions such as pre-discharge patient assessments, coordination of care between hospital and social service providers and post-discharge assessment. Such interventions lead to reduced rates of readmission and decrease the length of hospital stay of ALC patients (Coffey et al., 2015).

An example of integrated care models is the American Program of All-inclusive Care for the Elderly (PACE). This program provides frail community-dwelling older adults with the appropriate medical and social services through an interdisciplinary team of health care providers and social workers. The coordinated and comprehensive care received through the PACE program enabled the elderly individual to remain in the community instead of living in a nursing home. In addition, it reduces hospital utilization (Medicaid, n.d.).

Another example of a program that raises the prospect of integrated care for seniors is the SIPA (Services intégrés pour les personnes âgées en perte d'autonomie) project. It was carried out in Quebec and involved a randomized control trial that compared the effect of integrated care for community-dwelling seniors to usual care. The SIPA program provided community services through multidisciplinary teams integrated across health and social services. The trial showed that there was a 50% reduction in hospital ALC stays within the integrated care group (Beland et al., 2006).

To sum up, the implementation of integrated systems that involve hospital activities, post-discharge settings, and home-based services can improve system access, integration, and patient flow. Integrated care has the power of transforming the whole health care system; because the integrated models have the administrative authority and/or financial incentives as a core part of their infrastructure, which can encourage providers to cooperate towards a better coordinated acute and post-acute care.

Based on the discussion above, it is apparent that there is no single solution to overcome the ALC problem. The management of ALC requires a good understanding of the problem and its precipitating factors, then offer a combination of system and institutional transforming initiatives, in addition to putting policies and procedures in place, it improves the transitions of patients and

facilitates their safe discharge from hospitals to the most appropriate destination that meets their needs.

2.8 Alternate Level of Care in Ontario

This thesis involves the study of the ALC challenge among Ontario residents. This section sheds light on the ALC issue in Ontario by providing a more in-depth understanding of its standard definition, occurrence, consequences, governance and some guiding principles for proper ALC patient designation and management.

2.8.1 An Overview

Ontario has the highest rate of ALC in Canada. The ALC Expert Panel (2006) reported that there were more than 1,600 acute beds occupied daily by ALC patients. In 2017, 14% of acute-care beds were utilized by ALC designated patients (Bender & Holyoke, 2018). Some of these patients stay for extended periods of time (ranging from a few weeks to one or two years in some cases) in acute care settings although their care needs could be better addressed by post-acute care services (Motluk, 2018).

The ALC issue is not limited to acute care. Barriers to discharge from post-acute care facilities such as Complex Continuing Care (abbreviated as CCC, also called chronic care) create queues of ALC patients and increase wait times for the whole health system. In 2015, ALC patients occupied 19.6% of Ontario CCC beds, of which about 10% spent 30 or more ALC days and were described as “Long-stay ALC patients” by Cancer Care Ontario (CCO) (Turcotte, Luke Hirdes, 2015).

The greatest proportion of ALC days in Ontario pertains to the patients waiting to access LTC homes (ALC Task Group, 2008; Walker & Lead, 2011). Frequently, ALC patients and their families choose to stay in an acute care hospital rather than to move to a less convenient long-term

care setting. They may make such choices for financial reasons, since they have to pay for long-term care admission and there is a shortage of desirable facilities and/or proximity to family. Besides, contrary to many other provinces, it is illegal to move patients out of a hospital into the first available post-acute care bed without their consent. There is nothing that mandates them to pay if they declined that placement (Archer, 2016).

ALC reflects a care quality issue that puts patients at risk of falls, delirium, hospital-acquired infections and functional decline. It incurs substantial costs via emergency room bottlenecks and delayed surgeries (Kuluski et al., 2017). In addition, the average per diem cost of an Ontarian hospital bed is $842/day, while it costs an average of $126/day for a long-term care bed and only $42/day to provide care at home (Home Care Ontario, 2017). Bender et al. (2018) mentioned that each 10% shifts of ALC patients from hospital to home care could result in an annual saving of $35 million. With about 4000 beds/day occupied by patients waiting for alternate levels of care in Ontario, if 50% could be discharged to receive care at home with appropriate support services, over $230 million could be saved. Thus, the delay of discharging ALC patients is costly and wasteful of resources.

2.8.2 ALC Governance in Ontario

Until recently there were 14 Local health Integration Networks (LHINs) in Ontario which were established in 2006 to leverage the planning, funding and the integration of health care services. Until a recent change in organization of the Ontario health care system, LHINs managed many programs and services in public and private hospitals, Community Care Access Centers (CCACs), community support service organizations, mental health and addiction agencies, Community Health Centers (CHCs) and long-term care homes (Born & Sullivan, 2011).

LHIN Collaborative (LHINC) was a provincial LHIN-led advisory structure, which was

formed in 2009 to strengthen the relationships between health service providers, their associations and LHINs. LHINC is mandated to support LHINs in addressing issues influencing the health care system in Ontario (North West LHIN, n.d.).

Cancer Care Ontario (CCO) is the principal advisor on cancer and renal systems in Ontario. It is governed by the Ontario's Cancer Act and accountable to the Ministry of Health and Long-Term Care (MOHLTC). CCO provides resources, tools and evidence-based data that support health care providers in improving their services (Cancer Care Ontario, n.d.).

Access to Care (ATC) within CCO is a program that supports MOHLTC by designing, implementing and managing provincial information management/technology tools and processes across the province of Ontario. ATC helps to improve performance and ensure accountability within health care organizations by providing information products and services of high quality. ATC improves the access of patients to health care services, reduces wait times and supports Ontario's Wait Time and ER/ALC strategies on behalf of the Ministry (Access to Care, n.d.).

The following four sections (2.8.3-2.8.6) explain the contribution and the role of LHINs, LHINC, CCO, and ATC in addressing and managing the ALC issue.

2.8.3 ALC Provincial Definition

According to the CIHI definition, the designation of ALC applies only to acute care beds. Patients who wait for an alternative level of care in a post-acute care setting (CCC, rehabilitation or mental health facility) are not captured in the CIHI data. Taking that into consideration, a new definition of ALC was introduced by the province of Ontario to include all patients waiting to be transferred to the most appropriate health care setting (ALC Task Group, 2008). This definition was developed through the collaboration of many stakeholders including acute and post-acute care

hospitals, CCACs, MOHLTC, LHINs, CIHI, the Ontario Hospital Association (OHA) and the Ontario Health Quality Council (OHQC) (Access to Care, 2017).

Figure 4. CIHI vs. Ontario provincial ALC definition

In 2009, most hospitals in Ontario began using the standardized provincial ALC definition to designate patients, when clinically appropriate, as requiring an alternate level of care. Using a standardized ALC definition was an important step in capturing high-quality, near real-time data on all patients waiting in acute and post-acute hospitals for alternate levels of care. It allowed for consistency and accuracy of ALC data captured across Ontario (Byrick, 2018).

2.8.4 Ontario's Wait Time Information System

The provincial access to care wait-time is captured using the web-based CCO's Wait Time Information System (WTIS) which represents a key component of the "Wait Time Strategy" in Ontario. WTIS has been leveraged since 2006 as the first-ever technology system for Ontario that collects accurate and timely wait time data. It includes wait time data for surgery, diagnostic imaging and alternate level of care (Ministry of Health and Long-term Care, n.d.).

The data captured by the WTIS creates a better understanding of patient trajectories through the Ontario health care system. The WTIS has a large patient records database which contains information on patient demographics, admission facility, bed and service type, ALC days, the specialized needs of ALC patients (if any) and the most appropriate discharge destinations.

This rich database supports better resource allocation and decision making (Ministry of Health and Long-term Care, n.d.; Turcotte, Luke Hirdes, 2015).

The beta version of the WTIS for ALC was deployed in 2010 and the near-real-time data collection version was deployed to Ontario's acute and post-acute hospitals in 2011. Until fall 2016, the WTIS captured 440,000 ALC patient waits, 2 million surgical patient waits and 10.2 million MRI/CT scans waits (Access to Care, 2017).

Using various products and services, the WTIS provides a robust source of wait time information in Ontario to the public, MOHLTC, LHINs, hospitals, physicians and other stakeholders within the health system. It has been used by more than 180 hospital sites across Ontario (approximately over 97% of the provincial hospital beds) for reporting near-real-time (within two business days) ALC information. Moreover, discharge planners use the WTIS as a waitlist management tool to effectively manage the discharge process (Access to Care, 2017).

2.8.5 Home First Strategy

Because of the increasing numbers of ALC patients in hospitals and the inadequate LTC services that meet the needs of patients, managing the ALC challenge became a provincial priority. LHINs and CCACs collaborate across Ontario to apply measures that facilitate smooth patient transitions, reserve beds in LTC homes for the most vulnerable patients and encourage safe home discharge, whenever applicable.

In September 2008, the number of ALC days in Halton Healthcare Services (HHS, a community hospital in MH LHIN) nearly doubled from the previous year. Such a dramatic increase in ALC patients and their length of stay directly affected the ED admissions of HHS and resulted in the declaration of “Crisis Designation” at the hospital, which continued for one month. In

partnership with MH LHIN and MH CCAC, a new philosophy called “Home First” was created by the HHS and included changes in workflow, culture, and communication (Ho, 2011).

The Home First philosophy was adopted to encourage seniors to live independently at their homes, to minimize the growth of the ALC population in hospitals. The philosophy involved the identification of patients at risk to become ALC, once they are admitted to the hospital. Then, instead of staying hospitalized for long duration or being transferred to LTC, the Home First strategy aimed at providing those patients with the support needed to facilitates their discharge to home with or without receiving community services (LHIN Collaborative, 2011).

The implementation of the Home First philosophy led to a reduced demand for LTC beds and increased the capacity of acute care beds. It also allowed patients to remain at home for longer durations, which decreased their risk of acquiring hospital infections (Starr-Hemburrow, Parks, & Bisaillon, 2013). In order to leverage the gains achieved by the adoption of the Home First philosophy, and to promote the implementation of its measures across the province, in February 2011, the LHINC published the Home First implementation guide. That guide provided detailed information about the Home First philosophy, described its benefit and explained how to evaluate and monitor its performance. The guide suggested some outcome metrics to be measured such as percent ALC days, the numbers of ALC- LTC days, percent changes in LTC waitlist (the demand for LTC) and 60-day ED readmission rate (LHIN Collaborative, 2011).

2.8.6 ALC Designation Guiding Principles

In a comprehensive reference manual, Access to Care (2017) provided an excellent and detailed guidance for health care providers regarding how to designate a patient as ALC. All information in this section comes from the reference manual (Access to Care, 2017) and explains how and when patients should or should not be designated as ALC.

The treating physician or their delegate, in coordination with an interprofessional team, does ALC patient designation. This occurs when a patient is occupying a hospital bed in an acute or post-acute care setting and does not require the intensity of services provided in this facility. A patient should be designated as ALC in one of four scenarios: the goals of the patient's care plan were met, the progress of the patients reached a plateau, the patient reached their potential in the program/level of care or the patient was admitted to get supportive care because they cannot access those services in the community.

The ALC clock calculates the ALC length of stay, which starts at the time of designation and ends by discharging the patient or transferring them to a new destination. The ALC wait duration may also end when the ALC designation cannot be applied anymore due to changes in patient's needs or condition.

The provincial ALC definition does not apply to patients who are waiting at home, others waiting in acute care beds for another acute bed (e.g. from surgical bed to a medical bed) or those waiting in a tertiary acute care hospital bed to be transferred to a non-tertiary acute care hospital bed (e.g. repatriation to community hospital). Similarly, ALC designation does not apply in the case of moving patients within the same level of care (e.g. CCC to CCC) or to a higher level of care (e.g. mental health to acute care).

The destination of an ALC patient may include, but is not limited to: home (with/without services/programs), rehabilitation (facility/bed, internal or external), CCC (facility/bed, internal or external), transitional care bed (internal or external), LTC home, group home, convalescent care beds, palliative care beds, retirement home, shelter or supportive housing. Once a patient is ALC designated, their care team should specify their needs and the discharge planners have to determine

the patient's most appropriate discharge destination based upon those needs, regardless of whether or not the destination is available or accessible.

In order to capture real-time ALC incidence and precisely calculate the actual ALC length of stay, it is important to specify the most appropriate discharge destination, at the same time as the ALC designation is made. The health care team should record the suggested discharge destinations, based upon the patient's needs, without considering whether the patient meets the eligibility criteria for accessing those destinations.

2.9 Research Gaps and Study Objectives

Based on a cautious analysis of the literature discussed above, I was able to identify some research gaps. Those gaps are discussed below under three themes: ALC patient trajectories, ALC patient profiles and assessing the measures taken in Ontario to manage ALC.

2.9.1 ALC Patient's Trajectories

Although the trajectories of the Canadian ALC patient across the health care system were described in some reports, such as those released by CIHI, OHA and ATC (Access to Care, 2017; Byrick, 2018; Canadian Institute for Health Information, 2017). However, there is no available, comprehensive document, which portrays the ALC complete patient's journey and illustrates a full picture of the ALC patient by describing their characteristics while they move from one status to another.

Addressing the gap of providing a holistic view of ALC patients, by describing their characteristics, including their clinical and functional status within each transition is out of the scope of this work, hence limitations discussed in Chapter 5. Instead, a diagram describing the ALC patient's journey is provided at the beginning of the results chapter.

2.9.2 ALC Patients' Profile

I was able to specify 14 papers that were conducted to study the ALC challenge in Canada (see Appendix B). Those papers involved retrospective reviews of patient health records and tackled the ALC issue using descriptive analytics methods. Half of the 14 papers included in their methodologies the application of various regression models to determine which factors can predict the incidence of ALC.

First, I have categorized the variables in those studies into four categories: pre-admission, admission, treatment and discharge (see Figure 5). Next, I created the matrix in Figure 6, which reveals insufficient research work conducted to address the specialized clinical interventions received by ALC patients and their socioeconomic status.

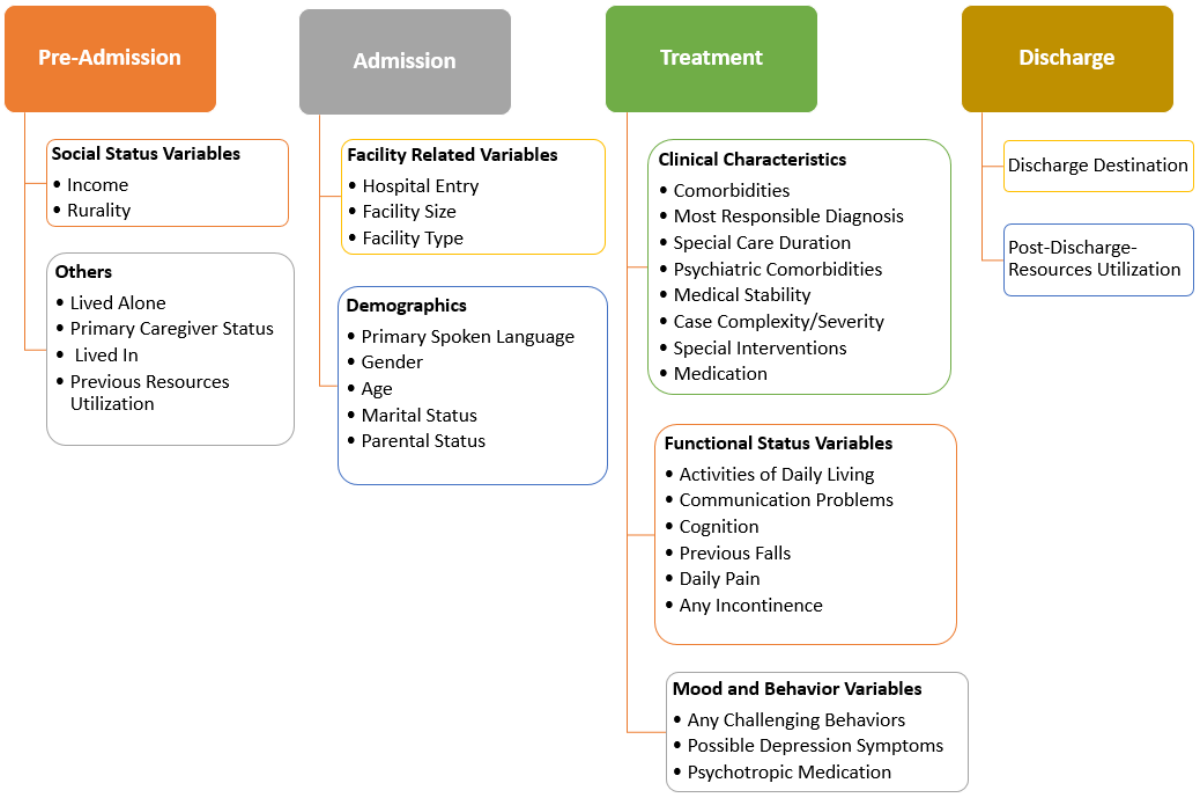

Figure 5. ALC variables studied in the Canadian literature.

	Pre-Admission						Admission							Treatment																	Disch	
	Social		Others				Facility			Demographics				Clinical Characteristics								Functional Status						Mood&Behav				
	Income	Rurality	Live_Alone	Careg_Stat	Lived_In	Pre_R_U	Entry	F_Size	F_Type	Language	Sex	Age	Mar_Stat	Par_Stat	Comorb	Most_R_D	Sp_Care	Ps_Comor	Stability	CPX	Sp_Interv	Med	ADL	Cognition	Comm	Falls	Pain	Incont	Ch_Behav	Depress	Ps_Med	D_Dest	Post_R_U
ALC Task Group, 2008	✓									✓		✓				✓					✓										✓	
Basu et al., 2016							✓				✓	✓			✓	✓															✓	
Chen et al., 2012		✓									✓	✓			✓		✓	✓		✓												
CIHI, 2009							✓				✓	✓			✓	✓					✓										✓	✓
CIHI, 2011							✓	✓			✓	✓				✓															✓	
CIHI, 2012		✓							✓		✓	✓	✓						✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Costa et al., 2010			✓	✓	✓	✓					✓	✓	✓		✓	✓				✓			✓	✓	✓	✓		✓		✓	✓	
Costa et al., 2012			✓	✓	✓						✓	✓	✓									✓	✓								✓	
Lavergne, 2015							✓	✓	✓			✓				✓																
Little et al., 2015			✓							✓	✓	✓	✓		✓			✓					✓				✓			✓		
McClaran et al., 1996				✓	✓	✓	✓				✓	✓	✓	✓		✓																
McCloskey et al., 2014						✓					✓	✓			✓	✓						✓	✓									
Stock et al., 2016	✓	✓									✓	✓			✓			✓		✓											✓	
Turcotte et al., 2015			✓							✓	✓	✓	✓		✓			✓	✓				✓	✓	✓		✓					

Social Status Variables: Income, Rurality.
Pre-Admission Related Variables: Lived Alone, Primary Caregiver Status, Lived In and Previous Resources Utilization.
Facility Related Variables: Hospital Entry, Facility Size and Facility Type.
Demographics: Primary Spoken Language, Sex, Age, Marital Status, Parental Status.
Clinical Characteristics: Comorbidities, Most Responsible Diagnosis, Special Care Duration, Psychiatric Comorbidities, Medical Stability, Case Complexity/Severity, Special Interventions and Medication.
Functional Status Variables: Activities of Daily Living, Cognition, Communication Problems, Previous Falls, Daily Pain and Any Incontinence.
Mood and Behavior Variables: Any Challenging Behaviors, Possible Depression Symptoms and Psychotropic Medication.
Discharge Variables: Discharge Destination and Post-Discharge Resources Utilization.

Figure 6. ALC variables in Canadian studies.

A) Specialized Clinical Interventions

This terminology is used in the literature to refer to the special medical interventions which were received by ALC patients during their hospital admission. The literature review showed that, to manage ALC, it is crucial to adequately understand the specialized services needed by ALC patients as well as the specialized clinical interventions received by them. This can then be used to assess their needs and facilitate their smooth discharge (see section 2.7). However, few researchers addressed such characteristics (Figure 6).

Only four interventions have been studied in the literature (dialysis, tube feeding, long-term mechanical ventilation, and short-term mechanical ventilation) (ALC Task Group, 2008; Canadian Institute for Health Information, 2009). I was able to identify a total of 12 specialized clinical interventions of which eight (Parenteral Nutrition, Chemotherapy, Radiotherapy, Vascular Access Device, Paracentesis, Pleurocentesis, Tracheostomy and Heart Resuscitation) have not been studied before.

The study of those characteristics informs better resources allocation and merits the attention of researchers and policy planners to some vital sub-populations such as those receiving chemotherapy and radiotherapy.

B) Socioeconomic Status

Regarding the socioeconomic characteristics of the ALC patients, little is known about its association with the incidence of ALC (see Figure 6). Few studies reported the geographic location of ALC patients (living in rural or urban areas). Similarly, only two papers reported the association between the incidence of ALC and the income of patients, and no study reported the marginalization index of ALC patients as an indicator of resources deprivation.

Using the Ontario marginalization index as a variable of interest, my thesis explores

whether or not greater marginalization could be associated with an increased incidence of ALC.

2.9.3 Assessing the ALC Management Initiatives in Ontario

Based on the discussion in section 2.8, I could highlight four key milestones within the Ontario government endeavors to manage ALC.

1. In 2008, the Emergency Room/ALC Strategy was released.
2. In 2009, the standard ALC definition was adopted.
3. In 2010, the WTIS beta version was deployed to capture ALC real-time data.
4. In 2011, there were two major initiatives:
    a. The release of the LHINC guide that promotes the implementation of the Home First philosophy across the 14 LHINs in Ontario.
    b. The go-live of the WTIS that captures the real-time ALC data reported by Ontario hospitals.

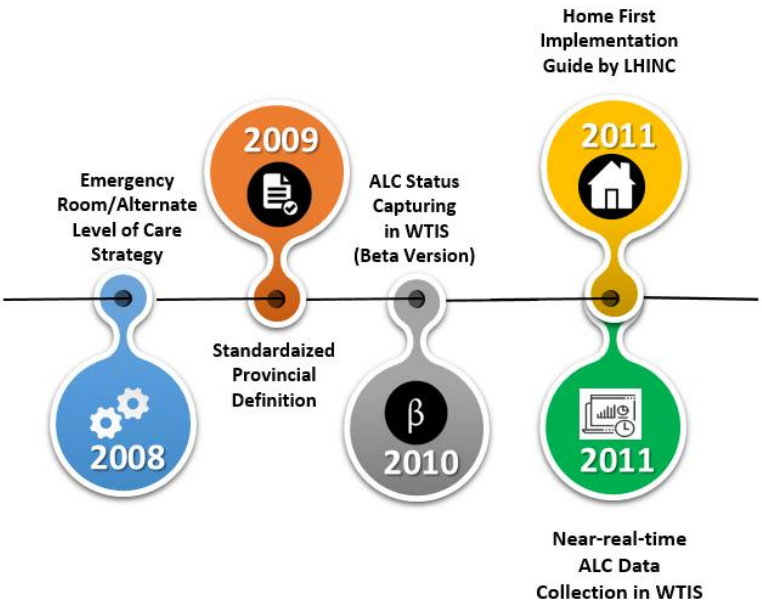

Figure 7. ALC management initiatives in Ontario.

All the LHINs and Health Quality Ontario (HQO) release quarterly reports, which include information regarding the performance of the health care system. Those reports use many

performance metrics in order to monitor the efficiency of the policies and procedures implemented by hospitals. Among those metrics, information about the wait time of patients accessing health care service and their ALC status represent crucial key performance indicators (Champlain LHIN, n.d.; Health Quality Ontario, n.d.).

However, to my knowledge, aside from the LHIN quarterly reports (which are not fully dedicated to address the issue of ALC), there has been no study conducted to scientifically assess the performance of ALC management initiatives across Ontario. Therefore, this research attempts to fill in that gap by assessing the impact of the Home First strategy on the incidence of ALC and the ALC length of stay.

CHAPTER 3: METHODS

Towards a thorough exploration of the ALC issue, descriptive data analysis was performed using the statistical software R version 3.3.0 for Windows. Frequencies were reported, odds ratios and their 95% confidence intervals were calculated according to Altman (1991) and P-values were calculated according to Sheskin (2004).

The analysis targeted the expansion of the current understanding of the ALC challenge, via unveiling the relationship between ALC and its associated factors.

Being the province with the largest population in Canada (Statistics Canada, 2018) and having the greatest proportions of ALC patients (see section 2.8.1), Ontario was selected as a province of interest in this research.

A representative sample was obtained from the health records of Ontario ALC patients and ethics clearance for conducting a "Retrospective Review of Medical Charts/Health Records" was granted in October 2018 by the Hamilton Integrated Research Ethics Board (HiREB).

3.1 Data Source

The Institute for Clinical Evaluation (ICES) provided the data for this analysis, in the form of an anonymized dataset prepared by ICES analysts. I was able to access this dataset remotely, on a secure, encrypted VMware virtual desktop server called the ICES Data & Analytic Virtual Environment (IDAVE). After conducting the analysis, an ICES analyst vetted the results for re-identification risk and granted me permission to include the results in this manuscript.

3.2 Study Group

The dataset analyzed in this research included a cohort of 6,059,033 hospitalization records of Ontario citizens, aged 65 years and older, who were admitted to an acute care facility between

April 2004 and March 2017. ICES derived the provided dataset from the CIHI's Discharge Abstract Database (DAD), which is an administrative dataset that contains the demographics, clinical data and administrative information of all patients who were discharged from acute care facilities across Canada except Quebec.

Upon a preliminary examination of the dataset provided by ICES, it was noticed that ALC status was missing from 607 records. Those records were removed from the analysis that finally included 6,058,426 hospitalization records.

3.2 Analysis Approach and Measures

Hospitalization was selected to be the unit of analysis in this research. The reason for choosing hospitalization rather than the patient themselves is that using the former enables the study of ALC prevalence over time. Besides, each hospitalization represents an independent instance of ALC, which can provide a better understanding and elucidation of the risk factors associated with that instance.

3.2.1 Outcome Variables

The main outcome variable for this analysis was the occurrence of ALC. It is a binary variable of two values (Yes/No) derived from DAD and named ALC status. A hospitalization record was marked as ALC (ALC status=Yes) if it included one or more ALC days. Those days were captured at any point during the hospital stay of each patient. Based upon the ALC status, hospitalization records were divided into two groups, ALC, and non-ALC. A comparison between the two groups was done with respect to the independent variables of this study.

Additionally, adopted from the performance metrics mentioned in the Home First implementation guide (LHIN Collaborative, 2011), percent ALC days were reported in the results as an outcome metric and calculated as

$$\% \text{ ALC Days} = \frac{\text{ALC Length of Stay}}{\text{Acute Length of Stay+ ALC Length of Stay}} \times 100$$

3.2.2 Independent Variables

Comparing ALC to non-ALC hospitalizations, several independent variables were selected to be included in this study. These variables are listed in Table 1 and were studied to identify which factors can put patients at a higher risk of experiencing ALC. The selection of the variables of interest was done following a stepwise approach (see Figure 8) that involved:

1. A cautious examination of the literature to understand and specify the key factors associated with ALC prevalence (see Figure 6).
2. A study of the variables provided by the ICES dataset.
3. Specifying and mapping the variables of interest to the ALC conceptual framework, which was designed to describe the ALC patient's journey (see Figure 9).

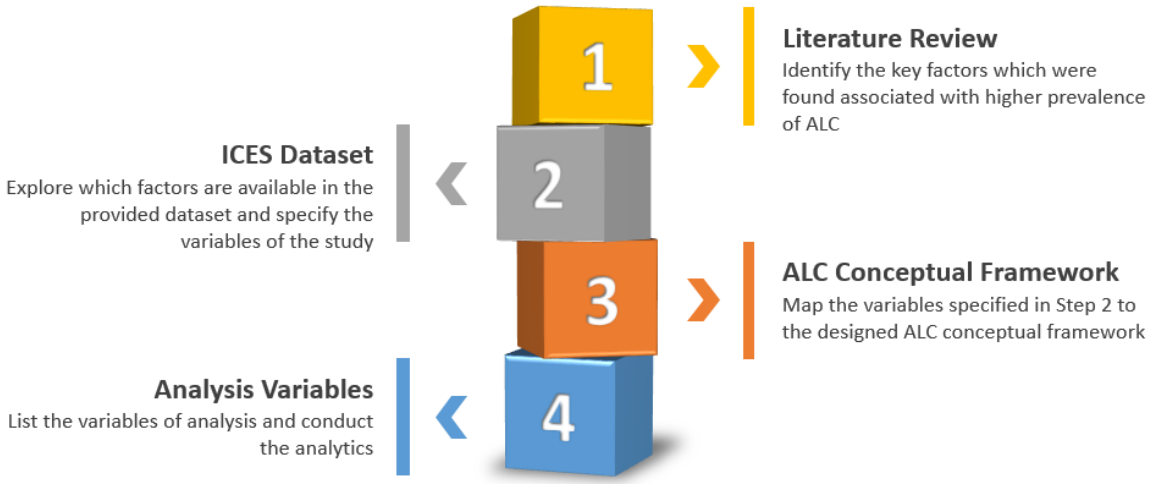

Figure 8. A stepwise approach to specify the analysis variables.

As shown in Table 1, this thesis mainly focused on the study of resource utilization, socioeconomic status, hospital entry, demographics, the specialized clinical interventions received by patients and their discharge disposition.

Table 1. Independent Variables of the Study.

Domain	Sub-Domain	Variables
Pre-Admission	Resource Utilization	• Acute Hospitalization 90 Days Prior to Admission

	Socioeconomic Status	• Geographic Location (Rural/Urban)
		• Ontario Marginalization Index:
		  ○ Ethnic Concentration Quintile
		  ○ Dependency Quintile
		  ○ Instability Quintile
		  ○ Deprivation Quintile
		• Nearest Census Based Neighborhood Income Quintile

	Hospital Entry	• Method of Hospital Entry
Admission		• Admission Fiscal Year
	Demographics	• Age • Sex
		• Specialized Clinical Interventions
Discharge		• Discharge Disposition
Post-Discharge	Resource Utilization	• Acute Hospitalization 90 Days After Discharge

Resource utilization variables were represented as the occurrence of at least one acute hospitalization 90 days prior to admission and 90 days post discharge. Socioeconomic status variables included: patient lived in a rural area upon admission, nearest census-based neighborhood income quintile, and marginalization index.

Marginalization is defined as a process of systemic discrimination that creates a minority which is excluded from society and deprived of its resources (Government of Ontario, n.d.). The Ontario marginalization index is a tool that aggregates a wide range of demographic variables into four dimensions of marginalization: residential instability, material deprivation, dependency, and ethnic concentration. This multifaceted index reflects Ontario's economic, ethno-racial, aged-based and social marginalization (Public Health Ontario, n.d.).

Demographic information represented both patients' age and sex. Age was represented as

a categorical variable with four groups: 65-74, 75-84, 85-94 and 95+. Finally, the clinical characteristics included the study of the specialized clinical interventions received by patients.

Discharge disposition is the final destination of patients after being discharged from an acute care facility. Discharge disposition of any DAD record could be one of the following categories (ICES, 2019):

1. Transferred to another facility providing inpatient hospital care or acute care inpatient institution (referred to as Acute Care).
2. Transferred to a long-term or continuing care facility (referred to as Long-term Care).
3. Transferred to other ambulatory care, palliative care/hospice, addiction treatment center, jails, infants and children discharged/detained by social services ((referred to as Ambulatory/Palliative Care).
4. Discharged to a home setting with support services (referred to as Home with Support).
5. Discharged to home; no support service from an external agency required (referred to as Home without Support).
6. Signed out (against medical advice).
7. Died.
8. Cadaver - admitted for organ/tissue retrieval.
9. Stillbirth.
10. Patients who do not return from a pass (applicable in 2008/09 and onwards).
11. Invalid value.

Because the study population included seniors aged 65 or more, the “Stillbirth” and “Cadaver” discharge dispositions did not appear in the analysis results. Moreover, I identified the three discharge dispositions of the lowest frequencies (“Signed out”, “Patients who do not return

from a pass" and "Invalid value") and merged them into an "Others" group.

Finally, to evaluate the performance of the measures taken by the Ontario government in 2011, the fiscal year of admission was considered to examine time trends in ALC propensity. Adopted from the LHINC implementation guide and a similar analysis conducted using data from the HHS (LHIN Collaborative, 2011; Starr-Hemburrow et al., 2013), the number of ALC hospitalizations and ALC days were also used for that purpose.

CHAPTER 4: RESULTS

4.1 ALC Conceptual Framework

Based upon the insights obtained from the conducted literature review, I have designed an ALC conceptual framework to provide a detailed, comprehensive representation of the ALC patient's journey, starting from their admission until their discharge.

I am not citing the information in this section, because it represents my own understanding of the literature in a trial to summarize the stages through which ALC patients pass, in order to access the appropriate health care services.

The main objective of designing the flow chart in Figure 9 is to provide a framework for researchers that helps them determine their study variables of interest and design their study approach. As shown in Figure 9, the ALC conceptual framework consists of five stages, which are described below.

4.1.1 Pre-Admission Stage

The ALC patient journey starts when their health status has deteriorated to an extent that requires acute or post-acute care (based upon the Ontario province definition of ALC). This occurs while patients are living in settings such as home, long-term care facilities, or retirement homes, where their caregivers cannot provide them with the appropriate needed care.

4.1.2 Admission Stage

The patient arrives at the hospital and is hospitalized mainly via two types of admission: emergency (ED) and elective. Elective admission (also known as direct-entry) is when a patient goes through the normal admission process, for example, when the treating physician arranges their admission in advance, or when they are admitted for a same day surgery. Another method of

entering a hospital is “transfers”, which occurs when the health care team transfers a patient to receive acute care from one hospital to another.

There is a consensus in the literature (as discussed in section 2.4) that the majority of ALC patients were elderly people, aged 75 or more and were admitted to hospital through the emergency department.

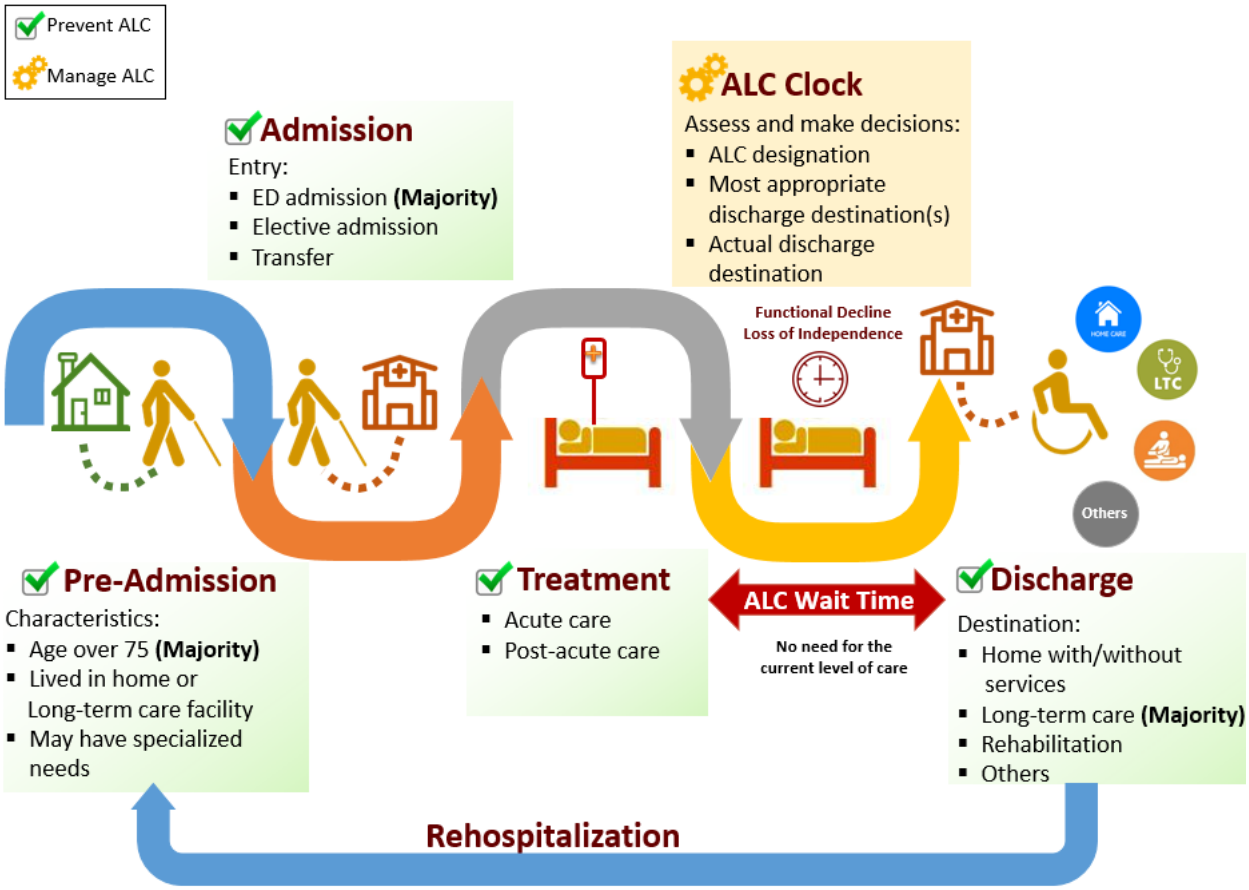

Figure 9. ALC conceptual framework.

4.1.3 Treatment Stage

After admission, patients receive the required treatment and when they complete their treatment course, they are discharged from the hospital. The ultimate scenario is when patients are discharged to the same place where they used to live before their hospital admission. However, in

some cases, this does not happen because of the deterioration of a patient's health status or the unavailability of that destination, and this is when the patient is designated as ALC.

4.1.4 ALC Stage

Once the treatment phase ends, the physicians or their delegates assess the patient's status. Based on this result, discharge planners determine the most appropriate discharge destination(s), then initiate the discharge process. If the patient is not discharged as planned, they are designated as ALC. On the same day as the ALC designation, the most appropriate discharge destination(s) are recorded for this patient based upon their needs; if not specified before.

Some patients may have specialized needs such as patients on ventilators, dialysis, or tube feeding. The arrangements for the discharge of those patients require more efforts from the discharge planners to find a suitable destination (i.e. it is fully equipped to fulfil such specialized needs).

ALC wait time is calculated from the first day of ALC designation until the day of discharge or transfer. Sometimes, if the patient's health status changes and they require the current level of care, they are no longer flagged as ALC, although they are occupying the same hospital bed.

4.1. 5 Discharge Stage

There is a consensus in the literature that, while waiting in hospital, ALC patients begin to lose their function and independence (Burr, Elaine Dickau, 2017; Landeiro et al., 2017). Leaving the hospital (often disabled), ALC patients end their journey by heading to the final discharge destination which could be any one of the following: long-term care facility (the destination of the majority of ALC patients), home, rehabilitation facility, mental health facility, palliative care setting, complex continuing care facility, convalescent care setting or retirement home.

4.1.6 Framework Insights

After describing the most important transitions within the ALC patient journey, it is crucial to highlight two points that represent cornerstones in the management of ALC. The first is that if patients are not provided with the appropriate care at their new destination, they are at great risk of rehospitalization, with a higher probability of experiencing multiple ALC episodes. Therefore, selecting the final discharge destination should be done carefully after a thorough patient assessment process.

The second point is that it is more efficient to think about solving the ALC issue at the beginning of the patient's journey. To face the ALC challenge, health care providers and discharge planners should consider measures to prevent ALC occurrence and other measures that efficiently manage the situation once a patient is ALC designated.

An optimal strategy to prevent the occurrence of ALC is to provide an appropriate level of care for the elderly in the community that will maintain them well enough to stay out of the hospital for as long as possible. It is also essential to assess the patients and act appropriately to fulfil their needs once they are admitted to hospital and during their treatment phase. This practice facilitates smooth discharge and decreases the incidence of ALC.

Similarly, the detailed examination of patient characteristics upon their admission and a careful early assessment of their needs could improve management of ALC once it happens. The early identification of patient needs speeds up the discharge process and decreases ALC wait times.

Practices such as determining the potential discharge destination(s) of the ALC patients before designating them as ALC, and the timely initiation of various communications and discharge arrangements can decrease the incidence and minimize the significance of ALC.

4.2 ALC Picture in Ontario

To determine the prevalence of ALC across Ontario acute care hospitals, frequency distributions were derived from the database. Figure 10 displays the overall percentage of hospitalizations that were designated as ALC, as well as percent ALC days. The analyzed discharge data showed that ALC presents a significant challenge for the health care system in Ontario. Overall, from 2004 until 2016, there were 610,976 documented ALC hospitalization cases, which resulted in about 10.7 million ALC days. The captured ALC instances accounted for 10% of the total number of hospitalizations and 20% of all hospital days spent by patients in the acute care facilities across Ontario.

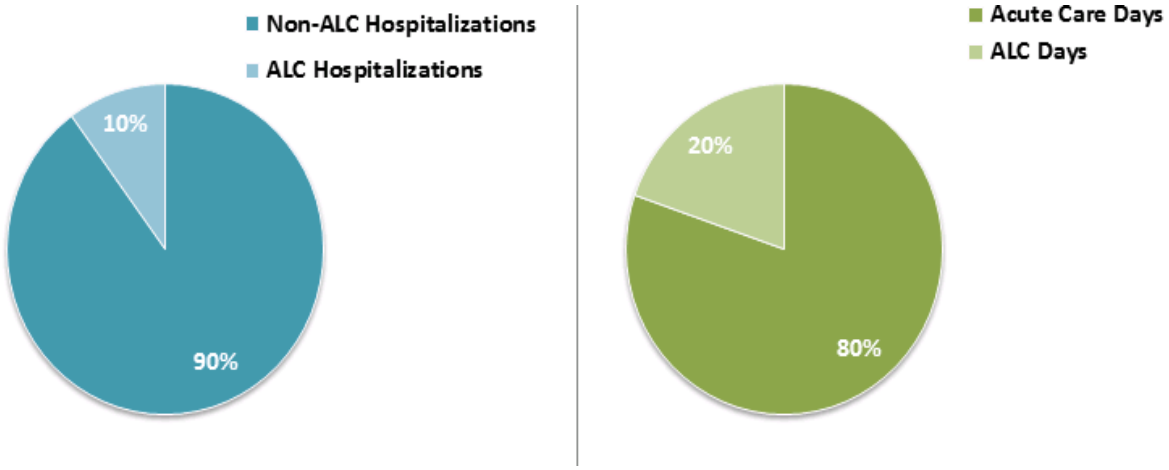

Figure 10. Percent ALC hospitalizations and Percent ALC days.

Figure 11 shows the numbers of ALC hospitalizations and ALC days grouped by the fiscal year of admission. In 2004, there were 129,606 hospitalization records with at least one day of ALC, after which the number of ALC hospitalizations fell to reach only 15,544 in 2016. Because of the decreasing numbers of ALC hospitalizations, there was a corresponding reduction in numbers of ALC days which decreased from 2,213,848 days in 2004 to only 263,977 days and 2016.

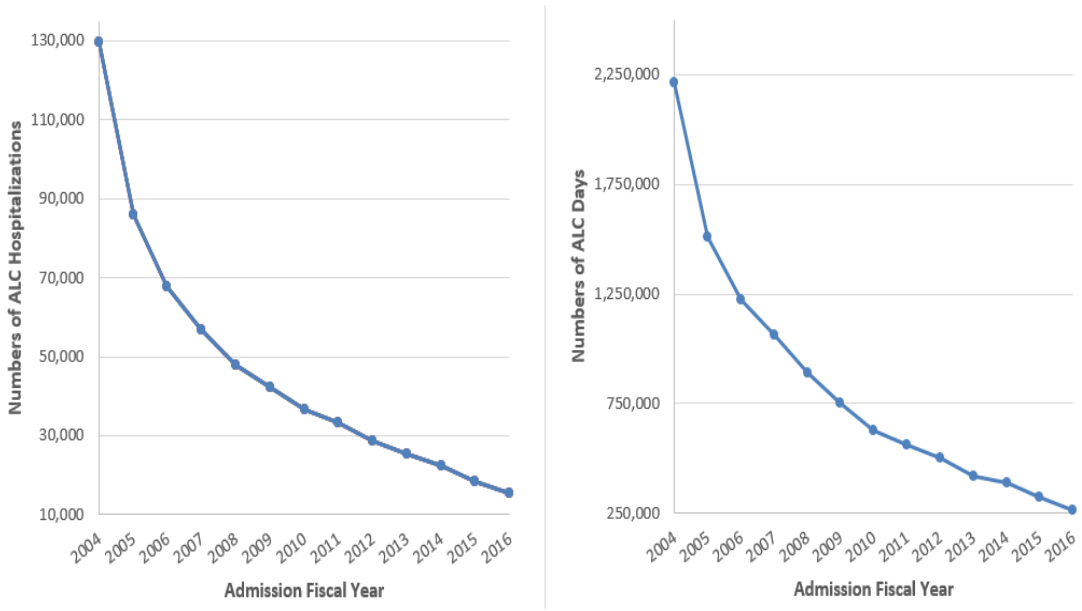

Figure 11. Ontario numbers of ALC hospitalizations and ALC days for 2004-2016.

Although both numbers of ALC hospitalizations and ALC days decreased over the 2004-2016 period (see Figure 11), the percentage of ALC hospitalizations and the percentage of ALC days followed a different pattern as shown in Figure 12. Here, the percentage of ALC hospitalizations increased slightly from 10.2% in 2004 to 10.8% in 2007. Between 2007 and 2009, the proportion of ALC hospitalizations remained constant, after which it dropped, reaching its lowest value of 7.5% in 2016.

A similar trend appears regarding the changes in ALC days from 2004-2016, comparing the number of ALC days to the total number of hospitalization days (the latter was calculated by summing both ALC and Acute Care days). The admission fiscal years 2004-2007 showed an increasing trend of the percentage of ALC days, reaching a peak of 21.6% that remained constant until 2008. In 2009 the proportion of ALC days dropped slightly to 20.1% and a gradual decrease continued within the subsequent years till 2016. Here, the ALC length of stay represented only 17.2% of total hospitalization days, the lowest value since 2004.

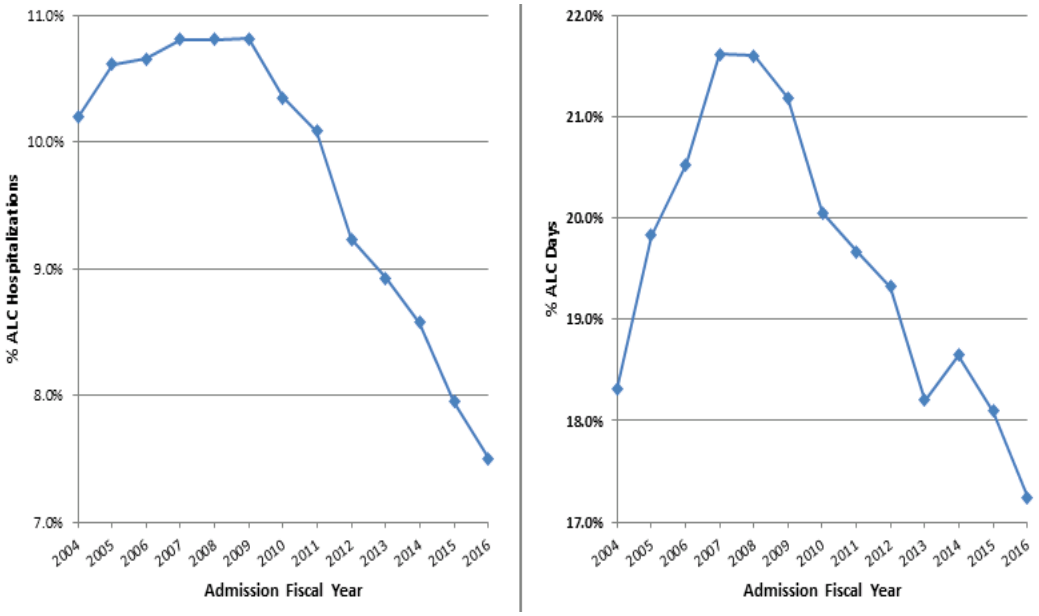

Figure 12. Ontario percent ALC hospitalizations and percent ALC days for 2004-2016.

4.3 Basic Characteristics and Demographics

Table 2 presents the descriptive statistics that compare ALC group to the non-ALC group. The comparison was done with respect to the independent variables; namely resources utilization, hospital entry, demographics, and discharge disposition. Overall, all odds ratios (OR) reported in Table 2 had P values less than 0.0001, this indicates that there were significant differences between ALC patients and non-ALC patients with respect to all subgroups.

Table 2. Basic Characteristics of Seniors Grouped by their ALC Status.

Category	**Level**	**Total N (%)**	**ALC Hospitalizations N (%)**	**Non-ALC Hospitalizations N (%)**	**OR* (95% CI)**
Total	**N/A**	**6,058,426 (100)**	**610,976 (10.1)**	**5,447,450 (89.9)**	**N/A**
Resources Utilization	Hospitalization 90 days prior admission (Yes)	1,419,788 (23.4)	162,488 (26.6)	1,250,913 (22.9)	1.22 (1.21- 1.22)

	Hospitalization 90 days after discharge (Yes)	1,419,788 (23.4)	128,587 (21.0)	1,291,201 (23.7)	0.86 (0.85-0.86)
Hospital Entry	Elective	1,345,511 (22.2)	63,720 (10.0)	1,281,791 (23.5)	0.38 (0.37-0.38)
	Urgent	4,712,883 (77.8)	547,256 (90.0)	4,165,627 (76.5)	2.64 (2.62-2.67)
Age	65-74	2,991,324 (49.4)	195,771 (32.0)	2,795,553 (51.3)	0.45 (0.44- 0.45)
	75-84	2,202,711 (36.4)	261,931 (43.0)	1,940,780 (35.6)	1.36 (1.35-1.36)
	85-94	811,287 (13.4)	141,908 (23.0)	669,379 (12.3)	2.16 (2.15-2.17)
	95 or older	53,104 (0.9)	11,366 (2.0)	41,738 (0.8)	2.46 (2.40-2.50)
Sex	Male	2,945,426 (48.6)	254,647 (42)	2,690,779 (49.4)	0.73 (0.73-0.74)
	Female	3,113,000 (51.4)	356,329 (58)	2,756,671 (50.6)	1.37 (1.36-1.37)
Discharge Disposition	Acute care	345,516 (5.7)	28,367 (4.6)	317,149 (5.8)	0.79 (0.78-0.8)
	Long-term care	901,246 (14.9)	326,310 (53.4)	574,936 (10.6)	9.71 (9.66- 9.77)
	Home with support	1,395,273 (23.0)	139,332 (22.8)	1,255,941 (23.1)	0.99 (0.98- 0.99)
	Home without support	2,897,259 (47.8)	43,715 (7.2)	2,853,544 (52.4)	0.07 (0.069-0.07)
	Ambulatory/ Palliative care	51,734 (0.9)	13,275 (2.2)	38,459 (0.7)	3.12 (3.06-3.17)
	Died	440,226 (7.3)	58,961 (9.7)	381,265 (7.0)	1.42 (1.41-1.43)
	Other	27,172 (0.5)	1,016 (0.2)	26,156 (0.5)	0.35 (0.32-0.37)

Note. OR = odds ratio; CI = confidence interval; % indicates the percentage of hospitalizations by each level of the independent variable.
*For all odds ratios reported in this table, P value < 0.0001.

Compared to other destinations, ALC was 10 times more likely than non-ALC in the subgroup of patients discharged to LTC (OR 9.71 95% CI 9.66- 9.77). Patients transferred to ambulatory care or palliative care had about three times greater ALC odds (OR 3.12, 95% CI 3.06-3.17) and those who died were about 1.5 times more likely to experience ALC patients (OR 1.41,

95% CI 1.41-1.43). On the other hand, those discharged to home without support and those who were transferred to another acute care facility were 93% and 21%, respectively, less likely to belong to the ALC group.

Moreover, Figure 13 shows that the percentage of those who were discharged to long-term care in the ALC group (53.4%) was five times greater than its value (10.6%) in the non-ALC group. On the other hand, those who were discharged to home without support represented over half of the non-ALC group (52.4 %) and only 7.2% of the ALC group.

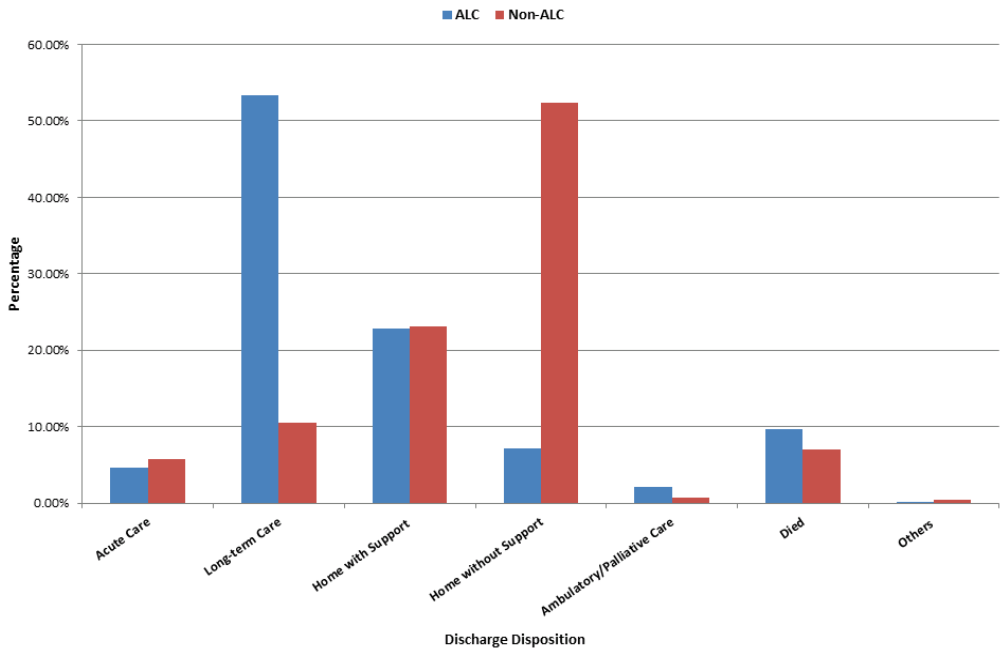

Figure 13. ALC and non-ALC hospitalizations grouped by discharge disposition.

In addition to the discharge disposition variable, age showed also a significant difference in all subgroups. Among seniors aged 65-74. ALC was 55% less likely than non-ALC (OR 0.45, 95% CI 0.044-0.45). However, ALC was 1.36, 2.16 and 2.46 times more likely than non-ALC in those aged 75-84, 85-94 and 95+, respectively. Figure 14 confirms the relationship between age and ALC, showing that ALC patients were older than non-ALC ones for ages 75 and above.

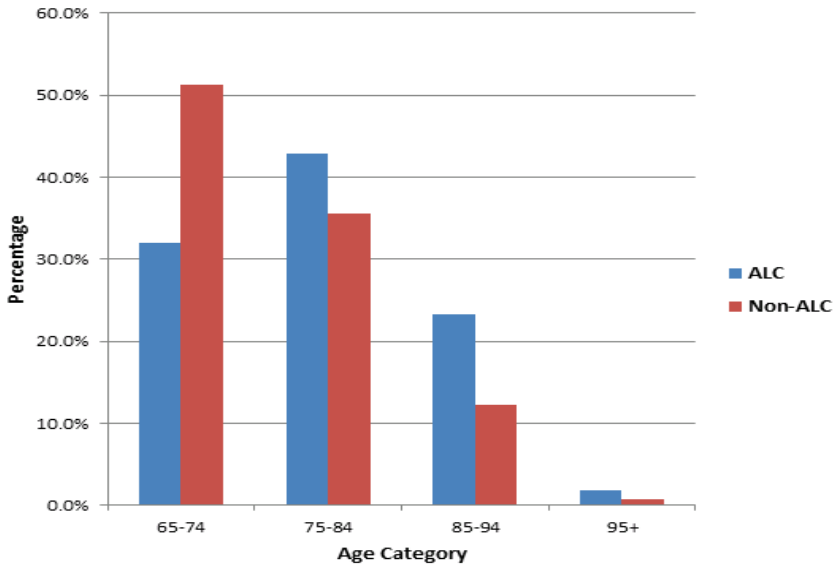

Figure 14. ALC and non-ALC hospitalizations grouped by age category.

Concerning the utilization of acute hospital resources, 26.6% of the ALC patients were hospitalized to receive acute care within 90 days prior to their current admission, while 22.9% of the non-ALC patients experienced recent hospitalization (OR 1.22, 95% CI 1.21-1.22). Unexpectedly, ALC was 14% less likely than non-ALC in the subgroup of those who were hospitalized after their discharge (OR 0.86, 95% CI 0.85-0.86).

Finally, upon examining the sex of both ALC and non-ALC hospitalizations, more than half of the ALC group were females (58%), compared to only 50.6% in the non-ALC group and the odds of ALC among females was 1.37 times greater than the odds of non-ALC (95% CI 1.36-1.37).

4.4 Specialized Clinical Interventions

Table 3 compares ALC patients to non-ALC patients regarding the specialized clinical services they received. Overall, there were significant differences between all subgroups (P value < 0.0001)), except for chemotherapy (P value=0.2341), where 0.6% of both ALC and non ALC groups received chemotherapy treatment (OR 0.98, 95% CI 0.94-1.02).

The subgroups where the odds of ALC were more than double compared to the odds of non-ALC were tube feeding, pleurocentesis, tracheostomy, radiotherapy, and mechanical ventilation (long term), for these subgroups the OR were 3.65 (95% CI 3.57- 3.74), 2.88 (95% CI 2.81-2.95), 2.64 (95% CI 2.54-2.74), 2.2 (95% CI 2.13-2.27), and 2.01 (95% CI 1.96-2.06); respectively.

The odds of ALC were 1.8 times and 1.7 times more than the non-ALC odds in those who had a vascular access device and those who received parenteral nutrition; respectively. Furthermore, ALC was 1.45 and 1.4 times more likely to occur in those who were on paracentesis and dialysis; respectively.

On the other hand, ALC was about 25% less likely than non-ALC in the subgroups of patients receiving mechanical ventilation for less than 96 days and those required heart resuscitation during their acute hospitalization (OR 0.71 and 0.74, respectively).

Table 3. Received Specialized Clinical Interventions Grouped by ALC Status.

Intervention	**Total N (%)**	**ALC Hospitalizations N (%)**	**Non-ALC Hospitalizations N (%)**	**OR (95% CI)**
Total	**4,507,786 (100)**	**484,060 (10.7)**	**4,023,726 (89.3)**	**N/A**
Tube Feeding	34,101 (0.8)	10,294 (2.1)	23,807 (0.6)	3.65 (3.57- 3.74)
Parenteral Nutrition	37,909 (0.8)	6,411 (1.3)	31,498 (0.8)	1.70 (1.66-1.75)
Chemotherapy	25,466 (0.6)	2,676 (0.6)	22,790 (0.6)	0.98* (0.94-1.02)
Radiotherapy	23,268 (0.5)	4,844 (1.0)	18,424 (0.5)	2.2 (2.13-2.27)
Vascular Access Device	194,050 (4.3)	33,671 (7.0)	160,379 (4.0)	1.8 (1.78- 1.82)
Dialysis	85,895 (1.9)	12,904 (2.7)	72,991 (1.8)	1.48 (1.46-1.51)
Paracentesis	32,635 (0.7)	4,823 (1.0)	27,812 (0.7)	1.45 (1.40-1.49)

Pleurocentesis	69,623 (1.5)	9,600 (2.0)	60,023 (1.5)	2.88 (2.81-2.95
Tracheostomy	14,212 (0.3)	3,413 (0.7)	10,799 (0.3)	2.64 (2.54-2.74)
Mechanical Ventilation (long term)	49,327 (1.1)	9,524 (2.0)	39,803 (1.0)	2.01 (1.96-2.06)
Mechanical Ventilation (short term)	152,683 (3.4)	12,118 (2.5)	140,565 (3.5)	0.71 (0.70-0.72)
Heart Resuscitation	23,676 (0.5)	1,936 (0.4)	21,740 (0.5)	0.74 (0.71-0.77)

Note. OR = odds ratio; CI = confidence interval; % indicates the percentage of hospitalizations by each level of the independent variable.

*The P values for all odds ratios reported in this table are less than 0.0001, except for the chemotherapy subgroup, P=0.2341.

4.5 Socioeconomic Characteristics

The socioeconomic characteristics of patients were studied in terms of their geographic location (whether they lived in a rural or an urban area), their income and their marginalization. Overall, the results that are reported in Table 4 show that there were significant differences between all subgroups (P value <0.0001) except the ethnic concentration quintile 2 and 5 subgroups. Those differences are elaborated more below.

Exploring the geographical location of a sample of 6,056,963 hospitalization records, 5,027,526 (83%) of the patients within that sample lived in an urban area. Stratifying data by ALC status, 87% of the ALC group came from an urban area, compared to 82.5% of the non-ALC group (OR 1.46, 96% CI 1.45-1.48).

6,032,414 hospitalization records were studied with respect to income quintiles, which is a measure of neighborhood socioeconomic status. It divides the population into five groups: poor & near poor (Quintile 1), lower-middle or modest income (Quintile 2), middle income (Quintile 3), upper-middle income (Quintile 4) and high income or well-off (Quintile 5) (Ivanova, 2011).

As shown in Table 4 and Figure 15, moving from the poorest group (quintile 1) to the

richest group (quintile 5), the proportions of ALC hospitalizations decrease, and there were significant differences between all subgroups (P values <0.0001). For the first income quintile subgroup, 24.2% of the ALC hospitalization records had the lowest income compared to 21.6% of the non-ALC group (OR 1.16, 95% CI 1.15-1.16). For the second subgroup, the proportions of both ALC and non- hospitalizations were almost equal (21.4% and 21.1%; respectively, OR 1.02, 95% CI 1.02-1.03). For the third subgroup, the proportions of ALC hospitalizations (19.1%) were slightly lower than the non-ALC hospitalizations (19.6%). The same pattern could be noticed within the fourth income quintile group (18.1% for ALC and 19.1% for non-ALC) as well as the fifth income quintile (17.2% for ALC and 18.7% for non-ALC).

Table 4. Socioeconomic Characteristics of Seniors Grouped by their ALC Status.

Category	**Level**	**Total N (%)**	**ALC Hospitalizations N (%)**	**Non-ALC Hospitalizations N (%)**	**OR (95% CI)**
Geographic Location	Rural	1,029,437 (17.0)	77,238 (13.0)	952,199 (17.5)	0.68 (0.68- 0.69)
	Urban	5,027,526 (83.0)	533,554 (87.0)	4,493,972 (82.5)	1.46 (1.45-1.48)
Income Quintiles	1 (lowest)	1,319,818 (21.9)	147,214 (24.2)	1,172,604 (21.6)	1.16 (1.15-1.16)
	2	1,273,381 (21.1)	130,400 (21.4)	1,142,981 (21.1)	1.02 (1.02-1.03)
	3	1,177,137 (19.5)	116,028 (19.1)	1,061,109 (19.6)	0.97 (0.97-0.98)
	4	1,146,879 (19.0)	110,133 (18.1)	1,036,746 (19.1)	0.94 (0.93-0.94)
	5 (highest)	1,115,199 (18.5)	104,887 (17.2)	1,010,312 (18.7)	0.91 (0.90-0.92)
Residential Instability Quintiles	1 (least unstable)	711,576 (11.9)	57,101 (9.5)	654,475 (12.2)	0.75 (0.75-0.76)
	2	990,166 (16.6)	85,608 (14.2)	904,558 (16.8)	0.82 (0.81-0.82)
	3	1,194,457 (20.0)	111,015 (18.4)	1,083,442 (20.2)	0.90 (0.89-0.90)

	4	1,321,567 (22.1)	136,603 (22.7)	1,184,964 (22.1)	1.04 (1.03-104)
	5 (most unstable)	1,755,606 (29.4)	212,260 (35.2)	1,543,346 (28.7)	1.35 (1.34-1.36)
Material Deprivation Quintiles	1 (least deprived)	985,765 (16.5)	91,624 (15.2)	894,141 (16.6)	0.9 (0.89-0.90)
	2	1,096,615 (18.4)	104,240 (17.3)	992,375 (18.4)	0.92 (0.92-0.93)
	3	1,199,618 (20.1)	117,936 (19.6)	1,081,682 (20.1)	0.97 (0.96-0.97)
	4	1,289,916 (21.6)	131,279 (21.8)	1,158,637 (21.6)	1.01 (1.01-1.02)
	5 (most deprived)	1,401,458 (23.5)	157,508 (26.1)	1,243,950 (23.2)	1.18 (1.17-1.18)
Ethnic Concentration Quintiles	1 (lowest)	1,492,579 (25.0)	138,056 (22.9)	1,354,523 (25.2)	0.88 (0.88-0.89)
	2	1,291,559 (21.6)	129,990 (21.6)	1,161,569 (21.6)	1.00* (0.99-1.10)
	3	1,126,586 (18.9)	119,547 (19.8)	1,007,039 (18.8)	1.07 (1.07-1.08)
	4	1,021,522 (17.1)	110,452 (18.3)	911,070 (17.0)	1.1 (1.09-1.12)
	5 (highest)	1,041,126 (17.4)	104,542 (17.3)	936,584 (17.4)	0.99* (0.99-1.00)
Dependency Quintiles	1 (least dependent)	661,087 (11.1)	62,014 (10.3)	599,073 (11.2)	0.91 (0.91-0.92)
	2	862,146 (14.4)	82,661 (13.7)	779,485 (14.5)	0.94 (0.94-0.93)
	3	1,033,216 (17.3)	100,176 (16.6)	933,040 (17.4)	0.95 (0.94-0.96)
	4	1,271,333 (21.3)	124,648 (20.7)	1,146,685 (21.4)	0.96 (0.95-0.97)
	5 (most dependent)	2,145,590 (35.9)	233,088 (38.7)	1,912,502 (35.6)	1.14 (1.14-1.15)

Note. OR = odds ratio; CI = confidence interval; % indicates the percentage of hospitalizations by each level of the independent variable. Variations in sample size are due to the deletion of missing cases.
* P value >0.05

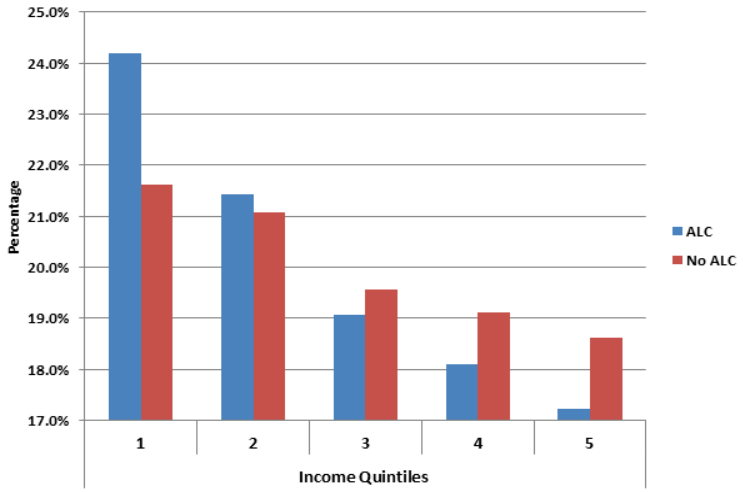

Figure 15. ALC and non-ALC hospitalizations grouped by income quintiles.

To study the marginalization of ALC patients, the analysis included 5,973,372 hospitalization records. Overall, as shown in Figure 16 and Table 4, there were differences between ALC and non-ALC patients within all components of the marginalization index. These differences are discussed below.

For the residential stability variable, which reflects family or housing instability of patients, there were significant differences between all subgroups (P value less than 0.0001). ALC was 1.35 times more likely to occur within the fifth quintile subgroup (the most unstable) (95% CI 1.34-1.36) and 1.04 times more likely to occur within the fourth quintile subgroup (95% CI 1.03-1.04). On the other hand, non-ALC was more likely within the least unstable subgroups. These results show that the higher the instability of the patient, the more likely they are to experience ALC.

For the material deprivation variable, which describes to what extent patients are deprived of accessing and attaining basic material needs, the odds of ALC for the fifth quintile subgroup (the most deprived) 1.18 times higher than that of the non-ALC (95% CI 1.17-1.18). However, the odds of ALC for the least deprived subgroups (quintiles 1, 2 and 3) was less than the odds of non-

ALC. These results show that the higher the deprivation of patients, the higher their likelihood of becoming ALC patients.

Similarly, the odds of ALC was higher than the odds of non-ALC for the fifth and fourth dependency quintile subgroups (OR 1.18, 95% 1.14-1.15 and OR 1.01, 95% CI 1.01-1.02, respectively). These results show that the most dependent population were more likely to experience ALC.

Finally, for the ethnic concentration variable, which measures area-level concentrations of recent immigrants and people belonging to a visible minority group, ALC was 12% (OR 0.88, 95% CI 0.88-0.89) less likely to occur within the first quintile subgroup (the lowest rates of immigrants and visible minority) , 7% (OR 1.07, 95% CI 1.07-1.08) and 10% (OR 1.1, 95% CI 1.09-1.12) more likely than non-ALC within the third and fourth quintile subgroups. However, there were no significant differences between the odd of ALC and non-ALC within the second and fifth quintile subgroups.

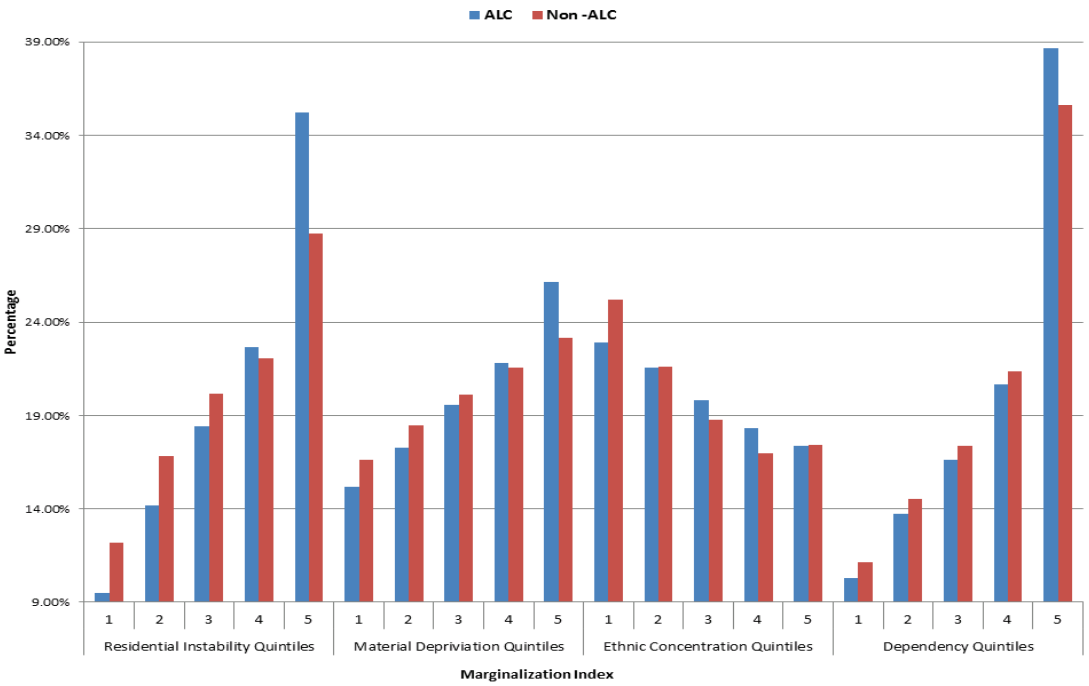

Figure 16. ALC and non-ALC hospitalizations sub-grouped by marginalization index.

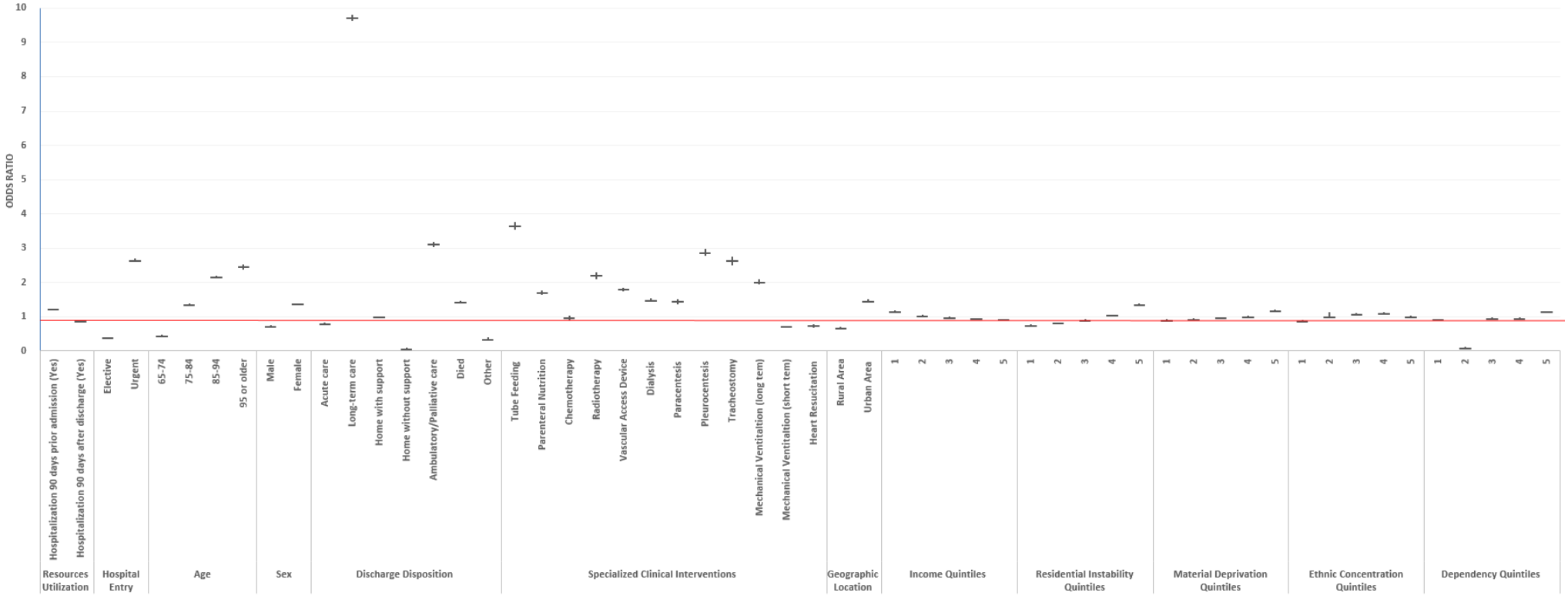

Figure 17. OR values and 95% CI of ALC hospitalizations compared across the study variables (Summary from Tables 3-5).

Figure 17 summarizes the results discussed above and highlights which variables could be considered potential ALC predictors. OR values were equal to 1 in the subgroups of patients who received chemotherapy, and those in the second and fifth ethnic concentration quintiles. Similarly, OR values were close to 1 in the subgroups of discharge home with support, income quintiles 1 and 2, residential instability quintile 1, material deprivation quintiles 3 and 4, ethnic concentration quintile 3, and dependency quintile 3. Thus, there was no significant difference between the odds of ALC and non-ALC among these subgroups. On the other hand, all other subgroups showed a significant difference and could be used to predict the incidence of ALC.

4.6 ALC Days Sub-grouped by Selected Characteristics

Further analysis was conducted to examine the length of stay of ALC patients within discharge disposition, age category, sex, and specialized clinical interventions subgroups.

4.6.1 Discharge Disposition

Table 5 and Figure 18 show that during the period 2004-2016, the highest percentage of ALC days were among those who were discharged to long-term care, followed by those transferred to ambulatory/palliative care, those who died while waiting for an appropriate destination and those who went back home with support from community services. On the other hand, patients who were discharged to their homes without support experienced the least percentage of ALC days.

Table 5. Total Numbers of Acute and ALC Days Grouped by Discharge Disposition.

Discharge Disposition	Total Hospitalization Days N (%)	ALC Days N (%)	Acute Days N (%)	% ALC Days*
Acute care	3,229,553	379,940	2,849,613	11.8

	(5.9)	(3.5)	(6.5)	
Long-term care	16,034,856 (29.4)	6,462,089 (60.2)	9,572,772 (21.9)	40.3
Home with support	13,586,809 (24.9)	1,889,959 (17.6)	11,696,850 (26.7)	13.9
Home without support	14,690,220 (26.9)	551,554 (5.1)	14,138,666 (32.3)	3.8
Ambulatory/ Palliative care	671,111 (1.2)	188,136 (1.8)	482,975 (1.1)	28.0
Died	6,216,315 (11.4)	1,252,310 (11.7)	4,964,005 (11.3)	20.1
Other	123,280 (0.2)	17,098 (0.2)	106,182 (0.2)	13.9

*%ALC Days=ALC Days/Total Hospitalization Days*100

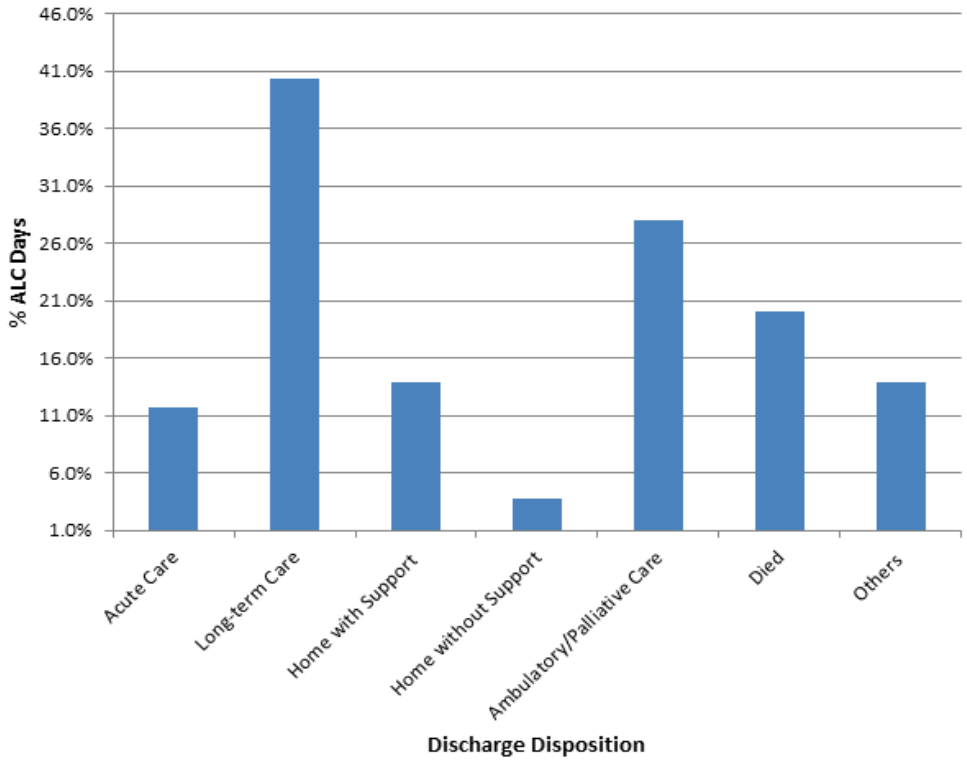

Figure 18. Percent ALC days per each discharge disposition.

Ranking the discharge disposition subgroups with respect to the number of ALC days compared to the total number of hospitalization days, from the highest to the lowest, ALC patients

who were waiting to be discharged to a long-term care facility occupied the first rank. They consumed a total of 16,034,856 days of acute care resources, of which 6,462,089 days (40%) were captured as ALC days.

Those who waited to be transferred to an ambulatory or a palliative care setting were ranked second, having waited in an ALC transition process for a total of 1,252,310 days, representing 28% of all hospitalization days spent by this subgroup.

The third rank was occupied by those who died before being discharged to the appropriate destination; they spent 1,252,310 days as ALC patients which constituted 20.1% of their total hospital length of stay.

The fourth rank was for those who were discharged home with support and those discharged to other destinations. Each spent only 13.9% of their hospitalization days as ALC patients, followed by patients who were transferred to another acute care facility, who spent 11.8% of their hospital stay as ALC patients.

Finally, patients discharged home independently without support services experienced only 551,554 days of ALC representing 3.8% of their total hospitalization days.

4.6.2 Age Category

Figure 19 demonstrates that the age of patients is in direct proportion to the total duration ALC patients spent waiting for an appropriate discharge disposition. The older the age category which patients belong to, the greater the percentage of ALC days they spent in hospitals.

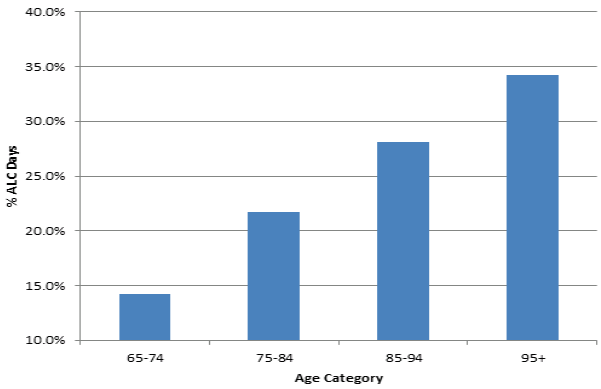

Figure 19. Percent ALC days per each age category.

As shown in Table 6, seniors aged 95 or more spent 219,338 days, corresponding to 34.3% of their total hospitalization days, waiting for the appropriate alternate level of care. Those aged 85-95 came in the second rank by spending 2,534,926 days as ALC patients, representing 28.1% of their total hospitalization length of stay. Only 21.7% of the hospitalization days of patients aged 75-84 were ALC days and those aged 65-74 spent only 14.2% of their hospital length of stay waiting for transfer to another discharge disposition.

Table 6. Total Numbers of Acute and ALC Days Grouped by Age Categories.

Age Category	**Total Hospitalization Days N (%)**	**ALC Days N (%)**	**Acute Days N (%)**	**% ALC Days***
65-74	23,443,423 (43.0)	3,328,157 (31.0)	20,115,266 (45.9)	14.2
75-84	21,450,638 (39.3)	4,658,660 (43.4)	16,791,978 (38.3)	21.7
85-94	9,017,946 (16.5)	2,534,926 (23.6)	6,483,020 (14.8)	28.1
95 or older	640,137 (1.2)	219,338 (2.0)	420,799 (1.0)	34.3

*%ALC Days=ALC Days/Total Hospitalization Days*100

4.6.3 Sex

Figure 20 shows that compared to male seniors, female seniors consumed higher percentages of hospitalization days as ALC patients waiting to be transferred to another facility.

However, as demonstrated in Table 7, the difference between the two groups is not as big it appears to be in Figure 20.

From 2004 to 2016, females spent 5,995,985 days waiting as ALC patients in Ontario hospitals; this number of ALC days corresponded to 20.8% of all hospitalization days, while males spent only 18.5% of their hospital length of stay waiting as ALC patients.

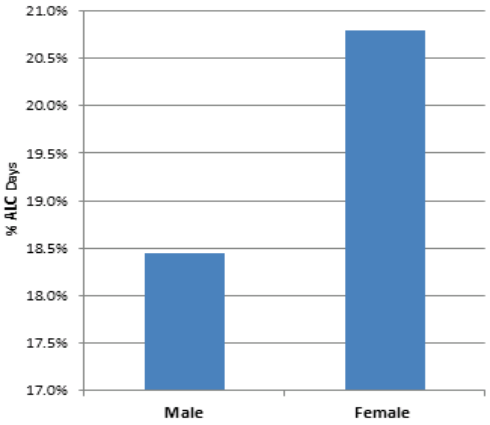

Figure 20. Percent ALC days per each sex group

Table 7. Total Numbers of Acute and ALC Days Grouped by Sex.

Sex	Total Hospitalization Days N (%)	ALC Days N (%)	Acute Days N (%)	% ALC Days*
Male	25,717,448 (47.1)	4,745,096 (44.2)	20,972,352 (47.9)	18.5
Female	28,834,696 (52.9)	5,995,985 (55.8)	22,838,711 (52.1)	20.8

*%ALC Days=ALC Days/Total Hospitalization Days*100

4.6.4 Specialized Clinical Interventions

Figure 21 and Table 8 demonstrate that proportion of ALC days was the highest among those who were on tube feeding (25.2%), dialysis (17.2%), radiotherapy (16%), vascular access devices (14.9%) , tracheostomy (13.9%), mechanical ventilation greater than 96 hours (12.9%), pleurocentesis (12.6%), paracentesis (12.0%) and heart resuscitation (12.0%). For those on

chemotherapy, although there was no significant difference between the ALC and non-ALC groups as shown in Table 3, those populations spent 10.7% of their hospitalization days, designated as ALC patients who were waiting for an alternate level of care. Finally, those who received parenteral nutrition spent and those who were on short-term mechanical ventilation had the least percentage of ALC days (10.0% and 9.2%, respectively).

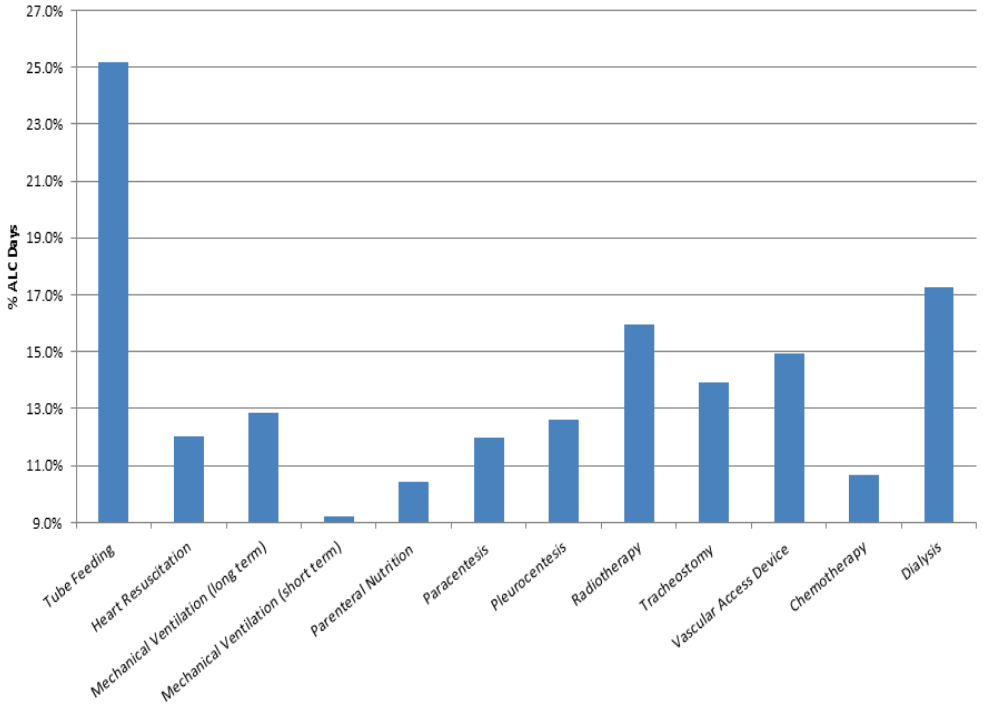

Figure 21. Percent ALC days per each specialized clinical intervention group.

4.7 Changes in Some Characteristics over Time, Grouped by ALC Status

Sub-setting hospitalization records into two groups (ALC and non-ALC), the records within each category were further sub-grouped by discharge disposition, age category, sex, and specialized clinical interventions in order to follow up trends over the 13 years of admission.

4.7.1 Discharge Disposition

Figure 22 and Appendix C demonstrate large differences between ALC and non-ALC groups with respect to cases discharged to long-term care, home without support services,

ambulatory/palliative care, acute care or those who died. On the other hand, there was little difference between the numbers of ALC and non-ALC hospitalizations who were discharged home with support services. The later (discharge home with support) was the only patient destination, for which hospitalization numbers increased over the 13 years of analysis. The percentage of those discharged to home getting support from community services increased by about 10%, from 20.2%

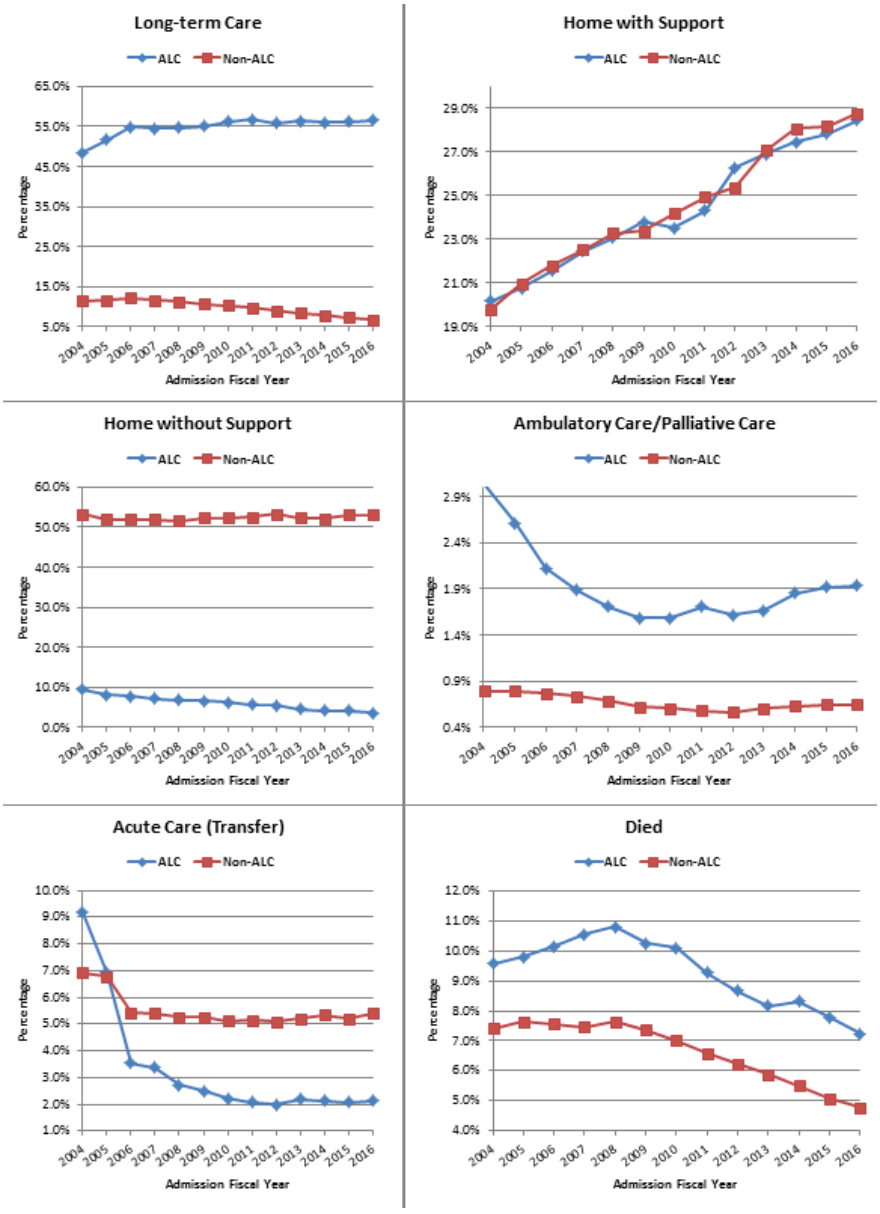

Figure 22. Changes in percent hospitalizations per each discharge disposition.

to 28.4% and from 19.8% to 28.8% within the ALC and non-ALC groups, respectively.

For the subgroup of patients who were discharged to long-term care, their proportion within the ALC group increased from 48.4% in 2004 to its maximum value of 56.8% in 2011. With some minor fluctuations, the percentage within this group is relatively constant from 2012 until 2016. On the contrary, starting at a relatively lower value of 11.6%, the proportion of those who were discharged to long-term care showed a declining trend within the non-ALC group until 2016, when only 6.7% of the hospitalizations in this year had been discharged to a long-term care facility.

Regarding those who were discharged to an ambulatory or palliative care unit, their numbers decreased over the years within both the ALC and non-ALC groups. The percentage of the former group declined to about half its value (from 3% to 1.9%), while the later changed from 0.8% in 2004 to 0.6% in 2016. Similarly, the percentage of those who died decreased over the 13 years of analysis from 9.6% to 7.2% and from 7.4% to 4.8% within the ALC and non-ALC groups, respectively.

While the proportions of those discharged to long-term care, ambulatory/palliative care and those who died were markedly higher in the ALC group compared to the non-ALC group, the opposite could be noticed in Figure 20 with respect to the other discharge dispositions; namely home without support and transfers to acute care.

Patients who were transferred to home without support represented the greatest segment within the non-ALC group. In 2004, 53.2% of the non-ALC hospitalization cases were well enough to be discharged to their homes without support services; this proportion remained almost constant over the 13 years of analysis. On the other hand, the proportions of this discharge disposition within the ALC group was as low as 9.5% in 2004, and continuously decreased over the years, becoming only 3.6% in 2016.

In 2004, the proportion of ALC patients who were transferred to another acute care facility was 9.2%, and this declined to reach only 2.1% in 2016. On the other hand, the non-ALC group showed 6.9% acute care transfers in 2004, and this percentage continued to decline until 2014 when it became 5.4%.

In addition to examining the proportions of hospitalizations within each discharge disposition and following up the changes of those proportions over the years, the number of ALC days was another variable of interest. Figure 23 reveals the changes of ALC days as a percent of all hospitalization days from 2004 till 2016, sub-grouped by the discharge disposition of ALC patients.

Compared to other discharge dispositions, patients who were discharged to long-term care got the highest proportions of ALC days. This aligns well with the results shown in Figure 22, which reveals that LTC was the discharge disposition with the highest ALC incidence. In 2004, the ALC days represented 38.1% of the hospitalization days spent by patients who were discharged to LTC facilities; this percentage increased slightly, reaching 42.5% in 2008, after which it remained almost constant till 2016.

Following long-term care discharge disposition, discharges to ambulatory or palliative care settings showed the second highest ALC days proportions. In 2004, the proportion of ALC days among this group was 27.7%. Then, the group of ambulatory/palliative care hospitalizations fluctuated in ALC days proportions reaching its lowest value of 23.1% in 2016.

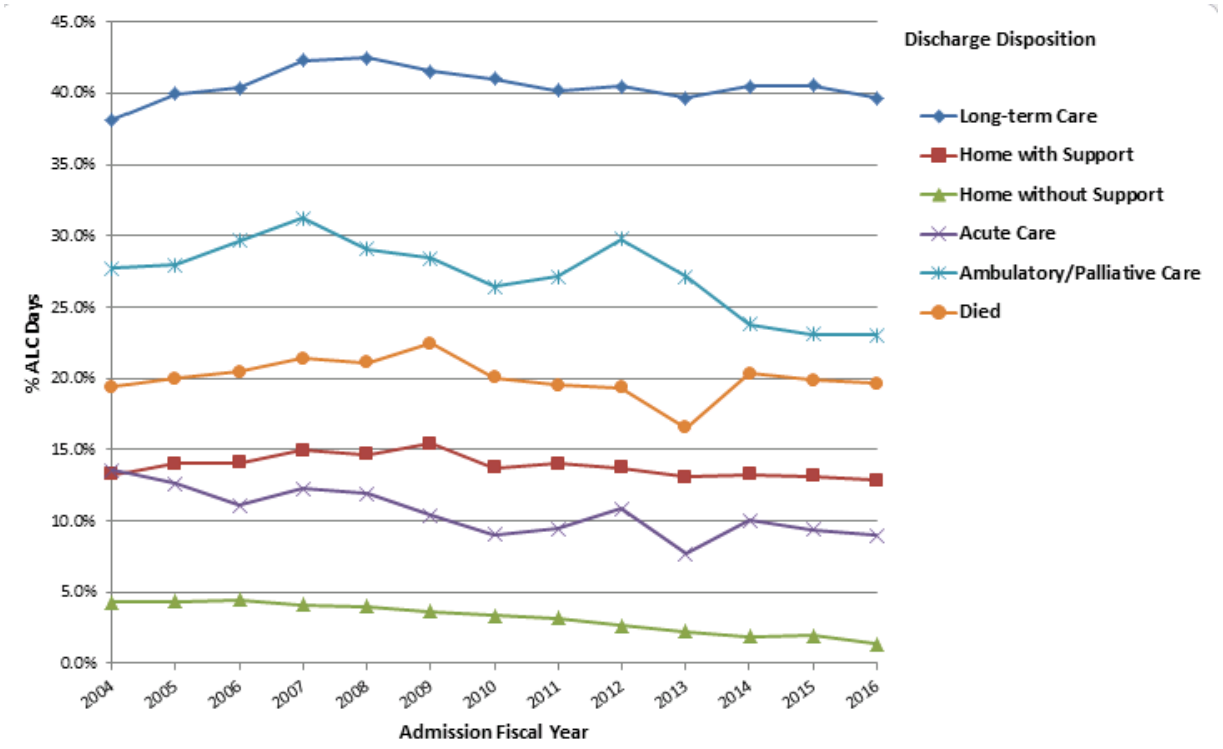

Figure 23. Changes of percent ALC days within each discharge disposition.

The third rank is the subgroup of ALC patients who died while hospitalized. The proportion of ALC days within this group remained relatively steady over the study period within a range of 19.4% to 22.4%.

Fourthly, in 2004, the ALC patients who were transferred home with support services spent 13.3% of their hospitalization days as ALC days. This proportion increased slightly to 15.4% in 2009, after which it decreased to reach its lowest value of 12.9% in 2016.

Fifthly, percent ALC days among those who were transferred to another acute care facility was 13.6% in 2004. This decreased until 2016, when only 9% of the hospitalization days of this group were ALC.

Finally, returning home without any support services represented the discharge disposition category for which patients spent the lowest numbers of ALC days. In 2004, 4.3% of the hospitalization days of those discharged to home without any support services were spent as

ALC days; this percentage showed a declining pattern till reaching its lowest value of 1.4% in 2016. This group had the lowest incidence of ALC shown in Figure 18.

4.7.2 Age Category

Age is another crucial ALC determinant. Therefore, the hospitalization records of both ALC and non-ALC groups were compared with respect to age categories. Overall, Figure 24 shows that while the numbers of those aged 65-74 within the non- ALC groups were always higher than those within the ALC group, the latter had higher numbers of hospitalizations for patients aged 75-84, 85-94 and 95+.

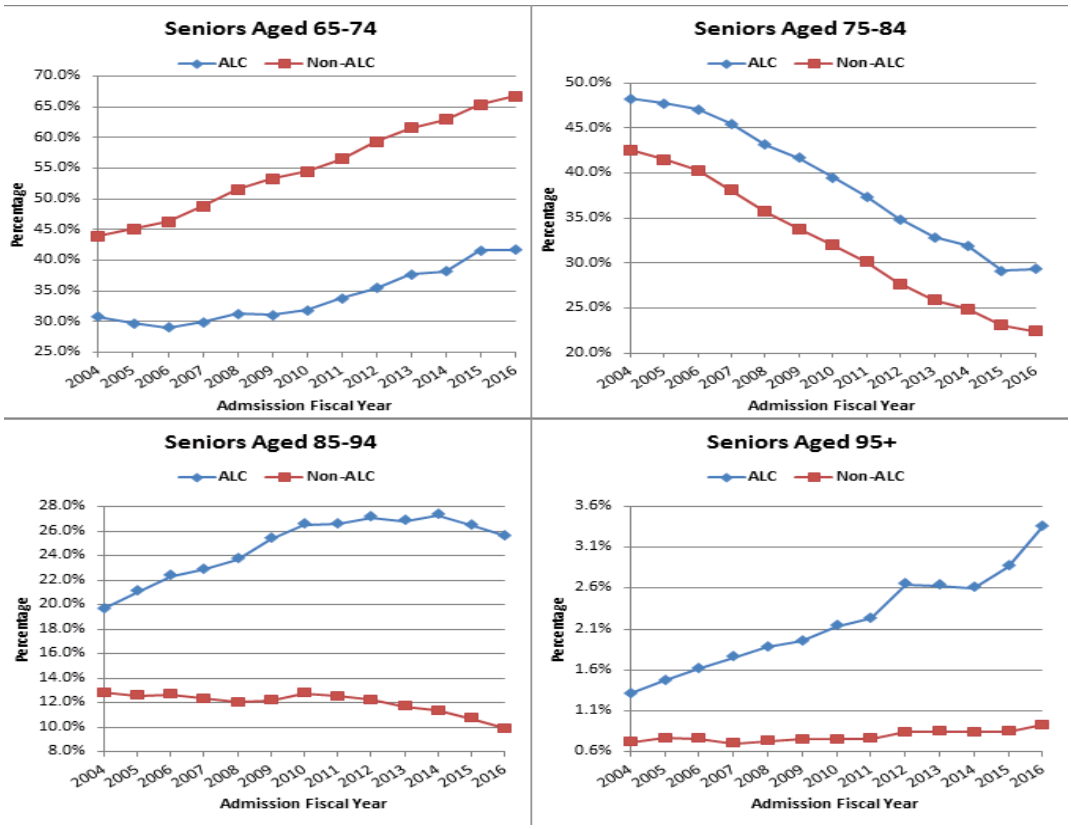

Figure 24. Changes in percent hospitalizations per each age category

For the age category 65-74, the numbers of hospitalizations related to this subgroup followed an increasing trend over the years, in both the ALC and non-ALC group. Within the ALC group, in 2004, seniors aged 65-74 represented 30.8% of ALC cases. These numbers continued to

increase, reaching a value of 41.7% in 2016. Likewise, the proportion of those aged 65-74 within the non-ALC group increased from 43.9% in 2004 to 66.8% in 2016.

A different trend of decreasing proportions appears in Figure 24 for the subgroup aged 75-84. In 2004, this age group represented 30.8% of the ALC group and 42.6% of the non-ALC group. Those percentages decreased across the years reaching 29.3% of the ALC group and 22.4% of the non-ALC group in 2016.

For patient groups aged 85-94 and 95+, their numbers increased within the ALC group over the 13 years of the study data. In 2004, 19.6% of the hospitalization records were for patients aged 85-94 and 1.3% were 95+ years old. Those proportions continuously increased until the year 2016, where 25.6% of the ALC cases were 85-94 years old and 3.4% were 95+ years old.

Figure 25 represents how percentages of ALC days within each age category changed over the years. The population which spent the highest numbers of ALC days, was those aged 95+, followed by 85-94, then those who aged 75-84. Finally, younger seniors aged 65-77 recorded the least proportion of ALC days.

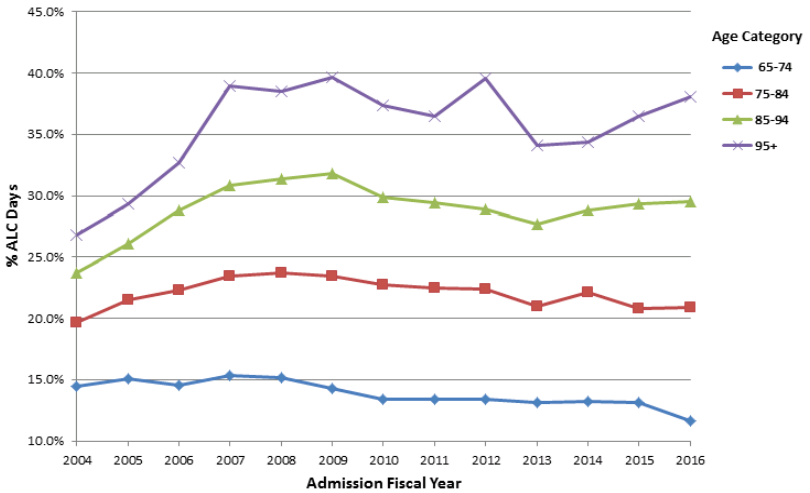

Figure 25. Changes of percent ALC days within each age category.

Despite representing the smallest segment within the study sample (see Table 2), where only 0.9% of the hospitalization records were related to cases aged 95 or older (2% of the ALC

group and 0.8% of the non-ALC group), the patients within this age category had the highest percentages of ALC days throughout the study period from 2004-2016, with an average of 35.6%. As shown in Figure 25, the hospitalized ALC patients in 2004 aged 95 years or older spent ALC days that contributed to 26.8% of the total hospitalization days. Such proportions fluctuated across the 13 admission years reaching 38.1% ALC days in 2016.

The percentage of ALC days spent by seniors aged 85-94 fluctuated around an average of 28.9% over the period 2004-2016. In 2004, the percentage of ALC days among this group was 23.7%, increasing to 28.9% in 2016. This proportion for those aged 75-84 had an average of 22%, starting at 19.6% in 2004 and reaching 22% in 2019.

Although a significant segment of the ALC patients included in this analysis were aged 65-74 (38% of the ALC hospitalizations), the proportions of ALC days among this group showed the lowest values compared to other age categories, with an average of 13.9% ALC days. In 2004, 14.5% of the total hospital length of stay of that group were ALC days. The numbers of ALC days continued to drop among patients aged 65-74 until 2016, when only 11.6% of the total hospitalization days were ALC.

4.7.3 Sex

Figure 26 describes how the proportions of males and females changed over the years within the ALC and non-ALC groups. With an average difference of 7.7%, females constituted a higher proportion of ALC hospitalizations. In 2004, 58.7% of the ALC hospitalizations were females, compared to 51.6% of the non-ALC group. The proportions of female in both groups rose in 2005, when the female population constituted 59.5% and 51.8% of the ALC and non-ALC groups, respectively. Then the numbers of females slightly decreased to become 56.5% of the ALC group and 49.1% of the non-ALC group in 2016.

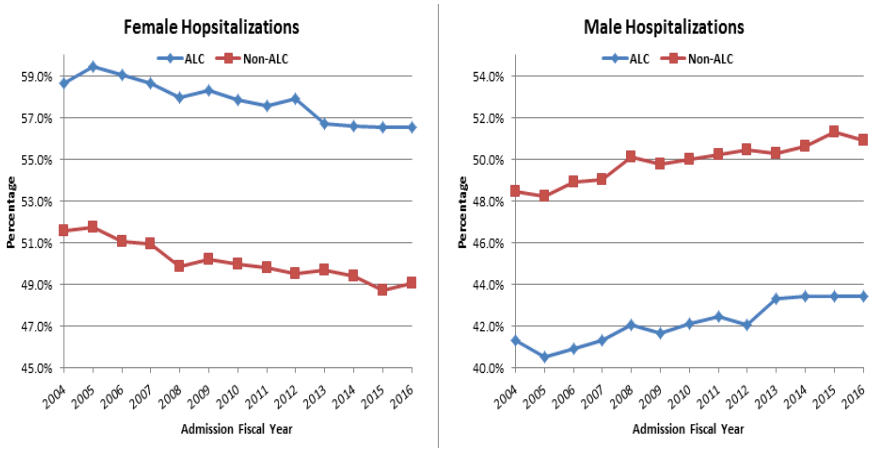

Figure 26. Changes in percent hospitalizations per each sex

The increasing proportions of females within the ALC group was accompanied by higher proportions of ALC days, with an average difference of 2.2% comparing female to male hospitalizations. As seen in Figure 27, females had 19.3% of the ALC days spent by patients in 2004, this proportion increased to its peak of 23% in 2008, then slightly decreased reaching 18.1% in 2016. Following a similar trend with slightly lower values, in 2004 the ALC days represented 17.1% of the total length of stay of the male population, this proportion slightly changed over years reaching 16.4% in 2016.

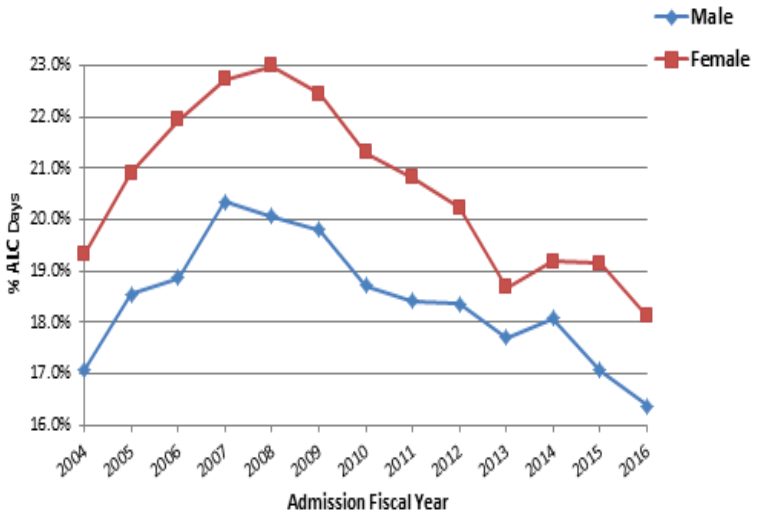

Figure 27. Changes of percent ALC days within males and females.

4.7.4 Specialized Clinical Interventions

Figures 28-30 demonstrate that throughout the years of the study, the numbers of hospitalizations of the ALC group exceeded those of the non-ALC groups within the subgroups of tube feeding, parenteral nutrition, long-term mechanical ventilation, radiotherapy, tracheostomy, dialysis, paracentesis, pleurocentesis, and vascular access device. On the other hand, the number of hospitalizations among those who had heart resuscitation or short-term mechanical ventilation was higher in the non-ALC group compared to the ALC group and there was no difference between the two groups within patients on chemotherapy.

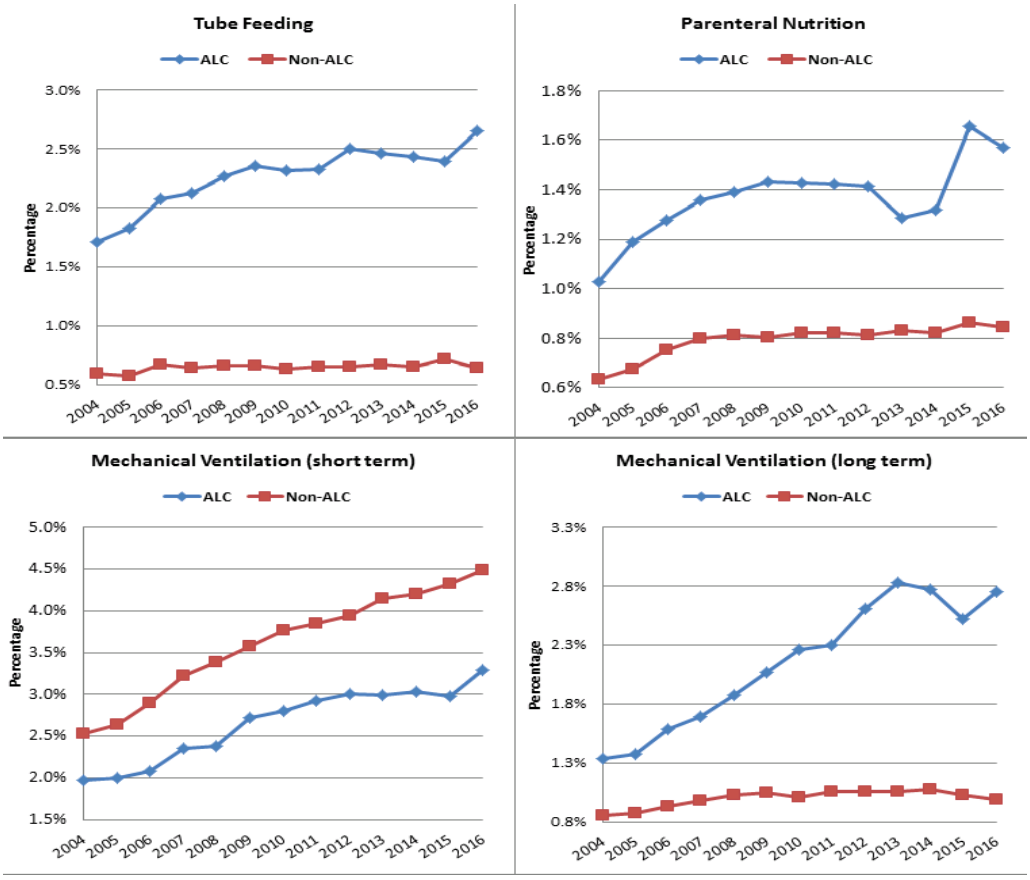

Figure 28. Changes in percent hospitalizations of tube feeding, parenteral nutrition, short-term and long-term mechanical ventilation.

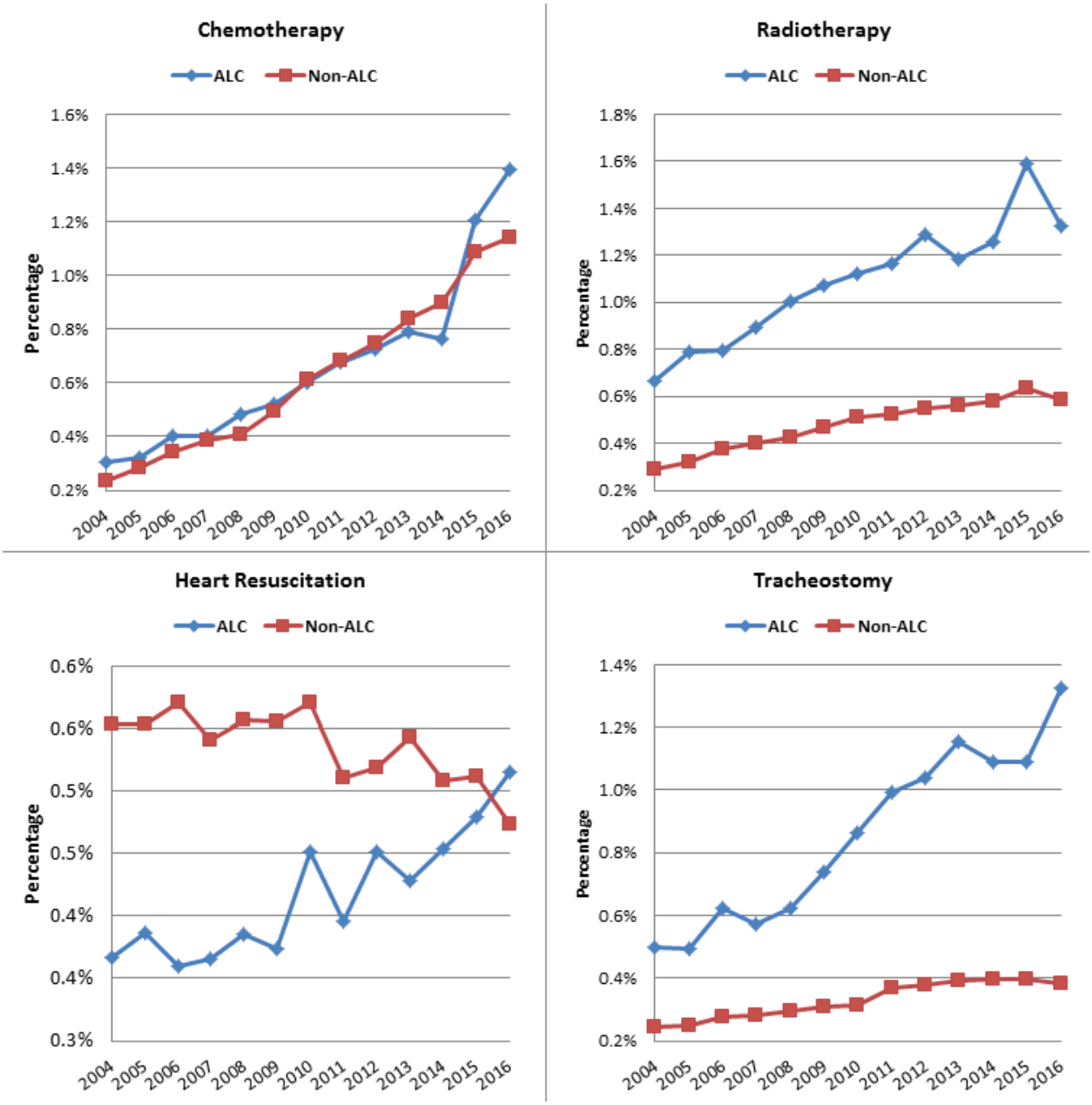

Figure 29. Changes in percent hospitalizations of chemotherapy, radiotherapy, heart resuscitation and tracheostomy over the years.

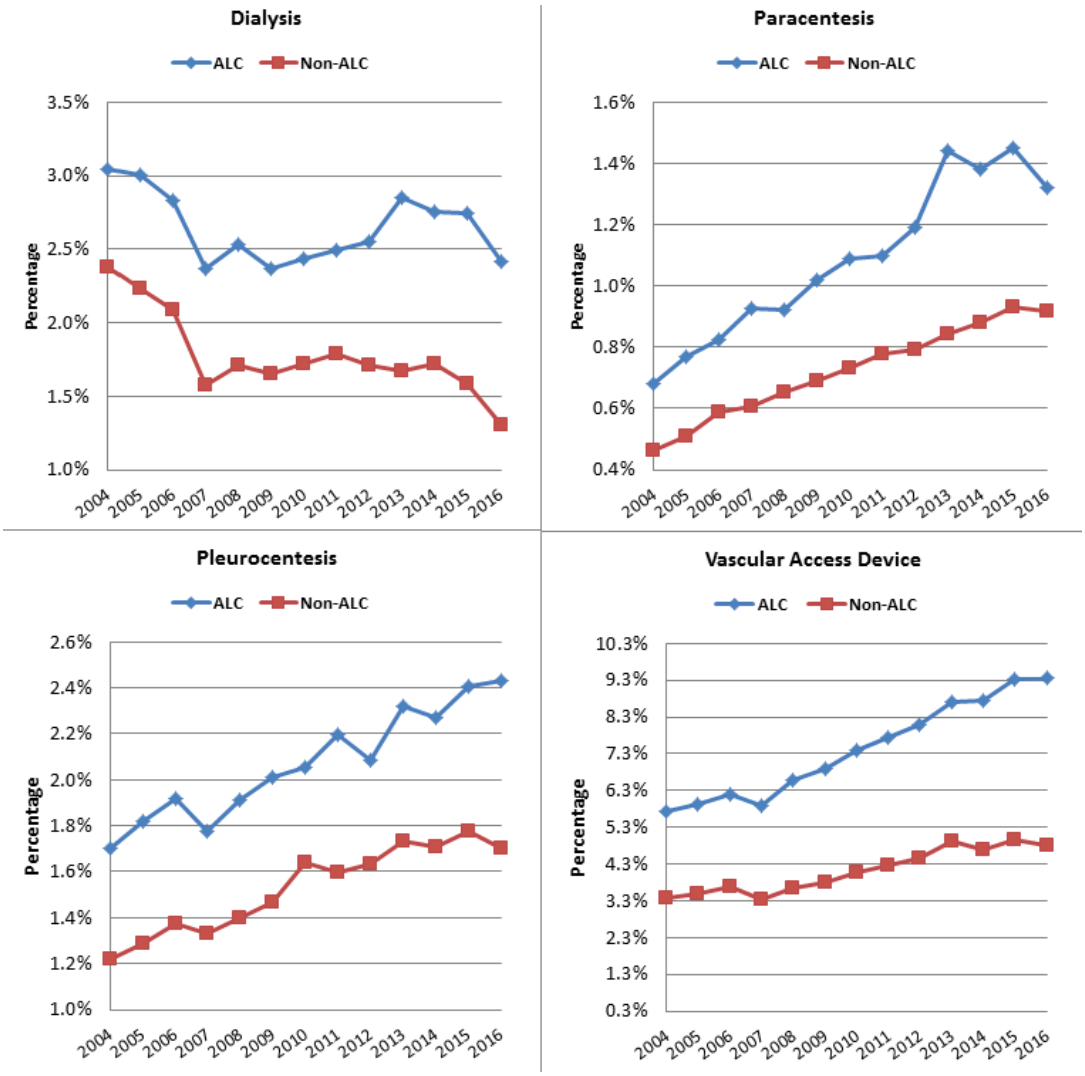

Figure 30. Changes in percent hospitalizations of dialysis, paracentesis, pleurocentesis and vascular access device.

Following up the trends throughout the study years, there were increasing numbers of patients who required specialized clinical interventions whether they belonged to the ALC or the non-ALC group. For instance, 0.7% of the ALC group required paracentesis in 2004 and this value increased to 1.3% in 2016, while the values were 0.5% and 0.9%, respectively in the non-ALC group. An exception was noticed within the subgroup of patients on dialysis; they represented 3% and 2.4% of the ALC and the non ALC groups, respectively in 2004, while those proportions decreased in 2016 to 2.4% and 1.3%, respectively.

Figure 31 represents how the percentage of ALC days within each specialized clinical intervention changed over the years. Overall, the population which spent the highest percentage of their hospitalization days designated as ALC was those on tube feeding, who spent about a quarter of their total hospital length of stay waiting for an alternative level of care. On the other hand, patients on short-term mechanical ventilations represented the population with the least percentage of ALC days throughout the study years. The proportion of ALC days within the tube feeding group remained steady over the study years with minor changes within a range of a minimum value of 22.1% in 2011 and a maximum value of 27.5% in 2014. On the other hand, all other groups showed decreases in their percentage of ALC days. For instance, those on dialysis spent 19.9% and 13.7% of their hospitalization days, designated as ALC in 2004 and 2016, respectively. Similarly, the percentage of ALC days of those on chemotherapy decreased from 17.2% in 204 to 9.3% in 2016.

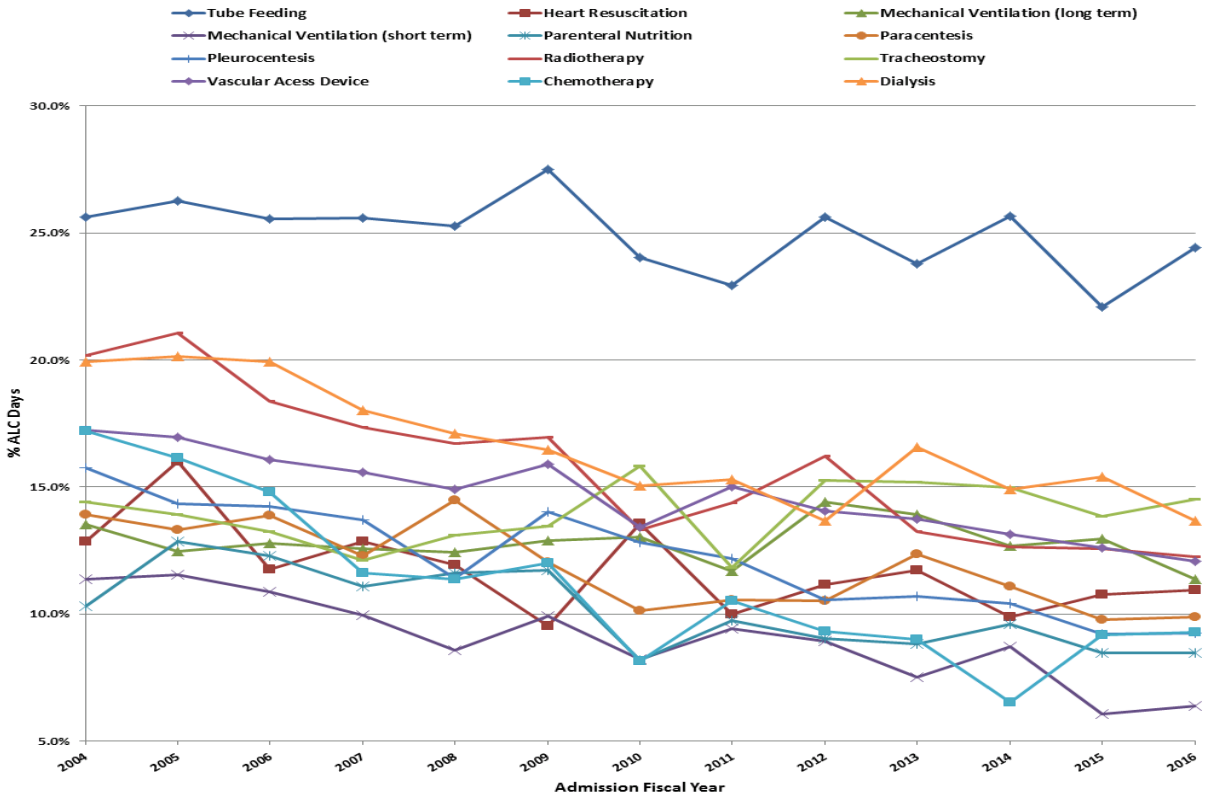

Figure 31. Changes of percent ALC days within each specialized clinical intervention group.

CHAPTER 5: DISCUSSION

5.1 ALC Picture in Ontario

This study found that from the fiscal years 2004/2005 to 2016/2017, 10% of the acute care hospitalization records across Ontario captured the incidence of one or more ALC days. That percentage accounted for 10.7 million days of hospitalization, consumed by seniors who were well enough to be discharged, but were kept hospitalized waiting for the availability of an appropriate alternate level of care.

Regarding the percentage of ALC days in Ontario, this study reported a higher value of 19.7 % when compared to 13.4% reported by Lavergne (2015). These remarkably high numbers reflect a waste of health care resources and confirm that ALC presents a serious challenge in Ontario. Future studies are required to explore whether the reasons behind high ALC incidence are administration related, patient related and/or disease related. This can guide policy makers in planning better management strategies.

Key Finding 1
From 2004 until 2016, ALC patients waited to access an appropriate destination for 10.7 million days. Those numbers represented 19.7% of all hospitalization days across Ontario, which indicates a remarkably inefficient utilization of acute care resources. Hence, future studies are required to clarify causative factors.

ALC prevalence showed changes over the years in this research study; some improvements were obvious with respect to numbers of ALC patients and numbers of ALC hospitalization days. The highest prevalence of ALC was observed in 2007, when 10.8% of the hospitalization records had an ALC incidence that accounted for about one million days of hospitalizations. On the other hand, the lowest ALC prevalence was observed in 2016, when ALC patients constituted only 7.9% of hospitalization records and occupied acute care beds for a total of only 263,977 days.

Similarly, comparing the number of hospitalization days marked as ALC days within one year to the total number of hospitalization days within the same year, the highest percentage of ALC days was recorded in 2007 (21.1%) and the lowest value was recorded in 2016 (17.2%). Burr and Dickau (2017) reported that the numbers of ALC patients in Canada increased by 23% from 2015 to 2016. My study showed that there was a reduction of 5% in the percentage of ALC hospitalization during this period, which reflects positive impacts of the policies and procedures implemented by Ontario hospitals to address and manage the ALC issue.

Key Finding 2
From 2007 to 2016, there was a 27% reduction in the percentage of ALC hospitalization records and 18.5% reduction in the percentage of ALC days. This may be an indication of successful ALC management in Ontario.

5.2 Basic Characteristics and Demographics

The demographic characteristics reported in this study suggest that ALC odds of having ALC increased significantly among females and with ages 75 and more. Similar findings were reported in the literature (Chen et al., 2012; Falcone et al., 1991).

For hospitalization 90 days prior to the current admission, McCloskey et al. (2015) reported that 62% of their study population (patients with dementia admitted to two hospitals in New Brunswick) had not been hospitalized within the last 90 days. Moreover, 83.9% of ALC patients who were waiting for LTC in Ontario hospitals from 2004 till 2009, did not have recent hospitalizations (Costa & Hirdes, 2010). Similarly, the results of my study show that 73.4% of ALC patients did not experience previous hospitalization. While other studies included only ALC patients, my study compared ALC patients to non-ALC patients and found that the odds of ALC were 22% higher within those who were recently hospitalized before their current admission.

For having re-hospitalized after discharge, only one study could be found in the literature that followed the acute care rehospitalization of ALC patients, where it was reported that 17% of

ALC hopitalizations had at least one readmission within 30 days of discharge (provincial range: 14% to 26%) compared to a readmission rate of 12% for non-ALC patients (CIHI, 2009). On the contrary, despite reporting almost the same provincial rehospitalization percentage among ALC patients, my study found that acute care rehospitalization was lower in the ALC group (21%) compared to the non-ALC group (23.7%). However, the two findings are not fully comparable because my study followed up the rehospitalization of ALC patients within 90 days, not 30 days as in CIHI (2009) report.

The method of hospital entry could be considered another remarkable predictor of ALC. CIHI reported that 83% of the ALC patients were admitted to the hospital through emergency departments (Canadian Institute for Health Information, 2011). Bender et al. (2018) reported the same finding in their case study, stating that 90% of ALC patients accessed hospitals through an urgent entry, which confirms that ED is the gateway of hospital admission for ALC patients.

Key Finding 3
ALC was more likely among seniors aged 75 and more, females, those who were hospitalized 90 days prior to their current admission, and those who were admitted to hospital through ED. Therefore, age, sex, previous hospitalization and method of admission could be potential ALC predictors, to be confirmed by future research.

There is a consensus in the literature that waiting for the most appropriate alternate level of care destination is the main reason for delayed discharge (Bender & Holyoke, 2018). Stock et al. (2016) reported that those who were expected to return home or transferred to other acute care, had significantly lower likelihoods of becoming ALC patients than those destined for long-term or palliative care. Likewise, my study compared ALC to non-ALC groups and found that the odds of ALC hospitalization was considerably lower (OR 0.07, 95% CI 0.069-0.07) in the subgroup of those who discharged home without support and extremely higher (OR 9.71, 95% CI 9.66-9.77) in the subgroup of those transferred to LTC.

Key Finding 4
ALC was 10 times more likely than non-ALC in the subgroup of patients who were discharged to LTC. Moreover, those patients spent 40% of their total hospital length of stay waiting as ALC. These results suggest that discharge disposition could be a strong predictor of ALC.

5.3 Socioeconomic Characteristics

In addition to patient demographics and their discharge destination, social factors such as low income were found to be associated with longer hospital length of stay. Elderly people may not have the financial resources that could support their transition from the hospital to receive care at home or at a long-term care facility, so they spend more days designated as ALC patients (ALC Task Group, 2008). My study found that it was more likely for a patient to experience ALC within the poor and lower middle income subgroups, however, patients of higher income (income quintile 4 and 5 subgroups) had lower odds of ALC. This suggests that less income may lead to a higher likelihood of ALC.

Regarding geographic factors, it was found that rurality could also be a predictor for non-ALC (Stock et al., 2016). The results of my study confirm that claim because the odds of non-ALC were higher among the subgroup of rural area. These results could be justified as people living in rural areas may have stronger family ties, where family members take care of each other. Therefore, older adults, despite their specialized needs, they do not wait at hospital for an alternative level of care, instead, they are discharged home, where their families provide them with the appropriate care. Future research work is needed to confirm this claim.

The association of a patient's marginalization index and the incidence of ALC has not studied before. For residential instability, this study found that non-ALC was more likely than ALC among the least unstable subgroups. The higher the family or housing instability, the more likely the patient is to experience ALC during their hospitalization. These findings confirm the

above findings of geographic location. As those who live in rural areas are more family stable, thus, they are less likely to experience ALC during their hospitalizations. Similarly, for material deprivation, my study found that the higher the patients are deprived of accessing and attaining their basic material needs, the higher is their likelihood of experiencing ALC. For dependency, my study showed that the higher the dependency of patients. On the other hand, both ALC and non-ALC groups were equal with respect to including a high concentration of recent immigrants and people belonging to a visible minority.

Key Finding 5
The lower the income, the higher the instability and the higher the dependence of a patient, the more likely they are to experience ALC during their acute hospitalization. On the other hand, those who lived in rural areas were less likely to become ALC patients.

5.4 Implications for Government and Policy Makers

5.4.1 Home First Strategy Impact on ALC

One of the main objectives of this study was to assess how the implementation of Home First strategy affected the performance of discharge planners in Ontario hospitals and how this was reflected on the management of the ALC challenge. To achieve that objective, this work followed up on the percent of ALC hospitalizations and ALC days throughout the 13 years of the study (Figure 11 and Appendix G).

Tracking changes that happened after 2011 (the year of implementation of the Home First strategy), this study found that, from 2011 to 2016, the percentage of ALC hospitalizations decreased by 26% (from 10.1% to 7.5%) and the percentage of ALC days decreased by 13% (from 19.7% 17.2%). A comparison of this study's results with those reported by Halton Healthcare Services (HHS) regarding the performance of the Home First strategy, over two years of implementation was instructive They found that the percentage of ALC patients decreased by 6% (Starr-Hemburrow et al., 2013), while this study reported a 12% reduction across Ontario hospitals

(from 10.1% in 2011 to 8.9% in 2013). The doubled reduction in the percent ALC days when comparing data from all Ontario hospitals to data from HHS could be seen as an indicator of better implementation procedures, guided by the lessons learned from the previous HHS experience during the period 2008/2010.

Furthermore, because the implementation of the Home First plan involved changes in workflow and communication that support the discharge of seniors to home instead of long-term care (Ho, 2011), the study population was sub-grouped by the discharge disposition in order to track the changes of those who were discharged to LTC and those who were discharged to home (Figures 21 and 22). It was expected that a successful implementation of the Home First strategy would result in decreasing numbers of patients who were discharged to LTC and increasing numbers of those who were discharged home with or without support.

Although Starr-Hemburrow et al. (2013) reported that there was a sustainable reduction in the numbers of LTC referrals from HHS, unanticipated results were found in my study. From 2011 to 2016, the percentage of ALC patients discharged to long-term care and percentage of ALC days spent by those patients remained almost constant (slightly fluctuated around the values of 56% and 40%, respectively). For ALC patients who were discharged home without support, a minimum reduction in their percentage was noticed from 5.7% to 3.6%, similarly their percent ALC decreased from 2.6% to 1.4%. On the other hand, the percentage of ALC patients who were discharged home with support services increased by 17% (from 14.3% to 28.4%) (refer to Appendix C for more details).

Those findings raise two questions. The first is why there is disagreement between my results and those reported by HHS. May be there was underreporting of the incidence of ALC within the HHS hospitals or may be their good practices and procedures were not fully adopted by

other LHINs while implementing the Home First Strategy across Ontario. The second question is why implementing the Home First strategy did not impact hospital discharges to LTC. To answer these questions, policy planners need to gather more information and conduct an in-depth analysis in order to assess the causes that lead patients to wait for a long-term care placement instead of going home (with or without support services).

There may be defects in the procedures followed to communicate with long-term care facilities or inefficient discharge planning policies. Also waiting to be transferred to long-term care could be related to the patients themselves. For instance, they may have specialized needs that are difficult to fulfill. Moreover, the financial status of patients and their families, and the proximity of a long-term facility can impact their ALC length of stay (Bender & Holyoke, 2018). Identifying, quantifying, and comparing the causes of the delayed discharge of ALC patients is crucial for a better understanding of ALC and potentially improving the performance of the current system.

Policy Implication 1

Although the implementation of the Home First strategy in Ontario resulted in a 26% reduction of ALC hospitalizations and a 13% decrease in ALC days, the percentage of patients discharged to long-term care did not change. Being the subgroup having the highest percent of ALC hospitalizations and ALC days, this reflects some failure of this strategy achieving its main objectives and may require a review of the strategy's implementation policies and procedures.

5.4.2 Specialized Medical Needs of ALC Patients

As discussed in Section 2.7, for better ALC management, it is important to address the specialized needs of patients who require special care such as chronic respiratory care and dialysis. These patients are usually unable to access the appropriate community care services that support their discharge from acute care (Bender & Holyoke, 2018).

Studying 12 specialized clinical interventions received by patients during their acute care hospitalizations, this study has provided a comprehensive presentation of ALC patients' needs that

informs better planning and decision making. The odds ALC were significantly higher for patients who had tube feeding, pleurocentesis, tracheostomy, radiotherapy, mechanical ventilation (long term), vascular access device, paracentesis, and dialysis.

On the other hand, ALC likelihood was about 25% less than the non-ALC likelihood for patients who had mechanical ventilation for less than 96 days or heart resuscitation. An explanation of these findings is that many patients receiving short-term mechanical ventilations or heart resuscitation die and do not reach a stage of being designated as ALC. Further analysis was conducted to study the destination of these two specialized clinical interventions subgroups. 80% of the heart resuscitation subgroup died while only 26.5% of the short-term mechanical ventilation died and 34.6% were discharged home.

Furthermore, this study found that patients with specialized clinical needs spent long duration of their hospitalization designated as ALC patients. The largest value of percent ALC days was reported for patients on tube feeding (25%), while the smallest value was for patients on short-term mechanical ventilation (9.2%). Patients receiving parenteral nutrition and those on short-term mechanical ventilation had the least percentage of ALC days (10.0% and 9.2%, respectively).

This work was not able to fully compare those findings with the published literature because, as discussed in section 2.9, only two papers addressed the specialized needs of ALC patients were found (ALC Task Group, 2008; CIHI, 2009). It was reported that 25% of patients on tube feeding, 40% of those receiving long-term ventilation and 10% of those on dialysis, experienced at least one ALC day during their hospitalization (CIHI, 2009).

The consequences of these findings for patient outcomes are immense. It is important to consider the needs of these patients. They are typically hospitalized for long durations, although

they could often receive care at LTC or at home through getting support from community services (ALC Task Group, 2008). They often require special discharge arrangements that result in increasing their hospital length of stay, which may expose them to many complications such as nosocomial infections, pressure sores, and deep vein thrombosis (Lim et al., 2006). Moreover, designating those patients as ALC increases the probability of their functional decline which makes it even harder to arrange for their discharge (Landeiro et al., 2017).

The above-mentioned findings provide important insights for policy planners by highlighting the need to staff long-term care facilities with geriatric expertise, trained staff, and required resources that support the care of patients with specialized needs that were discussed in this research. These needs should also be considered while planning and allocating resources for community care services.

Furthermore, upon checking the criteria based upon which CCACs prioritize patients who apply to access a long-term care facility, it was found that the assessment of patient needs was not comprehensive enough to consider the specialized medical needs of patients (Ministry of Health and Long-term Care, 2006). Thus, it is recommended to revisit and update such criteria for better inclusion and consideration of this population.

Policy Implication 2

The specialized clinical interventions received by patients could be potential predictors of ALC. Patients with special needs spent from 10% to 25% of their total hospitalization length of stay waiting to be discharged to an appropriate alternative level of care. This wastes many resources and negatively affects the health outcomes of patients. Therefore, it is recommended that policy planners and CCAC decision makers consider the needs of those patients while allocating resources and design plans and procedures.

5.4.3 Cost Saving Potential

The ALC issue cost the Ontario health care system around $9 billion over the period 2004-2016. This was calculated from the results of this study, given that the estimated daily cost of a

patient in an acute care facility is $842, while it costs $126 for a long-term care bed and only $42 to provide care for that patient at their home (Home Care Ontario, 2017). For instance, in 2016, Ontario hospitals were occupied by ALC patients for 263, 977 days, which cost the Canadian health care system $222.3 million. Reducing the number of ALC days by only 10% at that time, by shifting patients from acute care to long-term care, this could have saved $18 million a year, while transferring those patients to receive care at home could have more savings of $21.2 million.

This finding proves that managing the ALC issue has a significant cost-saving potential, which policy makers should consider while planning for a more efficient and effective health care system. Bender et al. (2018) reached the same conclusion, that millions of dollars could be saved by decreasing the ALC length of stay. They reported that, with about 4000 beds/day occupied by ALC patients, discharge planners could transfer 50% of them to receive care at home with appropriate support, saving the health care system over $230 million.

Policy Implication 3
Only a 10% reduction in the numbers of ALC days in Ontario per year, could result in a saving of $18 million by shifting patients to long-term care or $21.1 million shifting them to home care.

5.4 Study Contributions, Strengths, Limitations and Directions for Future Research

5.5.1 Contributions

The major contribution of this study is that, to our knowledge, it is the first to assess the impact of the Home First strategy on the management of ALC. Using a descriptive data analytics approach, this study was able to highlight inefficient implementation and provide suggestions for improvements to ALC policy makers.

Another contribution is that my study summarizes the initiatives taken by Ontario government to manage the ALC issues and highlights four key milestones for researchers who

could be interested in assessing the performance of those initiatives in future studies.

Another contribution is that the literature review conducted in this thesis revealed that this study is the first to study 12 specialized clinical interventions received by ALC patients. My results can provide insights for discharge planners and CCAC decision makers and focus on the importance of addressing the needs of patients affected by ALC in order to facilitate their prompt and safe discharge.

Similarly, the association of a patient's marginalization index and the incidence of ALC has not studied before. Therefore, addressing this variable in my study is considered a crucial contribution that highlights the importance of the socioeconomic status of ALC patients to researchers and policy planners.

Finally, this study provides a comprehensive review of the ALC challenge in Canada and worldwide, it reports evidence and summarizes results in a unique way that gives the reader a clear holistic view of ALC. Moreover, it provides researchers with a conceptual framework that compares ALC variables in Canadian literature in a manner that can guide future research.

5.5.2 Strengths

One of the major strengths of this study is the inclusion of a large, fully representative sample of Ontario in-patient seniors. When referring to published literature, the largest Canadian study (see Appendix B) was conducted by Basu et al. (2017) and involved the analysis of 1.7 million records. However, their study was not confined to Ontario, but included patients from all Canadian provinces. My study is the largest of its kind with respect to sample size, analyzing a total 6,058,426 hospitalization records of Ontario older adults who were hospitalized in acute care. This huge sample size gives the study higher significance, increases its statistical analysis power, and helps to draw more accurate conclusions from the results. Moreover, since it is restricted to

Ontario patients, the results of this study are more informative to Ontario's provincial planners and decision makers. Furthermore, because Ontario has the largest provincial population in Canada (Statistics Canada, 2018), results from this study could be generalized and considered for other provinces.

5.5.3 Limitations

Despite the strengths inherent in this study, there are some limitations to be mentioned. One limitation of this study is that the dataset included in the analysis had the ALC status captured in only acute care hospitalizations. This prevented the researcher from adopting the Ontario provincial definition of ALC which included post-acute care settings (ALC Task Group, 2008). Therefore, it is expected that the results of this research may underestimate the actual scale of ALC in Ontario.

Another limitation is the unavailability of some variables that prevented in-depth analysis and more informed implications. There were no variables available in the analyzed dataset related to whether patients had somebody (spouse, child or child-in-low) to take care of them when they returned back home. Such information, in addition to the specific reasons behind the delayed discharge of patients, if available, can help in more accurate identification of ALC predictors.

5.5.4 Future Research

This master's thesis represents the first phase of a comprehensive data analytics research, project, led by Manaf Zargoush (the supervisor on this thesis), that involves three stages to fill in the gaps in addressing the ALC (Figure 32). These phases are descriptive, predictive, and prescriptive analytics, respectively (Zargoush, Papaioannou & Samavi, n.d.). The results of this study highlight many potential ALC predictors that can guide the predictive analytics. Several independent variables can be examined simultaneously in future research as predictors of ALC

status, providing a more complete understanding of what can increase the risk of/or protect against the delayed discharge of ALC patients.

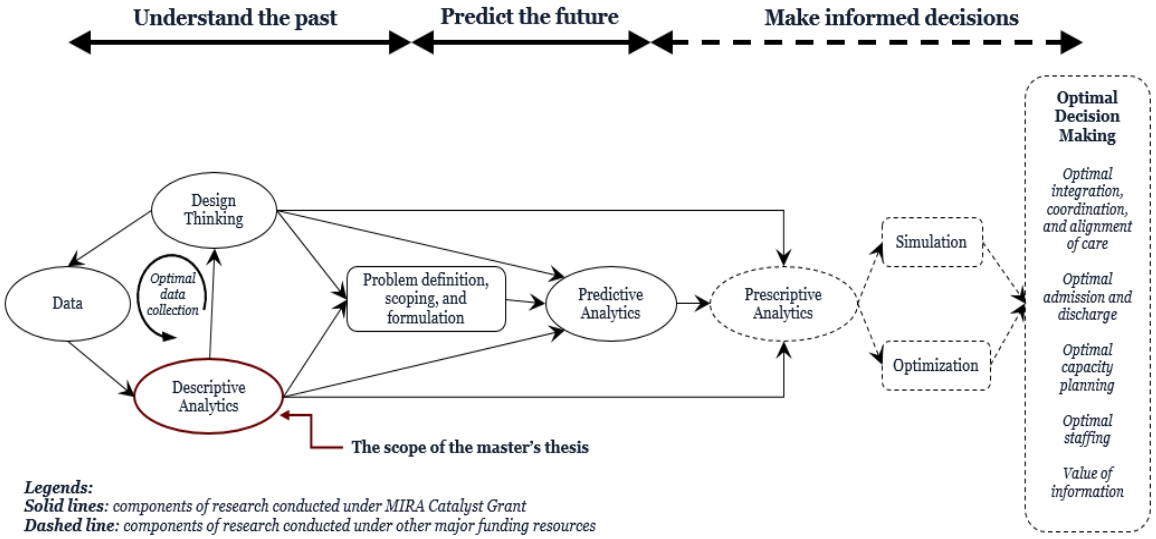

Figure 32. Proposed model for addressing ALC.

Considering the limitations discussed above, another topic for future research is a longitudinal analysis that would be very useful, since some variables may vary in predicting ALC at different times during a patient's journey. Describing patient characteristics (including clinical and functional status) within each transition and portraying a holistic picture of ALC, would inform a better understanding and hence improve the management of ALC issues. This requires tracking the same patient while being transferred form one level of care to another, and merging variables from many databases including emergency departments, acute care hospitals, community care services, residential care, rehabilitation centers, and mental health facilities.

Another potential project for research is to identify whether the reasons for the delayed discharge of ALC patients are related to system administrative issues, individual issues and/or the clinical status of patients. This requires gathering administrative information from hospitals and talking with patients and their families. A representative small sample of hospitals and patients could be used for a pilot study of these issues.

CHAPTER 6: CONCLUSION

In summary, this study unveiled a number of demographics, socioeconomic and clinical characteristics of ALC patients in acute care settings across Ontario. Moreover, it assessed the impact of the Home First strategy implementation on the incidence of ALC and highlighted that, unexpectedly, there was no change with respect to those who were discharged to LTC. The study addressed the specialized clinical interventions received by ALC patients and concluded that ALC patients had varied and complex needs that should be addressed in order to facilitate their discharge. Policy makers and health care practitioners may benefit from the findings of this study in a way that can reduce the probability of ALC designations, by considering the needs of ALC patients while planning, allocating resources and setting policies for discharge, LTC and community care. However, more work is necessary to quantify the impact of the ALC determinants suggested in this study and to assess the efficiency of current policies and procedures.

BIBLIOGRAPHY

Access to Care. (n.d.). About us. Retrieved from https://www.accesstocare.on.ca/cms/One.aspx?portalId=120513&pageId=121452

Access to Care. (2017). Alternate level of care (ALC): Reference manual. Cancer Care Ontario. Retrieved from https://ext.cancercare.on.ca/ext/databook/db1819/documents/Appendix/ALC_Reference_Manual_v2.pdf

ALC Expert Panel. (2006). Appropriate level of care: A patient flow, system integration and capacity solution. Retrieved from https://www.advantageontario.ca/oanhssdocs/Issue_Positions/External_Resources/ALC_Report_December_2006.pdf

ALC Task Group. (2008). Alternate level of care systems issues and recommendations. The Central East LHIN. Retrieved from http://www.centraleastlhin.on.ca/~/media/sites/ce/uploadedfiles/Home_Page/Be_Informed/ALC_Report_FINAL_June%202008.pdf

Archer, S. (2016). Ontario's Alternate Level of Care (ALC) problem is killing acute care hospitals: Time to cut the Gordian knot. Retrieved from https://deptmed.queensu.ca/dept-blog/ontarios-alternate-level-care-alc-problem-killing-acute-care-hospitals-time-cut-gordian

Basu, K., Livadiotakis, G., & Tanguay, S. (2016). The gridlock in Canadian hospitals: Which patients are overstaying, to what extent, and why ? Canadian Association for Health Services and Policy Conference. Retrieved from https://www.cahspr.ca/en/presentation/5750791c37dee8907f702e02

Beland, F., Bergman, H., Lebel, P., Clarfield, A. M., Tousignant, P., & Dallaire, L. (2006). A system of integrated care for older persons with disabilities in Canada: Results from a randomized controlled trial. Journal of Gerontology, 61(4), 367–373.

Bender, D., & Holyoke, P. (2018). Why some patients who do not need hospitalization cannot leave: A case study of reviews in 6 Canadian hospitals. Healthcare Management Forum: Sage Journals, 31. https://doi.org/10.1177/0840470418755408

Beveridge, J., Low, N., Medina, D., Smith, J., & Varey, D. (2016). Discharging older patients from hospital. The National Audit Office. Retrieved from https://www.nao.org.uk/wp-content/uploads/2015/12/Discharging-older-patients-from-hospital.pdf

Born, K., & Sullivan, T. (2011). LHINs and the governance of Ontario's health care system - Healthy Debate. Retrieved from https://healthydebate.ca/2011/06/topic/cost-of-care/lhins-2

Brown, Laurie Abellp, Annie Thurecht, L. (2011). Length of hospital stay by older Australians:

Bed-blocking or not? In National Centre for Social and Economic Modelling (NATSEM). Retrieved from https://pdfs.semanticscholar.org/36c5/6b4ed324a399cbf615cae7811f875336dec2.pdf

Bryan, K. (2010). Policies for reducing delayed discharge from hospital. British Medical Bulletin, 95(1), 33–46. https://doi.org/10.1093/bmb/ldq020

Burr, Elaine Dickau, S. (2017). Leading practices in alternate level of care (ALC) avoidance: A standardized approach. Healthcare Quarterly, 20(2), 44–47.doi:10.12927/hcq.2017.25227.

Byrick, K. (2018). Managing transitions: A guidance document-Second edition. Ontario Hospital Association. Retrieved from https://www.oha.com/Documents/Managing%20Transitions,%20Second%20Edition.pdf

Canadian Institute for Health Information. (n.d.). The why, the what and the how of activity-based funding in Canada: A resource for health system funders and hospital managers. Retrieved from https://secure.cihi.ca/free_products/ActivityBasedFundingManualEN-web_Nov2013.pdf

Canadian Institute for Health Information. (2009). Alternate level of care in Canada. Retrieved from https://secure.cihi.ca/free_products/ALC_AIB_FINAL.pdf

Canadian Institute for Health Information. (2011). Alternate level of care in Atlantic Canada, 2009–2010. Retrieved from https://secure.cihi.ca/free_products/alc_aib_january2011_e.pdf

Canadian Institute for Health Information. (2017). Seniors in transition: Exploring pathways across the care continuum. Retrieved from https://www.cihi.ca/sites/default/files/document/seniors-in-transition-report-2017-en.pdf

Cancer Care Ontario. (n.d.). Who we are – CCO. Retrieved from https://www.ccohealth.ca/en/who-we-are

Champlain LHIN. (n.d.). Champlain health system performance and accomplishments. Retrieved from http://www.champlainlhin.on.ca/Accountability/Performance.aspx

Chen, A., Zagorski, B., Chan, V., Parsons, D., & Laan, R. (2012). Acute care alternate-level-of-care days due to delayed discharge for traumatic and non-traumatic brain injuries. Healthcare Policy, 7(4), 41–55.

Coffeyet al. (2015). A systematic literature review on tackling delayed discharges in acute hospitals inclusive of hospital (re) admission avoidance. Department of Health Dublin. Retrieved from https://www.hse.ie/eng/services/publications/clinical-strategy-and-programmes/systematic-literature-review-tackling-delayed-discharges-2015.pdf

Costa, A P; Hirdes, J. P. (2010). Clinical characteristics and service needs of Alternate-Level-of-Care patients waiting for long-term care in Ontario hospitals. Healthcare Policy, 6(1), 32-46.

Costa, A., Poss, J., Peirce, T., & Hirdes, J. (2012). Acute care inpatients with long-term delayed discharge: evidence from a Canadian health region. BMC Health Services Research, 12(1), 172. doi: 10.1186/1472-6963-12-172

Falcone, D., Bolda, E., & Leak, S. (1991). Waiting for placement: An exploratory analysis of determinants of delayed discharges of elderly hospital patients. Health Service Research, 26(3), 339–374.

Gaughan, James Gravelle, Hugh Siciliania, L. (2015). Testing the bed-blocking hypothesis: Does nursing and care home supply reduce delayed hospital discharges? Health Economics, 24(1), 32–44.

Glasby, J., Littlechild, R., & Pryce, K. (2004). Show me the way to go home: Delayed hospital discharges and older people. The University of Birmingham. Retrieved from https://www.researchgate.net/publication/228608281_Show_Me_the_Way_to_Go_Home_Delayed_Hospital_Discharges_and_Older_People

Government of Ontario. (n.d.). Data standards for the identification and monitoring of systemic racism: Glossary. Retrieved from https://www.ontario.ca/document/data-standards-identification-and-monitoring-systemic-racism/glossary

Health Council of Canada. (2012). Seniors in need, caregivers in distress: What are the home care priorities for seniors in Canada? Retrieved from https://www.carp.ca/2012/04/03/seniors-in-need-caregivers-in-distress-what-are-the-home-care-priorities-for-seniors-in-canada/

Health Quality Ontario. (n.d.). Measuring system performance - Health Quality Ontario (HQO). Retrieved from https://www.hqontario.ca/System-Performance/Measuring-System-Performance

Health Quality Ontario. (2015). Experiencing integrated care. Retrieved from https://www.hqontario.ca/Portals/0/documents/pr/report-experiencing-integrated-care-1504-en.pdf

Ho, C. (2011). Home First: What does it mean for seniors living in Ontario? ACE Newsletter, 14(1), 1–20.

Home Care Ontario, (2017). Facts & Figures - Publicly funded home care. Retrieved from https://www.homecareontario.ca/home-care-services/facts-figures/publiclyfundedhomecare

ICES. (2019). ICES data dictionary. Retrieved from https://datadictionary.ices.on.ca/Applications/DataDictionary/Variables.aspx?LibName=DAD&MemName=&Variable=DISCHDISP

Ivanova, I. (2011). What is a middle class income these days? Retrieved from https://www.policynote.ca/what-is-a-middle-class-income-these-days/

John, P. S. (2016). Geriatric Assessment Units (GAUs): Optimizing evidence-based inpatient

care in the modern hospital. CGS Journal of CME, 6(1). Retrieved from http://canadiangeriatrics.ca/journals/cme-journal/publications/

Khurma, N Salmati, F Pasek, Z. (2013). Simulation of patient discharge process and its improvement. The 2013 Winter Simulation Conference, 84, 487–492. Retrieved from http://ir.obihiro.ac.jp/dspace/handle/10322/3933

Kodner, D. (2009). All together: A conceptual exploration of integrated care. Healthcare Quarterly, 13, 6–15. doi:10.12927/hcq.2009.21091.

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), 1–10. doi.org/10.1186/s12913-017-2272-6.

Landeiro, F., Roberts, K., Gray, A., & Leal, J. (2019). Delayed hospital discharges of older patients: A systematic review on prevalence and costs. Gerontologist, 59(2):e86-e97. doi: 10.1093/geront/gnx028.

Lavergne, M. R. (2015). Regional variation in alternate level of care (ALC) service use in British Columbia hospitals: An opportunity for intervention? Institute for Health System Transformation & Sustainability. Retrieved from http://ihsts.ca/wp-content/uploads/2016/06/BC-ALC-Report-Lavergne-2015.pdf

Lenzi et al. (2014). Sociodemographic, clinical and organisational factors associated with delayed hospital discharges: a cross-sectional study. BMC Health Services Research, 14(1), 128. doi: 10.1186/1472-6963-14-128.

LHIN Collaborative. (2011). Sharing best practices: Transition management in Ontario-Home First impementation guide. Retrieved from http://www.centrallhin.on.ca/goalsandachievements/seniors/homefirst/~/media/sites/central/uploadedFiles/Home_Page/Integrated_Health_Service_Plan/HomeFirst_FAQ_CentralLHIN.pdf

Lim, S. C., Doshi, V., Castasus, B., Lim, J. K. H., & Mamun, K. (2006). Factors causing delay in discharge of elderly patients in an acute care hospital. Annals Academy of Medicine Singapore, 35(1), 27–32.

Macadam, M. (2008). Frameworks of integrated care for the elderly: A systematic review|CPRN research report. Retrieved from https://brainxchange.ca/Public/Files/Primary-Care/HQPC/Care-of-the-Eldery-integrate-care.aspx

Manzano-Santaella, A. (2010). From bed-blocking to delayed discharges: Precursors and interpretations of a contested concept. Health Service Management Research, 23(3):121–127. doi: 10.1258/hsmr.2009.009026.

McCloskey, R., Jarrett, P., & Stewart, C. (2015). The untold story of being designated an alternate level of care patient. Healthcare Policy, 11(1), 76–89.

McCloskey, R., Jarrett, P., Stewart, C., & Nicholson, P. (2014). Alternate level of care patients in hospitals: What does dementia have to do with this? Canadian Geriatrics Journal, 17(3), 88–94. https://doi.org/10.5770/cgj.17.106

McDonagh, Marian Smith, David Goddard, M. (2000). Measuring appropriate use of acute beds. A systematic review of methods and results Marian. Health Policy, 53(157), 150–184.

Medicaid, R. (n.d.). Program of All-Inclusive Care for the Elderly. Retrieved from https://www.medicaid.gov/medicaid/ltss/pace/index.html

Ministry of Health and Long-term Care. (n.d.). Ontario wait times. Retrieved from http://www.health.gov.on.ca/en/pro/programs/waittimes/surgery/strategy.aspx

Morse, A. (2016). Discharging older patients from hospital. Retrieved from https://www.nao.org.uk/wp-content/uploads/2015/12/Discharging-older-patients-from-hospital.pdf

Motluk, Al. (2018). Hallway health care. Retrieved from https://torontolife.com/city/woman-waited-47-hours-surgery-broken-bones-cracked-ribs-internal-bleeding/

Mur-Veeman, Ingrid Govers, M. (2011). Buffer management to solve bed-blocking in the Netherlands 2000–2010. Cooperation from an integrated care chain perspective as a key success factor for managing patient flows. International Journal of Integrated Care, 11(Spec 10th Anniversary Ed), e080-e080. doi: 10.5334/ijic.650.

North West LHIN. (n.d.). LHIN Collaborative (LHINC). Retrieved from http://www.northwestlhin.on.ca/forhsps/LHINCollaborativeLHINC.aspx

O'Brien, F. (2019). B.C.'s first 'dementia village' set to open in Langley. Retrieved from https://www.vancouverisawesome.com/2019/05/28/first-dementia-village-langley-bc/

Office of Disease Prevention and Health Promotion. (2014). Older adults | Healthy people 2020. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/older-adults

Ontario Hospital Association. (2006). Alternate level of care - Challenges and opportunities: A collaborative position paper. Retrieved from https://books.scholarsportal.info/en/read?id=/ebooks/ebooks1/gibson_chrc/2010-08-06/2/10131011

Ostry, A. S., Yassi, A., Ratner, P. A., Park, I., Tate, R., & Kidd, C. (2003). Work organization and patient care staff injuries: The impact of different care models for "alternate level of care" patients. American Journal of Industrial Medicine, 44(4), 392-399. doi: 10.1002/ajim.10277

Planos, J. (2015). The Dutch village where everyone has dementia. Retrieved from http://www.theatlantic.com/health/print/2014/11/the-dutch-village-where-everyone-has-dementia/382195/1/3

Public Health Agency of Canada. (2012). Introduction: The chief public health officer's report on the state of public health in Canada 2012. Retrieved from https://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/chief-public-health-officer-report-on-state-public-health-canada-2012/introduction.html

Public Health Ontario. (n.d.). Ontario Marginalization Index (ON-Marg). Retrieved from https://www.publichealthontario.ca/en/data-and-analysis/health-equity/ontario-marginalization-index

Rock, B., Beckerman, A., Auerbach, C., Cohen, C., Goldstein, M., & Quitkin, E. (1995). Management of alternate level of care patients using a computerized database. Health and Social Work, 20(2), 133-139. doi: 10.1093/hsw/20.2.133

Starr-Hemburrow, L., Parks, J., & Bisaillon, S. (2013). Home First: Reducing ALC and achieving better outcomes for seniors through inter-organizational collaboration. Healthcare Quarterly, 14(1), 70–76. doi.org/10.12927/hcq.2011.22162

Statistics Canada. (2018). Canada at a glance 2018: Population. Retrieved from https://www150.statcan.gc.ca/n1/pub/12-581-x/2018000/pop-eng.htm

Sutherland, J. M., & Crump, R. T. (2011). Exploring alternative level of care (ALC) and the role of funding policies: An evolving evidence base for Canada. In *Canadian Health Services Research Foundation*. Retrieved from https://www.cfhi-fcass.ca/Libraries/Commissioned_Research_Reports/0666-HC-Report-SUTHERLAND_final.sflb.ashx

Sutherland, J. M., & Trafford Crump, R. (2013). Alternative level of care: Canada's hospital beds, the evidence and options. Healthcare Policy, 9(1), 26–34. doi.org/10.12927/hcpol.2013.23480

Triggle, N. (2016). Hospital bed-blocking costs NHS England £900m a year - BBC News. Retrieved from https://www.bbc.com/news/health-35481849

Turcotte, Luke Hirdes, J. (2015). Long-stay alternate level of care in Ontario complex continuing care beds. *Ontario Hospital Association*. Retrieved from https://www.oha.com/Documents/Long-Stay%20Alternate%20Level%20of%20Care%20in%20Ontario%20Complex%20Continuing%20Care%20Beds.pdf

Vetter, N. (2003). Inappropriately delayed discharge from hospital: What do we know? BMJ (Clinical research ed.), 326(7395), 927-928. doi: 10.1136/bmj.326.7395.927

Walker, D., & Lead, P. A. L. C. (2011). Caring for our aging population and addressing alternate level of care. *Minister of Health and Long-Term Care*. Retrieved from http://www.health.gov.on.ca/en/common/ministry/publications/reports/walker_2011/walker_2011.aspx

APPENDICES

Appendix A: Jurisdictional Differences in Home Care and Residential Care Terminology.

Jurisdiction	Home Care		Residential Care
	Home Care Services	Supportive Needs Services	
Ontario	Home care/ community support services	Retirement homes/ supportive housing	Long-term care homes/ nursing homes
Manitoba	Home care	Supportive housing	Personal care homes/ nursing homes
Saskatchewan	Home care	Assisted living services/ personal care homes	Special care homes/ nursing homes
Alberta	Home care	Supportive living (designated and non-designated)	Long-term care facilities
British Columbia	Home care	Assisted living	Residential care
Yukon	Home care programs	Not applicable	Long-term/facility care

Note. Adopted from the Canadian Institute for Health Information (2017).

Appendix B: ALC Canadian Studies that Involve Analytics.

Paper	Region	The population of the Study	Sample Size	Analytics Type
CIHI Reports				
CIHI, 2009	All Canada except Quebec and Manitoba	Patients discharged from acute care	74,000	Descriptive
CIHI, 2011	Atlantic Canada	Patients discharged from hospitals	251,005	Descriptive
CIHI, 2012	All Canada except Quebec	Patients discharged from acute care to long-stay home care or residential care	90,507	Descriptive and Predictive
Papers Included Ontarian Patients				
ALC Task Group, 2008	Ontario	Patients discharged from Central East LHIN acute care settings	100,073	Descriptive
Chen et al., 2012	Ontario	Traumatic and non-traumatic brain injuries patients	Not mentioned	Descriptive and Predictive
Costa et al., 2010	Ontario	Patients waiting for LTC in acute and CCC settings	13,915	Descriptive

Paper	Region	The population of the Study	Sample Size	Analytics Type
Costa et al., 2012	Southern Ontario	Patients discharged from acute care	17,111	Descriptive and Predictive
Little et al., 2015	Ontario	Patients occupying mental health beds	76,184	Descriptive and Predictive
Stock et al., 2016	Ontario	Patients admitted to hospitals with hypoxic–ischemic brain injury patients	669	Descriptive and Predictive
Turcotte et al., 2015	Ontario	Patients occupying CCC beds	32,810	Descriptive and Predictive
Others				
McClaran et al., 1996	Montreal	Patients admitted to the Montreal General Hospital	495	Descriptive and Predictive
McCloskey et al., 2014	New Brunswick	Patients with dementia admitted to 2 hospitals	181	Descriptive

Paper	Region	The population of the Study	Sample Size	Analytics Type
Lavergne, 2015	British Columbia (BC)	Patients discharged form BC's hospitals	397,416	Descriptive
Basu et al., 2016	All Canada except Quebec and Territories	Patients discharged from acute care	1.7 million	Descriptive

Appendix C: Trends over the Study Years, Subgrouping Data by Discharge Disposition.

Numbers of Hospitalization

	ALC Group							Non-ALC Group						
	LTC	Home with Support	Home without Support	Acute Care	Palliative Care	Died	Others	LTC	Home with Support	Home without Support	Acute Care	Palliative Care	Died	Others
2004	62,727	12,275	26,165	11,899	3,938	12,397	205	130,887	607,045	225,879	79,113	9,007	4,910	84,566
2005	44,492	6,912	17,865	5,955	2,246	8,436	141	83,890	375,706	151,838	49,082	5,766	3,010	55,242
2006	37,173	5,220	14,625	2,404	1,436	6,870	88	68,910	295,036	123,972	30,898	4,378	2,335	42,948
2007	30,855	4,070	12,744	1,918	1,067	5,985	93	53,902	242,952	105,442	25,251	3,460	2,135	34,917
2008	26,186	3,261	11,038	1,309	817	5,162	92	44,164	203,378	91,919	20,760	2,724	1,894	30,119
2009	23,305	2,791	10,067	1,051	668	4,331	77	37,092	182,075	81,551	18,305	2,169	1,721	25,660
2010	20,667	2,292	8,643	817	583	3,710	60	32,749	166,626	76,917	16,323	1,921	1,562	22,293
2011	18,868	1,890	8,074	687	565	3,075	65	28,643	155,601	73,867	15,256	1,723	1,588	19,481
2012	15,938	1,560	7,500	571	461	2,474	48	25,437	149,060	71,230	14,256	1,585	1,515	17,510
2013	14,338	1,170	6,856	555	423	2,079	55	22,095	135,737	70,324	13,547	1,582	1,393	15,263
2014	12,574	946	6,173	482	416	1,872	37	18,753	124,803	67,317	12,838	1,516	1,447	13,186
2015	10,405	767	5,161	387	355	1,446	31	15,659	113,767	60,548	11,172	1,392	1,369	10,913
2016	8,782	561	4,421	332	300	1,124	24	12,755	101,758	55,137	10,348	1,236	1,277	9,167

% Hospitalizations

	ALC Group							Non-ALC Group						
	LTC	Home with Support	Home without Support	Acute Care	Palliative Care	Died	Others	LTC	Home with Support	Home without Support	Acute Care	Palliative Care	Died	Others
2004	48.4%	20.2%	9.5%	9.2%	3.0%	0.2%	9.6%	11.5%	53.2%	19.8%	6.9%	0.8%	0.4%	7.4%
2005	51.7%	20.8%	8.0%	6.9%	2.6%	0.2%	9.8%	11.6%	51.9%	21.0%	6.8%	0.8%	0.4%	7.6%
2006	54.8%	21.6%	7.7%	3.5%	2.1%	0.1%	10.1%	12.1%	51.9%	21.8%	5.4%	0.8%	0.4%	7.6%
2007	54.4%	22.5%	7.2%	3.4%	1.9%	0.2%	10.5%	11.5%	51.9%	22.5%	5.4%	0.7%	0.5%	7.5%
2008	54.7%	23.1%	6.8%	2.7%	1.7%	0.2%	10.8%	11.2%	51.5%	23.3%	5.3%	0.7%	0.5%	7.6%
2009	55.1%	23.8%	6.6%	2.5%	1.6%	0.2%	10.2%	10.6%	52.2%	23.4%	5.3%	0.6%	0.5%	7.4%
2010	56.2%	23.5%	6.2%	2.2%	1.6%	0.2%	10.1%	10.3%	52.3%	24.2%	5.1%	0.6%	0.5%	7.0%
2011	56.8%	24.3%	5.7%	2.1%	1.7%	0.2%	9.3%	9.7%	52.5%	24.9%	5.2%	0.6%	0.5%	6.6%
2012	55.8%	26.3%	5.5%	2.0%	1.6%	0.2%	8.7%	9.1%	53.1%	25.4%	5.1%	0.6%	0.5%	6.2%
2013	56.3%	26.9%	4.6%	2.2%	1.7%	0.2%	8.2%	8.5%	52.2%	27.1%	5.2%	0.6%	0.5%	5.9%
2014	55.9%	27.4%	4.2%	2.1%	1.8%	0.2%	8.3%	7.8%	52.0%	28.1%	5.4%	0.6%	0.6%	5.5%
2015	56.1%	27.8%	4.1%	2.1%	1.9%	0.2%	7.8%	7.3%	53.0%	28.2%	5.2%	0.6%	0.6%	5.1%
2016	56.5%	28.4%	3.6%	2.1%	1.9%	0.2%	7.2%	6.7%	53.1%	28.8%	5.4%	0.6%	0.7%	4.8%

Numbers of ALC Days

Year	Long-term Care	Home with Support	Home without Support	Acute Care	Ambulatory/Palliative Care	Died	Others
2004	1,259,252	350,713	155,937	132,128	53,022	259,306	3,490
2005	899,063	242,396	92,051	66,573	31,092	177,913	1,941
2006	751,953	196,855	71,265	33,817	23,320	144,205	1,422
2007	657,903	177,071	52,549	30,347	18,749	126,939	1,584
2008	552,778	149,846	41,284	23,430	12,059	109,755	1,549
2009	452,911	138,759	33,043	17,451	9,339	97,619	1,140
2010	390,677	112,096	27,246	13,021	7,541	73,932	1,118
2011	345,363	109,195	23,138	12,609	7,153	63,510	860
2012	306,958	99,154	17,685	13,806	6,962	54,714	1,034
2013	263,395	89,628	13,024	8,908	5,969	38,716	1,107
2014	233,014	84,828	9,902	11,127	4,961	43,569	1,037
2015	194,134	75,091	8,907	9,019	4,285	34,513	379
2016	154,683	64,327	5,523	7,704	3,684	27,619	437

% ALC Days

Year	Long-term Care	Home with Support	Home without Support	Acute Care	Ambulatory/Palliative Care	Died	Others
2004	38.1%	13.3%	4.3%	13.6%	27.7%	19.4%	13.7%
2005	40.0%	14.0%	4.4%	12.6%	27.9%	20.0%	12.9%
2006	40.4%	14.1%	4.5%	11.1%	29.6%	20.4%	12.9%
2007	42.3%	14.9%	4.1%	12.3%	31.3%	21.4%	15.2%
2008	42.5%	14.7%	4.0%	11.9%	29.1%	21.1%	16.0%
2009	41.5%	15.4%	3.6%	10.4%	28.4%	22.4%	13.9%
2010	41.0%	13.8%	3.4%	9.0%	26.5%	20.1%	15.5%
2011	40.2%	14.0%	3.2%	9.4%	27.1%	19.5%	11.8%
2012	40.5%	13.7%	2.6%	10.9%	29.8%	19.4%	15.1%
2013	39.7%	13.1%	2.2%	7.7%	27.1%	16.6%	16.3%
2014	40.5%	13.3%	1.9%	10.0%	23.8%	20.3%	17.8%
2015	40.5%	13.1%	1.9%	9.4%	23.1%	19.9%	7.7%
2016	39.7%	12.9%	1.4%	9.0%	23.1%	19.7%	9.7%

Appendix D: Trends over the Study Years, Subgrouping Data by Age Categories.

Numbers of Hospitalizations

	ALC Group				Non-ALC Group			
	65-74	75-84	85-94	95+	65-74	75-84	85-94	95+
2004	39,920	62,529	25,463	1,694	501,121	485,780	146,312	8,194
2005	25,609	41,048	18,126	1,264	326,994	300,668	91,319	5,553
2006	19,672	31,910	15,137	1,097	262,940	229,046	72,150	4,341
2007	16,991	25,788	12,958	995	228,539	178,441	57,793	3,286
2008	14,980	20,649	11,336	900	203,576	140,960	47,536	2,886
2009	13,131	17,620	10,713	826	185,756	117,687	42,492	2,638
2010	11,705	14,533	9,749	785	173,407	101,869	40,718	2,397
2011	11,245	12,408	8,831	740	167,482	89,295	37,120	2,262
2012	10,134	9,929	7,733	756	166,396	77,517	34,309	2,371
2013	9,600	8,375	6,831	670	159,964	67,295	30,482	2,200
2014	8,595	7,177	6,143	585	150,990	59,651	27,209	2,010
2015	7,709	5,403	4,908	532	140,395	49,595	23,004	1,826
2016	6,480	4,562	3,980	522	127,993	42,976	18,935	1,774

% Hospitalizations

	ALC Group				Non-ALC Group			
	65-74	75-84	85-94	95+	65-74	75-84	85-94	95+
2004	30.8%	48.2%	19.6%	43.9%	42.6%	12.8%	0.7%	43.9%
2005	29.8%	47.7%	21.1%	45.1%	41.5%	12.6%	0.8%	45.1%
2006	29.0%	47.1%	22.3%	46.3%	40.3%	12.7%	0.8%	46.3%
2007	29.9%	45.5%	22.8%	48.8%	38.1%	12.3%	0.7%	48.8%
2008	31.3%	43.1%	23.7%	51.5%	35.7%	12.0%	0.7%	51.5%
2009	31.0%	41.7%	25.3%	53.3%	33.8%	12.2%	0.8%	53.3%
2010	31.8%	39.5%	26.5%	54.5%	32.0%	12.8%	0.8%	54.5%
2011	33.8%	37.3%	26.6%	56.6%	30.2%	12.5%	0.8%	56.6%
2012	35.5%	34.8%	27.1%	59.3%	27.6%	12.2%	0.8%	59.3%
2013	37.7%	32.9%	26.8%	61.5%	25.9%	11.7%	0.8%	61.5%
2014	38.2%	31.9%	27.3%	62.9%	24.9%	11.3%	0.8%	62.9%
2015	41.6%	29.1%	26.5%	65.4%	23.1%	10.7%	0.9%	65.4%
2016	41.7%	29.3%	25.6%	66.8%	22.4%	9.9%	0.9%	66.8%

Numbers of ALC Days

Year	65-74	75-84	85-94	95+
2004	680,580	1,068,569	435,263	29,436
2005	443,835	730,992	313,570	22,632
2006	334,269	577,713	289,950	20,905
2007	304,159	480,565	257,359	23,059
2008	264,444	388,721	217,754	19,782
2009	219,120	313,884	199,650	17,608
2010	187,944	253,036	169,408	15,243
2011	179,431	215,757	152,902	13,738
2012	172,294	179,840	133,348	14,831
2013	159,005	141,499	108,838	11,405
2014	147,365	129,698	101,274	10,101
2015	134,064	96,677	85,599	9,988
2016	101,647	81,709	70,011	10,610

% ALC Days

Year	65-74	75-84	85-94	95+
2004	14.5%	19.6%	23.7%	26.8%
2005	15.1%	21.5%	26.1%	29.3%
2006	14.5%	22.3%	28.9%	32.7%
2007	15.3%	23.5%	30.8%	38.9%
2008	15.2%	23.7%	31.4%	38.5%
2009	14.3%	23.5%	31.8%	39.6%
2010	13.4%	22.8%	29.9%	37.4%
2011	13.4%	22.4%	29.4%	36.5%
2012	13.4%	22.4%	28.9%	39.6%
2013	13.1%	21.0%	27.7%	34.1%
2014	13.2%	22.1%	28.8%	34.3%
2015	13.2%	20.8%	29.3%	36.5%
2016	11.6%	20.9%	29.5%	38.1%

Appendix E: Trends over the Study Years, Subgrouping Data by Sex.

Hospitalizations

	ALC Group		Non-ALC Group	
	Males	Females	Males	Females
2004	53,571	76,035	552,816	588,591
2005	34,888	51,159	349,552	374,982
2006	27,753	40,063	278,033	290,444
2007	23,461	33,271	229,555	238,504
2008	20,128	27,737	197,922	197,036
2009	17,622	24,668	173,530	175,043
2010	15,497	21,275	159,206	159,185
2011	14,103	19,121	148,721	147,438
2012	12,011	16,541	141,558	139,035
2013	11,033	14,443	130,713	129,228
2014	9,769	12,731	121,406	118,454
2015	8,057	10,495	110,191	104,629
2016	6,754	8,790	97,576	94,102

ALC Days

	Number of ALC Days		% ALC Days	
	Males	Females	Males	Females
2004	946,978	1,266,870	17.1%	19.3%
2005	645,031	865,998	18.5%	20.9%
2006	519,179	703,658	18.9%	21.9%
2007	469,484	595,658	20.3%	22.7%
2008	393,977	496,724	20.1%	23.0%
2009	333,482	416,780	19.8%	22.4%
2010	280,908	344,723	18.7%	21.3%
2011	253,455	308,373	18.4%	20.8%
2012	231,225	269,088	18.4%	20.2%
2013	202,363	218,384	17.7%	18.7%
2014	187,424	201,014	18.1%	19.2%
2015	155,894	170,434	17.1%	19.1%
2016	125,696	138,281	16.4%	18.1%

Appendix F: Trends over the Study Years, Subgrouping Data by Specialized Clinical Interventions.

Numbers of Hospitalizations in ALC Group

Year	Tube Feeding	Heart Resuscitation	Mechanical Ventilation (long term)	Mechanical Ventilation (short term)	Parenteral Nutrition	Paracentesis
2004	1,052	232	848	1,248	652	430
2005	894	194	691	1,004	598	387
2006	939	167	738	968	594	383
2007	1,132	200	923	1,283	742	507
2008	1,041	181	883	1,117	653	434
2009	967	157	868	1,139	601	428
2010	828	165	827	1,025	522	398
2011	754	131	762	969	471	364
2012	699	129	744	857	403	340
2013	615	109	720	763	328	367
2014	535	102	624	681	296	311
2015	434	89	468	553	307	269
2016	404	80	428	511	244	205

Year	Pleurocentesis	Radiotherapy	Tracheostomy	Vascular Acess Device	Chemotherapy	Dialysis
2004	1,077	420	284	3,640	193	1,927
2005	915	395	284	2,985	162	1,927
2006	891	370	284	2,888	188	1,927
2007	971	487	284	3,225	219	1,927
2008	898	471	284	3,088	227	1,927
2009	843	450	284	2,899	219	1,927
2010	753	410	284	2,701	220	1,927
2011	729	387	284	2,564	225	1,927
2012	596	368	284	2,313	208	1,927
2013	591	302	284	2,216	202	1,927
2014	511	283	284	1,966	172	1,927
2015	447	295	284	1,729	224	1,927
2016	378	206	284	1,457	217	1,927

Numbers of Hospitalizations in non-ALC Group

Year	Tube Feeding	Heart Resuscitation	Mechanical Ventilation (long term)	Mechanical Ventilation (short term)	Parenteral Nutrition	Paracentesis
2004	2,308	2,370	3,673	10,815	2,716	1,972
2005	1,800	1,901	2,983	9,075	2,325	1,747
2006	1,972	1,823	2,961	9,227	2,401	1,876
2007	2,517	2,311	4,167	13,771	3,410	2,594
2008	2,285	2,086	3,832	12,706	3,052	2,445
2009	2,070	1,879	3,540	12,075	2,723	2,333
2010	1,801	1,778	3,150	11,738	2,570	2,282
2011	1,773	1,502	3,097	11,320	2,415	2,281
2012	1,674	1,454	2,973	11,076	2,286	2,218
2013	1,613	1,410	2,756	10,781	2,158	2,186
2014	1,431	1,218	2,570	10,096	1,974	2,116
2015	1,428	1,100	2,212	9,289	1,851	2,005
2016	1,135	908	1,889	8,596	1,617	1,757

Year	Pleurocentesis	Radiotherapy	Tracheostomy	Vascular Acess Device	Chemotherapy	Dialysis
2004	5,220	1,228	823	14,462	1,009	10,181
2005	4,422	1,096	688	11,946	968	7,667
2006	4,377	1,200	719	11,795	1,097	6,657
2007	5,694	1,706	979	14,185	1,655	6,725
2008	5,245	1,582	925	13,611	1,527	6,406
2009	4,970	1,592	882	12,860	1,667	5,600
2010	5,119	1,598	828	12,722	1,907	5,357
2011	4,702	1,544	934	12,510	2,005	5,243
2012	4,587	1,544	926	12,484	2,103	4,786
2013	4,508	1,458	885	12,748	2,179	4,339
2014	4,104	1,386	836	11,222	2,154	4,125
2015	3,810	1,367	740	10,645	2,334	3,403
2016	3,265	1,123	634	9,189	2,185	2,502

Numbers of ALC Days

Year	Tube Feeding	Heart Resuscitation	Mechanical Ventilation (long term)	Mechanical Ventilation (short term)	Parenteral Nutrition	Paracentesis
2004	44,117	5,404	25,706	18,608	11,573	7,646
2005	36,563	6,077	19,311	15,631	12,988	6,104
2006	37,050	4,195	19,893	15,573	12,591	7,079
2007	44,339	5,397	25,070	19,762	15,396	8,295
2008	40,657	4,217	23,665	14,651	14,579	9,220
2009	40,141	3,002	21,981	16,421	12,736	6,910
2010	29,168	4,457	20,615	12,803	7,939	5,403
2011	26,557	2,613	17,457	14,169	8,933	5,443
2012	29,358	2,994	21,302	12,917	7,453	5,206
2013	23,247	2,998	18,425	10,145	6,607	6,236
2014	22,109	2,277	15,163	10,863	6,621	5,075
2015	17,399	2,078	13,476	6,648	5,879	4,013
2016	16,994	1,707	9,847	6,481	4,904	3,763

Year	Pleurocentesis	Radiotherapy	Tracheostomy	Vascular Acess Device	Chemotherapy	Dialysis
2004	22,666	8,114	11,928	85,352	4,068	42,885
2005	16,681	7,659	9,081	69,417	3,449	34,323
2006	17,108	7,301	9,074	65,698	4,034	30,216
2007	19,682	9,217	9,143	75,656	4,360	28,330
2008	14,592	8,180	9,966	67,373	4,197	24,915
2009	16,204	8,293	9,270	66,484	4,477	20,253
2010	14,714	5,861	11,486	52,527	3,044	17,109
2011	12,417	5,926	9,024	58,607	4,415	17,052
2012	10,238	6,935	11,408	50,831	3,853	13,388
2013	9,853	4,849	10,607	47,995	3,768	15,391
2014	8,223	4,193	9,070	40,211	2,328	12,763
2015	6,943	4,421	7,646	35,530	3,908	11,085
2016	5,882	3,309	6,507	28,776	3,700	7,374

% ALC Days

Year	Tube Feeding	Heart Resuscitation	Mechanical Ventilation (long term)	Mechanical Ventilation (short term)	Parenteral Nutrition	Paracentesis
2004	25.6%	12.9%	13.5%	11.4%	10.3%	13.9%
2005	26.3%	16.0%	12.5%	11.5%	12.8%	13.3%
2006	25.5%	11.7%	12.8%	10.9%	12.3%	13.9%
2007	25.6%	12.8%	12.6%	10.0%	11.1%	12.3%
2008	25.3%	11.9%	12.4%	8.6%	11.6%	14.5%
2009	27.5%	9.5%	12.9%	9.9%	11.7%	12.0%
2010	24.0%	13.6%	13.0%	8.2%	8.2%	10.1%
2011	22.9%	10.0%	11.7%	9.4%	9.7%	10.6%
2012	25.6%	11.1%	14.4%	8.9%	9.0%	10.5%
2013	23.8%	11.7%	13.9%	7.5%	8.8%	12.4%
2014	25.7%	9.9%	12.7%	8.7%	9.6%	11.1%
2015	22.1%	10.8%	13.0%	6.0%	8.5%	9.8%
2016	24.4%	10.9%	11.4%	6.4%	8.5%	9.9%

Year	Pleurocentesis	Radiotherapy	Tracheostomy	Vascular Acess Device	Chemotherapy	Dialysis
2004	15.8%	20.2%	14.4%	17.2%	17.2%	19.9%
2005	14.3%	21.1%	13.9%	17.0%	16.1%	20.1%
2006	14.2%	18.4%	13.2%	16.1%	14.8%	19.9%
2007	13.7%	17.4%	12.1%	15.6%	11.6%	18.0%
2008	11.4%	16.7%	13.1%	14.9%	11.4%	17.1%
2009	14.0%	17.0%	13.4%	15.9%	12.0%	16.5%
2010	12.8%	13.3%	15.8%	13.4%	8.2%	15.1%
2011	12.2%	14.4%	11.8%	15.0%	10.5%	15.3%
2012	10.6%	16.2%	15.3%	14.1%	9.3%	13.7%
2013	10.7%	13.2%	15.2%	13.7%	9.0%	16.6%
2014	10.4%	12.7%	15.0%	13.1%	6.5%	14.9%
2015	9.2%	12.6%	13.9%	12.6%	9.2%	15.4%
2016	9.2%	12.2%	14.5%	12.1%	9.3%	13.7%

Appendix G: Numbers of ALC Hospitalizations and ALC Days Grouped by Admission Fiscal Year.

Fiscal Year	Number of ALC Hospitalizations (%ALC Hospitalizations)	Number of ALC Days (%ALC Days)
Total	**610,976 (10.1)**	**10,741,081 (19.7)**
2004	129,606 (10.2)	2,213,848 (18.3)
2005	86,047 (10.6)	1,511,029 (19.8)
2006	67,816 (10.7)	1,222,837 (20.5)
2007	56,732 (10.8)	1,065,142 (21.6)
2008	47,865 (10.8)	890,701 (21.6)
2009	42,290 (10.8)	750,262 (21.2)
2010	36,772 (10.4)	625,631 (20.1)
2011	33,224 (10.1)	561,828 (19.7)
2012	28,552 (9.2)	500,313 (19.3)
2013	25,476 (8.9)	420,747 (18.2)
2014	22,500 (8.6)	388,438 (18.6)
2015	18,552 (7.9)	326,328 (18.1)
2016	15,544 (7.5)	263,977 (17.2)