AGE-RELATED DIFFERENCES IN PATIENT OUTCOMES AND FACTORS ASSOCIATED WITH PSYCHIATRIC STAYS AT THE DUBE CENTRE, ROYAL UNIVERSITY HOSPITAL, SASKATOON.

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Abstract

Due to the global exponential increase in life expectancy, the average 65-year-old Canadian can expect to live for an additional 21 years. This increase in the population of seniors will significantly impact the healthcare system and though mental health conditions occur throughout life course, seniors with mental illnesses also experience multimorbidity, functional decline and cognitive difficulties due to aging. The complex needs of these patients are best addressed by age-specific services. Unfortunately, psychiatric care for older adults is undifferentiated from that of younger patients and as a result, mental health services are better suited to cater to the needs of younger patients.

We sought to examine the differences in outcomes between older and younger patients in the psychiatric unit at Royal University Hospital (RUH), Saskatoon, as well as factors that influence length of stay and delayed discharge. We used administrative health data from the Saskatchewan Health Authority of in-patients' admissions between 2012 and 2019. In this study, we show that despite the small population of older adult admissions at RUH, there are large and important differences in clinical outcomes between younger and older patient admissions. We also show that age is an important predictor of both length of stay and delayed discharges. Particularly, older patients are more likely to have longer lengths of stay and have thrice the odds of delayed discharges compared to their younger counterparts. The implications of these are many but the most important is that improving the outcomes of older patients by providing age-specific, specialized services such as geropsychiatric units can be useful and effective in reducing healthcare costs and expenditure for older patients, their caregivers, and the government.

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List of Abbreviations

ACE	Acute Care of Elders
ADT	Admissions, Discharge, and Transfers (database)
ALC	Alternate Level of Care
CGAs	Comprehensive Geriatric Assessments
CIHI	Canadian Institute of Health Information
DAD	Discharge Abstract Database
HAD	Hospitalization-Associated Disability
ICD	International Classification of Diseases
LOS	Length of Stays
MB	Mental and Behavioural (disorders)
RUH	Royal University Hospital
WHO	World Health Organization

Chapter 1: Introduction

1.1 Statement of Problem

According to a recent report by the Public Health Agency of Canada on aging, the average Canadian senior is expected to live for an additional 21 years (1). This increase in life expectancy is similar in other parts of the world; the average 65-year old between 2015 and 2020 is expected to live for 17 more years and this is expected to increase in coming years (2). As a result, by 2050, 16% of the world's population is estimated to be 65 years or older. Specifically, in Canada, by 2036, nearly one out of four Canadians would be a senior, outnumbering children for the first time (3).

This shift in demographics is having notable impacts on the healthcare system especially the mental healthcare system. While it is true that mental health conditions can occur in all stages of life, older adults with mental illnesses often experience an interaction of mental health problems, chronic conditions, and cognitive difficulties due to aging (4). In addition, they might experience a double stigma of ageism and mental illness. As a result, older adults are less resilient and particularly vulnerable to acute illnesses. Acute illnesses often cause stress for older adults- who present to the hospital with various levels of frailty, as well as their families, and caregivers. Adverse experiences in the hospital such as falls, injuries, reduced mobility, prolonged bed rest, bowel and urinary dysfunction, undernutrition, and restraints can further worsen functional status in older adults. Most of these experiences are potentially avoidable, and hospital outcomes can be improved by preventing these experiences and establishing patient centered, age-specific hospital services and specialized units for the elderly (5).

1.2 Background of Study

Many countries including Canada, define their elderly population as those aged 65 years and above. Though this definition has been contested by some authors, the chronological age of 65 is generally used as a marker for older age (6). Regardless, ageing is a biological process beyond control and old age is often perceived to be associated with a decline in social roles and functional status (7). In this study, older adults are defined as people who have reached or surpassed the chronological age of 65 years.

For older adults, hospitalization is a notable event, not only because it poses a threat to later health and function, but it also represents an opportunity to assess, treat or manage both acute and chronic conditions (8). One of the goals of care as identified by many older patients is functional independence; however, functional decline in many hospitalized older adults has been acknowledged as a major concern in the last few decades. This decline, often described as Hospitalization-Associated Disability (HAD), reflects failure to recover from disability before admission and/or new disability after admission. Outcomes of HAD include long hospital stays, readmissions, long-term and sustained disability, placement in nursing homes, transfers to other institutions and deaths. Apart from the disability caused by functional decline, the associated financial, physical, and emotional burden on these patients, their families, and their caregivers is higher when compared to patients without functional decline (8).

In order to solve these challenges and meet the increasing pressures and demands of the hospitalized elderly, some specialized services for the elderly have been developed (9). These services, broadly referred to as Comprehensive Geriatric Assessments (CGAs), have been described as the cornerstone of geriatric care. The concept of CGAs is credited to Dr. Marjory Warren who established the first geriatric assessment unit in the United Kingdom in 1935. Since

then, comprehensive geriatric assessment has evolved to incorporate modern strategies and social services (10). CGA is conducted on various levels of intensity and varies across healthcare settings such as in-patient, outpatient hospital settings and post-hospital settings. Outpatient CGA programs include the Home Assessment Service (HAS), Hospital Home Assessment Service (HHAS) and Outpatient Assessment Service (OAS). In-patient CGA programs, the focus of this study, are further divided into the Team Model and the Ward Model. The Team Model involves the assessment and delivery of recommendations by a multidisciplinary team to attending physicians for the older patients (11). An example of the team model is the Inpatient Geriatric Consultation Team (IGCT) or the Geriatric Liaison Team (12). On the other hand, the Ward Model involves the delivery of care in a separate ward under the control and supervision of a multidisciplinary team. Examples include the Geriatric Evaluation and Management Units (GEMUs) also known as Geriatric Assessment Units (GAUs) and the Acute Care of Elders (ACE) units (5,13,14).

Comprehensive Geriatric Assessments are particularly beneficial for older adults with mental illnesses since mental conditions in later life are complicated by several distinctive features. Many older adults have comorbidities and some of these chronic illnesses may be associated with mental illness (4). For example, it has been reported that there are increased rates of depression among people with heart disease (15). Similarly, arthritis, cancers, diabetes, and respiratory conditions have been linked to mood disorders and anxiety (15). Comorbidities, biological heterogeneity, polypharmacy and higher rates of side effects from drugs decrease the accuracy in the diagnosis of mental illnesses and without proper diagnosis, mental conditions may go untreated (15,16).

It is estimated that between 17 to 30 percent of Canadian seniors have mental health illnesses (17). The most common of these illnesses are mood and anxiety disorders, dementia and delirium,

substance abuse and psychotic disorders (4). These illnesses may require acute care in hospitals, which can be a hostile environment for older adults with mental illnesses (18). It has also been found that older adults with psychiatric illnesses are more likely to have longer hospital stays often because of delayed discharges, as well as higher rates of readmissions, deaths, and institutionalization after discharge (19,20). These have considerable implications on the health care system and the economy at large in terms of health costs and demand for acute or long-term beds. These implications also provide valid reasons for action and support for older patients with mental illnesses (17). Geropsychiatric units have been shown to offer several benefits for older patients with psychiatric disorders including an holistic, integrated and interdisciplinary approach to care which results in effective interventions that improve the quality of life in older patients (21).

1.3 Purpose of Study

In Canada, specialized geriatric psychiatric inpatient services have been recognized to be an important feature of comprehensive geriatric care. In fact, there are notable geropsychiatric units including the Royal Ottawa Mental Health Centre's Geriatric Psychiatry Inpatient Unit in Ottawa, Ontario, and the Interior & Northern B.C.'s Geriatric Tertiary Inpatient Unit in Kamloops, B.C. However, these services are sparsely distributed across Canada (22). As a result, most seniors in acute care are managed using the conventional model of care, which is often suited to younger patients. Older patients with mental illnesses are more likely to experience worse outcomes and difficult discharges from acute care but there is limited knowledge on the scope of the problem in Canada. Truly little research has been conducted in the field of specialized inpatient services, fewer studies have evaluated the necessity of specialized geropsychiatric units and there are no known studies in Saskatoon, Saskatchewan. This study aims to assess and examine the age-related differences in outcomes as well as factors associated with psychiatric stays in a general psychiatric

unit at Royal University Hospital, Saskatoon, Saskatchewan in order to inform and advocate for the need, or lack thereof, for enhanced specialized geriatric psychiatric services and/or the establishment of a geropsychiatric unit.

1.4 Research Questions

The study will answer the following research questions:

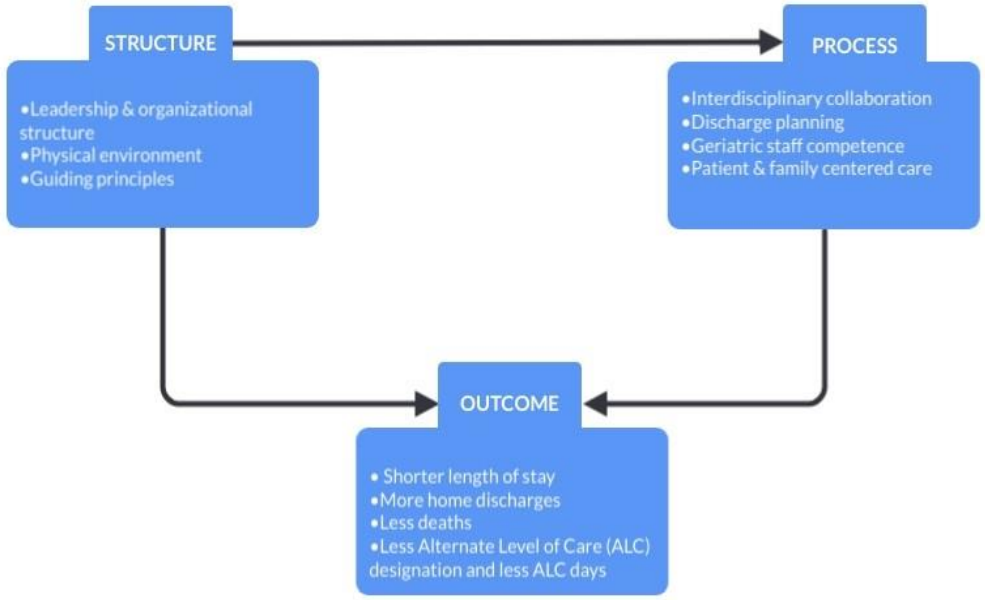
1) Are there differences in in-patient outcomes such as length of stay, discharge disposition, alternate level of care, and deaths between age-groups in a general psychiatric unit?
    a) Do these outcomes differ between older patient admissions patients and other admissions in a general psychiatric unit?
    b) Do these outcomes differ within older patient admissions in a general psychiatric unit?
2) What factors influence length of stay and delayed discharges among all admissions and older patient admissions in a general psychiatric unit in Royal University Hospital?

1.5 Theoretical and Conceptual Framework

An adaptation of the Donabedian's model of quality of care and the geriatric acute care model will form the basis of the conceptual framework used in this study. (23,24). The Donabedian framework utilizes a three-component approach to evaluate the quality of care namely structure, process, and outcome. The structure refers to the setting where care is provided and reflects organizational factors which are otherwise known as input measures. The process refers to the coordination of care and its acceptability to the patient while the outcome represents the result of care in the patient (24). On the other hand, the geriatric acute care model is a framework composed of clusters or constructs that represents the components of the model. The components include guiding principles, organizational structures, leadership, physical environment, patient and family centred

approach, age-sensitive practices, staff competence, interdisciplinary processes (23). In this study, these components are separated into structure and process and result in the outcomes.

Figure 1- Conceptual framework adapted from Donabedian's model of quality of care and the Geriatric acute care model



Specialized inpatient geropsychiatric services and/or geropsychiatric units represent an improvement in the quality of the conventional model of care (5). The quality of care, as proposed by Donabedian, can be determined by the structure of care, the process of care and outcomes. The components of the geriatric acute care model serve as a useful tool to conceptualize the structure and process of acute care received by elderly patients in the general psychiatric units. The structure of care includes leadership and organizational structure which refers to the administrative support and infrastructure to enforce the standard of care in the unit; the physical environment to ensure the functional independence and safety of older adults; and the guiding principles based on respect, autonomy, and growth of older adults (23). The process of care involves interdisciplinary processes to ensure continuity of care; discharge planning to ensure appropriate discharge and continuity of

care; staff competence to provide effective and specialist care as well as medical care reviews; and patient and family centred care to ensure the needs of these patients as well as their family and/or caregivers are met (5,23). The structures, processes and outcomes of care are all interrelated as shown in Figure 1.1.

Chapter 2 : Literature Review

In the past two decades, the specialty of Geriatric Psychiatry has gained increasing prominence. Geriatric Psychiatry or geropsychiatry, is the practice of psychiatry in older adults and is differentiated from general adult psychiatry in the additional training and experience in psychiatric syndromes such as delirium, dementia, depression, mood disorders, psychosis, alcohol and substance abuse, psycho-social and personality disorders in older adults and their families (25). The goal of this specialty is to reduce the burden of mental illness and improve quality of life in seniors (26).

The Canadian Academy of Geriatric Psychiatry was founded in the 1990s (26), however geriatric psychiatry became an official subspecialty in Canada in 2009 (27). Since the 1990s, this discipline has evolved in advancing the science and delivery of medical knowledge to older patients. Despite these advancements, there are gaps in the growing expertise and its effective application by care providers which translates to a deficiency in service delivery (26). In the absence of the specialized services provided by this discipline, older adults are deprived of the quality of care that is suited to their complex age-related needs.

This is especially true for older patients in acute psychiatric units who often have comorbidities, functional disabilities, and cognitive difficulties. In a population-based study conducted in Ontario, it was observed that there were significant differences in sociodemographic, psychiatric, and medical characteristics between older and younger patients. Older adults with psychiatric illnesses were also described as “a medically complex population” who require integrated geriatric and psychiatric care by staff who are knowledgeable and skilled to provide quality care (28). From the review of existing literature, it has been shown that older adults would benefit from a model of

care involving a joint, integrated geriatric and psychiatric unit to address these complex needs and provide high-quality inpatient care (18).

These units, often referred to as geropsychiatric units or psychogeriatric units, are not new in the provision of specialized inpatient services for older adults. In many developed countries such as the United Kingdom, United States, Australia, geropsychiatric units are established to address the complex medical and psychiatric needs of older adults. They are based on the Acute Care for Elders model of care (29), a model which was originally designed to address the concerns of HADs in older adults while making the hospitalization experience patient-centred and more effective (5). As a result, geropsychiatric units have certain features which differentiate them from general psychiatric units.

2.1 Features of Geropsychiatric Units

While the most obvious feature of geropsychiatric units are the characteristics of patients admitted, that is, older patients with psychiatric conditions, less obvious features are the structures and processes of care. A study conducted in Clinton Hospital, Massachusetts, USA described a geriatric-medical/psychiatric unit/program established in 1989. This program was designed to serve elderly patients with comorbidities and functional disabilities based on the principles of the Comprehensive Geriatric Assessment (CGA) program. Management of the unit consisted of a program director, medical director, nursing manager and senior social worker. Psychiatrists in the unit were experienced geriatric psychiatrists who led multidisciplinary staff teams consisting of social workers, occupational and physical therapists, mental health counsellors and primary nurses. Each patient received over 6 hours of nursing care daily. In addition, several architectural modifications and age-inclusive activities were tailored to the functional and cognitive abilities for these patients. Architectural modifications included window coverings, non-weight bearing

fixtures, protective covers for radiators, locked exits and medication rooms, spaces for occupational therapy, loud and quiet activities, and others. Activities involved daily community meetings for patients and staff, arts and crafts, light exercise therapy, supervised group walks, group sing-alongs, quiet time with music from the 1930s and 1940s, games, group meal preparations and more. Particularly noteworthy was the family therapy sessions and discharge planning activities organized by the social workers. These developments were also at low costs since the unit made use of available services in the hospital, making it a cost-effective program (30).

A randomized controlled trial in Netherlands, in which the intervention was multidisciplinary care compared to usual care in a general unit, highlighted that care in the intervention group involved organizing a primary geriatric team including: a geriatric psychiatrist, a specialized geriatric liaison nurse, and a physiotherapist. The team was responsible for integrated assessments for each admission, management of treatment plans and planning and management of discharge. Additionally, nurses were employed to increase the staff-to-patient ratio and the primary geriatric team worked closely with the nurses as well as social workers, dietitians, general psychiatrists, and other consultants. The family members of patients were also actively involved in the provision of care. Teamwork between all the members was said to be an integral part of the organization of care. At the end of the trial, the estimated net benefit of this intervention was $3000 per patient (31).

More recently, a survey was conducted in the United States (US) to describe some of the best practices of geropsychiatric inpatient units across the country in an effort to improve the quality of care for older adults. Of the 24 units included in the survey, it was found that most of the units were remodeled and widely adapted to accommodate the needs of older patients. These adaptations

included modifications in physical features, staff training and staff ratios, patient care practices, and family involvements. When asked what made the unit successful, most respondents highlighted the skilled multidisciplinary team who love to work with geriatric patients and the services provided which were specially curated for elderly patients (32).

In the United Kingdom (UK), a study which sought to examine predictors of discharge destination for patients admitted into one of such units revealed that compared to an acute medical ward, the environment of the unit was "reasonably calm and spacious" and provided additional security for the older patients. Furthermore, staff teams included consultants who were well-trained in geriatric psychiatry, mental health nurses, clinical psychologists, occupational therapists and a therapies coordinator (33). This is similar to the organization of care in a unit developed for older delirious patients in Australia which involved integration of medical and psychiatric care, staff who are well-trained and qualified, and extra attention to the physical environment to ensure maximum safety for older adults (34).

While the intensity and mode of provision of care differs across various countries and settings, most geropsychiatric units have unique features which are crucial to the way care is organized and provided. With regards to the structure of care, one of the distinguishing features of geropsychiatric units are the guiding principles or values which reflect a commitment to support the rights and autonomy of older adults with psychiatric disorders. Leadership and organizational structure play an integral role as decision-makers in geropsychiatric units are recognized leaders in geriatric practice who maintain high standards across the continuum of care. Moreover, the physical environment of these units are safe, age-inclusive, and secure environments that facilitate recovery and maintain independence of older adults (18,23).

The process of care, which is often a by-product of the structure of care, also differentiates the geropsychiatric unit model from the conventional model. The emphasis on interdisciplinary or multidisciplinary collaboration cannot be overstated. Various providers from different disciplines work in a team to provide appropriate care to patients. Members of these teams are often skilled and well-trained in the mental health conditions of the elderly. Age-appropriate practices and activities are encouraged to promote functional independence. Discharge planning, a key component, is initiated early, often at the point of admission and is done with family members and caregivers to ensure that care is patient and family-centered (23). These features are pivotal to the enhanced quality of care and improved outcomes observed in older patients in these units (18).

2.2 Benefits of Geropsychiatric Units

Several studies have described the benefits of geropsychiatric units based on outcomes of patients who are admitted into geropsychiatric units or comparisons of outcomes of patients admitted in these units to those admitted into general medical and psychiatric wards. These outcomes include length of stay, improvement in behaviour, discharge status, use of restraints, transfers to other institutions, adverse events, level of independence and mobility, costs, and mortality. While some studies show mixed or no benefits, many of these studies show that geropsychiatric units offer better care and improved outcomes for older patients.

2.2.1 Length of Stay (LOS)

A patient's length of stay is the period between admission and discharge in a care facility. The length of stay is used as a quantitative measure of the efficiency of hospital management and quality of care received by a patient. Longer LOS is associated with increased risks of adverse events in the hospital such as healthcare-acquired infections (HAIs), medication side effects, decline in functional status and mortality. Longer LOS also reduces the bed turnover rate, and increases healthcare costs for both patients and the government (35). For older adults with mental

illnesses, increased length of stay is a prevalent concern that occurs frequently. Increased LOS in this demographic is also a predictor of functional and cognitive decline, institutionalization, readmission, and higher rates of mortality (19). The Canadian Institute of Health Information (CIHI), reports that the age-adjusted, average LOS was approximately 7 days between 2020 and 2021 and has been relatively stable (36), However, a study conducted in a specialty hospital in Ontario, Canada for patients with mental and substance use disorders found that the average LOS for older patients with mood disorders was 61 days (median: 40 days) compared to 26.5 days (median: 20 days) for adult patients with mood disorders. Longer LOS was also associated with negative symptoms and increased functional dependence (37).

LOS varies across different settings and is usually reported to be primarily influenced by the patient's characteristics including age, diagnosis, severity of illness, and physical health, cognitive ability, and comorbidities (38). However, a recent study conducted by Challis et al. (2014) to examine factors influencing delayed discharge and length of stay of older adults in acute care setting in the UK found that while there were several factors implicated, the model of care in the hospital rather than patient factors were the most important predictors of LOS. Discharge planning in particular was highlighted as a major predictor of LOS (39). Another study carried out in an older adult psychiatric ward in the UK found that when a Quality Improvement (QI) project was undertaken, LOS reduced significantly by 36% and bed occupancy reduced from 77% to 55% within a year. This QI project involved restructuring the ward management and assembling a multidisciplinary team which included consultant psychiatrists, nurses, social workers, occupational therapists, service user representatives, service directors and an improvement specialist. The team was able to meet regularly to plan discharge processes in collaboration with patient's families and caregivers. In addition, special attention was paid to patients who had been

admitted for longer periods to implement an integrated approach to deliver better care. Leverage provided by management was valuable in providing swift and sustainable changes with little resources (19).

Decreased LOS has also been reported in comparative studies between general psychiatric services and specialized psychiatric services for older adults. One of such studies is the randomized controlled trial in which patients aged 75 years and above were randomly allocated to two units; one unit for the usual care group and the other unit for the intervention group, to compare differences in functional status, length of stay, and rates of institutionalization. The usual care consisted of general services provided by health professionals in a general unit while intervention included age-specific multidisciplinary care by a geropsychiatric liaison team in addition to usual care. Length of stay for both groups were differentiated into length of stay for medical reasons and overall length of stay. At the end of the study, all outcomes were in favour of the intervention group who were admitted into the intervention unit. In particular, the overall LOS and LOS for medical reasons in the intervention group was 5 days and 4 days shorter respectively compared to the control group after controlling for confounding baseline characteristics. Furthermore, when index admission and readmissions within 6 months were combined, the difference in length of stay was 9 days shorter for the intervention group (31).

Another study sought to compare change in performance indicators and length of stay between Bankstown geropsychiatric unit and the state average, consisting of 8 other units in New South Wales, Australia. The main difference between Bankstown and the other units was its multidisciplinary and integrated model of care provided to patients aged 65 years and older. The Bankstown unit was managed by geropsychiatrists, a psychiatric registrar, and a medical officer who worked closely with skilled geriatricians, nurses, physical and occupational therapists, and a

social worker. The other units were reported to be independently managed and/or separated from geriatric care. The results showed that though Bankstown admitted patients with more severe illnesses, the overall LOS was significantly 5 days shorter. This difference was more pronounced in patients with moderate to severe overactive, aggressive, and disruptive behaviour. Additionally, change in performance indicators including activities for daily living (ADL), disability, living conditions and occupation at admission and discharge, was significantly better in Bankstown patients. The improved outcomes observed in this study was attributed to the integration of care between geriatric and psychiatric disciplines. This facilitated communication and enabled early detection and management of complications. The multidisciplinary mental health, medical and allied teams helped address discharge planning and rehabilitation and the physical environment allowed for close observation and minimized the use of physical or chemical restraints (40).

2.2.2 Alternate Level of Care (ALC) or Delayed Discharge

The term ‘alternate level of care’ describes patients who occupy a bed in acute care but do not require the intensity of care provided in that setting. ALC designation reflects a lapse in the healthcare system including acute care in hospitals, community care and long-term care (41). It is also detrimental to quality of care, as well as the utilization and costs of care (42). For older patients, ALC leads to decline in mobility and functional status (41). ALC reduces the capacity of acute care, increases overcrowding and wait-times thus compromising the efficiency of the care facility. Patients and their families or caregivers have expressed the emotional burden, anxiety, and uncertainty which ALC designation often places on them (43).

Between 2007 and 2008, CIHI reports that ALC designation accounted for 5% of hospitalizations and 14% of all hospital days in Canada. ALC patients were more likely to be older than non-ALC patients (median age: 80 years) and twice as likely to have comorbidities. Dementia, in particular,

was responsible for almost 25% of all ALC hospitalizations and more than 30% of ALC days. Though the median ALC length of Stay (ALC LOS) was 10 days, patients who were primarily diagnosed with dementia had a median ALC LOS of 23 days (44). Between 2017 and 2018, ALC accounted for 12%, 15%, and 21% of hospital days in British Columbia, Ontario, and Prince Edward Island respectively (45). Similarly, a retrospective observational study conducted in two hospitals in New Brunswick, Canada found that 33% of overall hospitalizations were designated ALC patients. In one of the hospitals, a specialized geriatric hospital, more than half of the patients were designated ALC. The average age of these patients was 79 years and about 64% of them had dementia. (41).

ALC designations are associated with longer hospital stays. In Ontario, Canada, ALC designation is the administrative term used to represent delayed discharges. In a population-based retrospective study conducted in Ontario, the biggest predictor of longer ALC days (>30 days) was the level of dependence and functional ability, measured by the Instrumental Activities for Daily Living (IADL) scale. The odds of delayed discharge in patients with the most severe impairment was almost 4 times compared to those with no impairment. For older patients, the odds of longer ALC days was 3 times greater than other patients. Other variables associated with delayed discharges were childhood and adolescent disorders, cognitive disorders, impairment in ADLs, aggressive behaviour, history of substance abuse, intellectual disabilities, and history of admissions to a psychiatric hospital. (46).

Frailty and delirium have also been identified as independent predictors of delayed discharge among the elderly. In a study conducted in an acute general geriatric ward at a hospital in UK, where multidisciplinary comprehensive geriatric assessment is routinely practised, it was observed that among social factors such as living alone and new institutionalization, frailty and delirium

were important clinical factors that increased the odds of delayed discharge among patients (47). These studies, as well as others, show that many geriatric syndromes among hospitalized older adults including dementia, frailty, delirium, immobility, cognitive impairments, functional decline, depression, comorbidities, and others may be associated with delayed discharge (48–50). Geriatric syndromes are clinical conditions which are prevalent among older adults. These conditions involve many organ-systems and do not fit a disease category. They are also associated with several adverse outcomes among hospitalized patients, yet are underdiagnosed and often overlooked in hospital management (51). Though these conditions affect all elderly patients, they present a clinical and biological complexity in older adults with psychiatric illnesses. For example, schizophrenia may increase the risk of dementia syndrome (52). Such complexities may be harder to diagnose and manage leading to prolonged stay in the hospital.

There are mixed results of the benefits of specialized geriatric units and comprehensive geriatric assessments on delayed discharge. In a retrospective study that explored the association of geriatric syndromes as frailty, confusion, and history of dementia on hospital outcomes, although inpatient CGA increased the odds of survival in frail patients, patients admitted in a geriatric unit were more likely to experience delayed discharges compared to those in a general medical unit. This was attributed to the likelihood of specialized geriatric units to admit more complex patients compared to the general ward (50). Another cohort study aimed to examine outcomes of patients in seven geropsychiatric wards in the UK, and overall, 40% of admissions experienced delayed discharges. Patients admitted for both functional and organic disorders were more likely to have delayed discharges compared to patients either admitted for functional mental health disorders or organic disorders (53).

Geriatric syndromes such as frailty, delirium and functional impairment are highly prevalent among older patients with psychiatric illnesses (54). However, in Canada, there is limited data on these conditions, therefore, the primary reasons for delayed discharges are often documented as nonmedical reasons. This omission has several implications. First, the reasons for delayed discharges cannot be properly identified and potentially avoided. Second, the lack of data on these syndromes may emphasize a focus on interventions and resources to ameliorate patient flow rather than a focus on services and practices that take into consideration complex needs of older adults and prevention of complications that lead to delayed discharges (55). Such practices involve identifying the risk factors for delayed discharges through screening and assessments, followed by multidisciplinary and integrated approaches such as early discharge planning and collaboration between the hospital, community, and social services (47, 56).

2.2.3 Discharge Disposition

In many Discharge Abstract Databases (DAD), a patient's discharge disposition refers to their anticipated location after discharge from a unit. It is also known as the discharge destination or discharge status. While length of stay and mortality are important measures of quality of care, as more studies utilize routine data from administrative databases such as Admissions, Discharge, and Transfer Databases, outcomes such as discharge disposition provide a useful measure that can inform the quality of care. Patients may be discharged home, to ongoing care, transferred to another care setting or may even die in care (56).

Before discharge, discharge planning is undertaken to decide the appropriate level of care required by a patient and make necessary arrangements to move the patient to the desired destination. To do this, several factors are taken into consideration including cognitive status, functional status, suitability of the patient's home, availability of caregiver or family support, and availability of

suitable community services. These factors involve various actors including the patient, care providers, family and/or caregivers, social workers, and insurance providers. As a result, patient discharge is a complex process which must be done appropriately else, the risks of readmissions, additional healthcare utilization, increased healthcare expenses, and associated stress and burden becomes unavoidable. Patients are usually discharged home if they are functionally independent and able to perform self-care activities including outpatient care or can be effectively managed at home. They may also be discharged to another care setting if they require additional care and discharge to an outpatient setting is not suitable. Examples of such care settings include nursing facilities, acute care hospitals and long-term care or rehabilitation facilities (57).

In older patients, the discharge disposition can reflect their cognitive and functional status following hospitalization (58). During hospitalization, the older adult with mental illness is more vulnerable to several risks and complications that cause functional decline and leads to prolonged dependency and consequent decrease in quality of life (59). Therefore, to maintain or improve their independence and quality of life, the ability to perform basic self-care activities, otherwise known as Activities for Daily Living (ADL) remains a major goal in the care of older adults. In a prospective observational study among older adults hospitalized in two general hospitals in the US, more than one-third of patients had worse ADL status at time of discharge compared to pre admission baseline. This decline in functional status was also more prevalent with advanced age. Increased age correlated strongly with the likelihood of functional loss and failure to recover during hospitalization (60). Likewise, a study that sought to describe discharge destinations among older adults from a geriatric acute care unit observed that patients over the age of 75 years who had been admitted from long-term care settings were less likely to be discharged home (59).

Specialized geriatric units have been shown to improve functional status among older patients. In 1995, Landefeld and colleagues conducted a study in which older patients were randomly assigned to either admission in a general medical unit (usual care) or a geriatric unit (intervention) designed to maintain independence. To achieve this, modifications in the structure and process of care in the geriatric ward were adapted. At discharge, compared to usual care, more patients in the intervention group had better functional status compared when they were admitted. Additionally, fewer patients in the intervention group were discharged to long-term care settings at discharge and 3 months after discharge (61).

Geropsychiatric units may improve quality of care for older adults with mental disorders by maintaining or improving their cognitive and functional status. Astell and colleagues carried out a retrospective study in Scotland, UK in which patients who required ongoing management were admitted into a geropsychiatric unit. Among 234 patients who were originally awaiting discharge to a long-term care setting, 21 were discharged home after admission in this geropsychiatric unit and 20 of these patients were partially or fully independent at discharge from the unit. Home discharge rather than long-term care as originally planned suggests that the unit was able to maintain or improve their outcome although functional independence was a major influence. The majority of the other patients were discharged to nursing homes as they were not as functionally independent and required assistance from staff (33). Correspondingly, a recent cohort study explored the outcomes of patients in a geropsychiatric unit and found that the majority of patients who were admitted from their homes were more likely to be discharged home. However, patients with functional dependence, cognitive impairment, and distressed behaviour were less likely to be discharged home (53).

2.2.4 Deaths

Mortality may be assessed during admission (in-hospital mortality) or after discharge from the hospital. Because death is an evident, negative outcome often associated with poor quality of care in the hospital, it is a useful indicator of quality of care. When this indicator is adjusted for differences in hospital and patient characteristics, the resultant indicator is the risk-adjusted mortality. (62,63). Despite criticisms of the use of mortality rates as a measure of quality of care because of the apprehension of risk adjustment to effectively control for differences in hospital and patient characteristics or the inability to identify the quality issues that lead to deaths, mortality rate remains a useful indicator in healthcare (63).

For older adults, hospitalization is a life-changing event that can lead to death either during admission or shortly after discharge. Many studies have tried to investigate factors that increase the risk of in-hospital mortality in older patients. One study conducted in a geriatric unit in Brazil found that conditions such as delirium, immobility, malnutrition marked by low albumin levels, high creatinine levels, cancer, and history of heart disease significantly increased the odds of inpatient mortality (64). Similarly, Tal and colleagues found that malnutrition measured by low albumin levels and B12 level was a very strong predictor of in-patient mortality among the hospitalized elderly (65). Another study conducted in Italy highlighted frailty as well as the presence or absence of psychiatric or psychological symptoms such as confusion, functional and physical status, and social support, as independent predictors of mortality among hospitalized older patients (66).

Often measured by instruments such as the Frailty Index (FI) or Clinical Frailty Scale (CFS), frailty has been described as the biological age of a person, characterized by poor functional status, decreased physiological reserve, and increased vulnerability to stressors due to cumulative age-

related deficits. The results of a systematic review and meta-analysis of cohort studies from various countries including US, UK, Italy, Netherlands, Canada, and China revealed that the odds or "hazard" of in-hospital mortality was greater for patients who were frailer. Higher frailty was strongly associated with increased risk of mortality (67). Frailty is also a strong predictor of mortality after hospitalization for older adults with psychiatric illness. A 5-year follow up study conducted in the Netherlands in geriatric patients of a psychiatric hospital found that most patients who were frail on admission died within 5 years (68).

Cognitive impairments are also associated with in-hospital mortality (66). In an integrated review of studies conducted in various countries, several studies showed that older patients with dementia had increased risks of in-patient mortality compared to older patients without dementia. Patients with cognitive impairments were also at increased risks of malnutrition, new infections, functional decline, and death if an adverse event occurred in the hospital (69). These findings are not surprising since the coexistence of medical and psychiatric illnesses have been shown to be an indicator of poorer outcomes (29).

The effect of specialized geropsychiatric units on in-hospital mortality are mixed. In a before and after intervention study in Australia, the rates of in-patient mortality dropped from 14% to 5% after a delirium unit adapted a Close Observation Unit (COU) Model compared to the usual care. The COU model involved staff from multidisciplinary teams as well as changes in the physical environment to ensure safety and age-appropriate practices (70). On the other hand, a one-year randomized control trial conducted in the UK among older patients with symptoms of cognitive impairment and confusion were either admitted into a medical and medical health unit (MMHU) as the intervention group or standard general unit as control showed no significant changes after controlling for baseline characteristics. The control included general medical wards and acute

geriatric medical wards, the intervention was a specialist acute geriatric ward with specialist multidisciplinary mental health staff who were trained in the management of dementia and delirium. The environment and activities were organized to be more appropriate for this group of patients and family and caregivers were included in the care process. Both groups had access to standard medical and mental health care, rehabilitation, intermediate and social care. However, though there was not much difference in the risk of in-hospital mortality between control and intervention, patients in the MMHU had higher quality of care, were more often in positive moods, and more engaged in social interactions. Their family or caregivers were also more satisfied with the overall care, met needs, nutrition, and discharge arrangements (71). Comparable results were observed by Slaets and colleagues (1997) in a randomized controlled trial conducted, where more patients in the intervention group who received multidisciplinary specialized geropsychiatric services died, even though intervention reduced overall health costs, functional status, length of stay and increased home discharges (31). These results are plausible since the severity of illnesses and patient frailty in these studies are not taken into consideration. Moreover, care in geropsychiatric units is often directed towards improving the quality of care and not quantity of life (31).

2.2.5 Other Benefits

Geropsychiatric units have been shown to improve clinical management (30). A comparative study in the US between a geropsychiatric unit and a general psychiatric unit revealed that patients in the specialized unit who were managed by geriatric psychiatrists, received better and more complete laboratory assessments including diagnostic assessments, routine cognitive assessments, and side effect monitoring of various psychotropics They also received age-specific aftercare referrals (72). The separation of older patients with delirium or dementia who show aggressive or disturbing behaviour from other inpatients is another advantage of geropsychiatric units (29).

Additional benefits of geropsychiatric units highlighted in the literature include fewer transfers to other acute units (34,73), lower risks of adverse events such as falls (74,75), cost-effectiveness (30,31,75), improvement in aggressive behaviour and emotional wellbeing (30) lesser use of physical restraints and better rates of recovery (34,74).

2.3 Challenges of Geropsychiatric Units

Despite the numerous benefits of geropsychiatric units, the establishment of such a unit also comes with its own challenges and complexities. Porello et al, (1995) described a program in a general hospital in Massachusetts, USA where a geriatric medical/psychiatric unit was established. While the benefits of the units were numerous in terms of patient management, outcomes and low-start-up costs, staff development and recruitment were disclosed as major challenges in the operation of the unit (30). Since the process of care in geropsychiatric units involves multidisciplinary teams and an integrated approach to care, recruiting new skilled and trained professionals with required expertise who are willing to work exclusively with older psychiatric patients may be difficult. Similar concerns were raised by many staff of geropsychiatric units across the US in a survey that aimed to understand the challenges faced (30,32). In already established wards, training older nursing staff and adapting program activities to include age-appropriate practices have also been recognized as challenges (74).

Another challenge as emphasized Hanna and colleagues, (2007) also stems from the multidisciplinary process of care of the unit. In the event that members of the team of care providers do not agree on the most suitable plan for the patients perhaps, due to limited funding or differing opinions, the process of care might become stressful for both patient and their family or caregivers. In addition, the authors acknowledge the high demand and stigma associated with such units. Older patients with psychiatric illness require complex and specialized care therefore, the

concentration of such specialized needs may overextend nursing and other staff or care providers in the unit. This may also lead to a "de-skill" in the other general wards if these patients with more complex needs are removed (16,29,32). Furthermore, the potential stigma of a geriatric and psychiatric ward must be considered since these conditions are generally stigmatized (29).

Though establishments of geropsychiatric units have been shown to be cost-effective in the long-term (30,31,75) and may require low-start-up costs, the financial implications of architectural renovations, development of a suitable, safe, and spacious environment, as well as age-inclusive training, programs and practices may be expensive and difficult to implement in low-resource settings or in facilities without funding (30).

Other challenges noted in the literature are associated with the discharge planning arrangements particularly the inadequate capacity in long-term care facilities or unavailability of facilities that support disturbed or agitated patients (32). Similar concerns were noted decades ago by Tulloch (1986) in Australia (76). In countries such as the US where healthcare is mainly financed out-of-pocket or via insurance programs, payment issues may further complicate and limit choice of suitable placements (74).

2.4 Use of Administrative Data in Clinical Research

In recent years, health research has increasingly made use of administrative databases which contain large storage of data routinely collected in health institutions. These data often include information on healthcare utilization including admissions, outpatient care, diagnosis, prescriptions, and medical services. (77). Administrative data, also known as secondary data, is analyzed retrospectively in research. Secondary data is used to answer questions, generate, and prove (or disprove) hypotheses that may otherwise be unfeasible to study using traditional methods of data collection. There are numerous advantages of using administrative data in health and

clinical research. These include ready availability, heterogeneity, lesser costs, and the possibility of data linkage. Large volumes of data collected over extended periods are also useful for observing trends in a population. Because of the large sample size and larger demographic coverage provided by administrative databases, they are useful in generalizability of study findings. In particular, administrative data is useful for research on outcomes such as mortality, readmissions, lengths of stay as well as research on quality of healthcare, economics, and inequities present in healthcare (77,78).

The use of administrative data in research also comes with its drawbacks. Access to such data sources may vary from a few days to years making analysis sometimes unfeasible. In using secondary data in health research, since data collection precedes determination of research question, it is often harder to control for confounding or avoid misclassification bias especially when data is obtained from various sources. Relevant clinical information may also be absent in such databases which mainly rely on coding standards. As a result, causal relationships are difficult to prove using secondary data (77,79). There is notable research on the inaccuracy involved in the use of administrative data for adverse events research (80). There are also concerns about the validity and reliability expressed by several researchers and clinicians (78). The quality of administrative data is often assessed by its completeness, correctness, and consistency (77).

Regardless of these disadvantages, administrative databases are a great source of health information which can be leveraged for research purposes. They allow the evaluation of trends in healthcare from the perspective of the real-world and can influence evidence-based decision making in clinical settings and policy making. Despite their use as the gold standard to measure clinical outcome, their use requires in-depth evaluation of coding systems, knowledge of population under study and the application of appropriate statistical methods (77,80,81). In mental

health research, several studies have evaluated the use of administrative data for psychiatric disorders by estimating the sensitivity, specificity, and predictive values of diagnostic information found in these databases compared to review of medical charts. Many of these studies support the use of administrative databases for monitoring these disorders (82). However, there is caution about the variability in accuracy for mental diagnoses and it is often advised that each data source undergo individual assessment and validation (83). Many Canadian administrative databases undergo routine assessments. A Canadian study conducted across five provinces to assess the validity of administrative databases found that provincial and territorial administrative data provides a feasible and reliable source for the surveillance of psychiatric disorders (84).

Administrative data used in clinical research includes electronic health records or electronic medical records, hospital discharge data, claims data patient or disease registries, health surveys and clinical trial registries (85,86). In Canadian hospitals and acute care settings, electronic health records (EHR) are found in two major datasets, the Discharge Abstract Database (DAD) and the Admissions, Discharge and Transfer (ADT) Database. While the ADT provides real-time information about a patient's status regarding admissions, transfers, discharges from the moment of arrival to departure, the DAD collects data from acute care facilities or from the health authorities in the various provinces and territories except Quebec. The DAD captures administrative, clinical, and demographic information on hospital discharge and contains diagnostic procedures and codes standardized by the Canadian Institute of Health Information (87–89). Both databases represent the entire Hospital Information System (HIS) and profiles of inpatients (87).

In a study conducted by the CIHI to evaluate the quality of coding data contained in Discharge Abstract Database at the provincial and territorial level in 2007-2008, for the province of

Saskatchewan, the completeness of reporting diagnoses and interventions was estimated to be about 78% and 91% respectively compared to a national average of 80% and 92%. Correctness of diagnoses and interventions was 89% and 95% respectively against a national average of 88% and 94%. The consistency of diagnoses coding according to ICD-CA codes and ICD-CA category was also estimated to be 88% and 95% respectively compared to a national average of 87% and 95%. The agreement rates on diagnosis type and significance were also assessed to be 81% and 89% respectively against 80% and 88% in Canada (90).

The completeness and correctness of information in the DAD in comparison with chart reviews have been used to assess the sensitivity and positive predictive value of the DAD. Between 2007 and 2008, Saskatchewan had estimates of 78% and 89% versus the national average of 80% and 88% respectively with respect to diagnoses information and coding standards (90). Between 2009 and 2010, there were improvements in coding standards and similar results were achieved. Saskatchewan's DAD had a sensitivity and positive predictive value of 77% and 86% compared to 79% and 84% respectively (91). These findings show that provincial data from the DAD is fit for use for research and despite complexities of medical conditions and presentations, there is general agreement on the coding standards in the database (91)

The ADT database is more dynamic in nature and contains live information based on the hospital's EHR. It is quick to identify changes in a patient's status and is therefore useful for quick interventions. It is also useful for core healthcare administrative functions. Some of the benefits of the ADT database include its ability to identify requirements and provide specifications for exchanging demographic and administrative data for patient encounters and enable exchange of administrative data to describe resources involved in delivery of health services (92). Recent research has utilized the ADT database to predict clinical outcomes such as readmissions (88).

More recently, a study conducted in Ontario sought to assess the quality of a broad range of administrative, clinical data (including the DAD and ADT database) in 7 hospitals over a period of 8 years using quality indicators found that overall, the database had an accuracy of 98 -100%, sensitivity of 95% - 100%, predictive positive value of 93% - 100%. There were also few data quality issues relating to data extraction and transfer (93). At this time of this study, there are no known quality assessment checks of the ADT database in Saskatchewan.

2.5 Conclusions

The society at large, is youth-oriented (94). In many hospitals, care for older adults is not distinguished from that of younger adults and care of the elderly is extrapolated from the traditional model of care (95). As a result, health services are better suited to cater to the needs of younger patients compared to the elderly. With the aging population in Canada, there is a need for improved services for Canadian seniors with mental illnesses and addressing these needs is a public health concern and priority (96). It is important to assess the quality of care provided to older patients with mental illnesses in acute care by highlighting the differences in outcomes among older and younger age-groups as well as identifying predictors of length of stay and delayed discharge. Presently, there is limited research on this in acute care facilities in Saskatchewan, and this study aims to fill this gap using routinely collected administrative data.

Chapter 3: Methods

3.1 Study Design and Study Setting

The objective of this study was to assess and examine the quality of care received by older adults in a general psychiatric unit. Specifically, the study aimed to answer the following research questions:

1) Are there differences in in-patient outcomes such as length of stay, discharge disposition, alternate level of care, and deaths between age-groups in a general psychiatric unit?
    a) Do these outcomes differ between older patient admissions patients and other admissions in a general psychiatric unit?
    b) Do these outcomes differ within older patient admissions in a general psychiatric unit?
2) What factors influence length of stay delayed discharges among all admissions and older patient admissions in a general psychiatric unit in Royal University Hospital?

To answer these questions, a retrospective cross-sectional series design was employed. This involved the analysis of routinely collected administrative health data for in-patients admitted in the general psychiatric unit (Dube Centre), Royal University Hospital (RUH), Saskatoon, Saskatchewan.

3.2 Data Source and Collection

This study utilized routinely collected administrative data from the Admissions, Discharge, and Transfer Database of the Saskatchewan Health Authority. This database contains administrative, clinical, and demographic information on hospital admissions, discharges, and transfers in acute care facilities.

De-identified, in-patient records of admissions between 2012 and 2019 into Royal University Hospital's psychiatric unit (Dube Centre) were included in the study. The variables used in the study and their corresponding descriptions are available (Appendix B).

3.3 Study Participants

In-patient admissions for psychiatric reasons in the general psychiatric unit, RUH, Saskatoon between 2012 and 2019 were included in the study to examine the differences in outcomes and the factors that influence length of stay and delayed discharges. All observations were retained for descriptive analysis. Few observations were dropped for bivariate and regression analysis. These observations were dropped based on the characteristic lengths of stay of diagnoses causing outliers. Details are available in Chapter 4: Results.

3.4. Data Variables

Most variables were recoded to facilitate analysis. In the dataset, each patient was assigned a unique ID. This ID allowed individual records within and across years to be linked where necessary. Therefore, a variable, "Admission type", was created to indicate whether each admission was an index admission or a readmission. Another variable, "30-day Readmission" was created to indicate whether each readmission occurred within 30 days of prior discharge.

The sex of each admission was described as either male or female, as in the original dataset. Though originally presented both as a continuous variable and a categorical variable with two groups (18-64 years; 65+ years) in the dataset, age was recoded into six groups (18-35 years; 36-55 years; 56-64 years; 65-74 years; 75-85 years; 85+ years). Patient's address at admission was given as the three digits of the postal code. This was recoded into "Urban" and "Rural" as well as into "Saskatchewan Province" and "Other Province".

In the Admissions, Discharge, and Transfer Database, each admission can have up to 25 diagnosis codes. In the dataset, diagnosis codes are originally labelled as follows:

- M for “Most Responsible Diagnosis”
- 1 for “Pre-admit Comorbidities”
- 2 for “Post-admit Comorbidities’
- 3 for “Secondary Diagnosis”
- 5 for “Admitting Diagnosis”
- 6 for “Proxy Most Responsible Diagnosis”
- W, X, Y for “Service Transfer Diagnosis”
- 9 for “External Injury Code”

In this study, only diagnostic codes M, 1, 2, 3, 9 were utilized. Each admission has only one most responsible diagnosis (M), hence, this was utilized as the main diagnosis for all diagnosis. Although all observations for the main diagnoses were described in univariate analysis, some diagnoses were excluded for bivariate analysis and regression models because of their very lengthy lengths of stay which could increase error variance and reduce the model’s ability to describe associations at the population level. Details on these observations are available in Chapter 4: Results. In regression analysis, the main diagnosis was categorized into the following variables:

- Organic, including symptomatic, mental disorders (F00-F09)
- Mental and behavioural disorders due to psychoactive substance use (F10-F19)
- Schizophrenia, schizotypal and delusional disorders (F20-F29)
- Mood [affective] disorders (F30-F39)
- Other Mental and Behavioural Disorders (all other diagnoses belonging to the ICD-10 CA Chapter F and excluding the diagnoses listed above)
- Non-Mental and Behavioural Disorders (all other diagnoses excluding diagnoses from the ICD-10 CA Chapter ‘F’)

The number of pre- and post-admit comorbidities for each admission was also summed to obtain the continuous variable "Number of comorbidities". Another variable, "Comorbidities" was developed as a dichotomous variable to indicate the presence (1 or more comorbidities) and absence (no comorbidities) of comorbidities. Likewise, the number of secondary diagnoses and external injury for each admission was also summed to obtain the continuous variables "Number of secondary diagnoses" and "Number of external injuries" respectively. Dichotomous variables, "Secondary diagnosis" and "external injury" were also encoded to indicate the presence and absence of secondary diagnosis and external injury respectively.

Several units were originally presented in the dataset as the admit and discharge nursing units, however, these units were dichotomized into "Dube Centre" and "Other" since most admissions and discharges were from the Dube Centre. Discharge Disposition refers to the place or outcome of discharge after admission from the facility. The table below describes the original categories of discharge disposition in the dataset and the recoded categories:

Original Variable Category	**Recoded Variable Category**
Absent without leave	Discharge without approval
Did not return from pass/leave	Discharge without approval
Left against medical approval	Discharge without approval
Discharged home without support	Discharge home without formal support
Discharged home with support	Discharge home with formal support
Transferred to acute care inpatient facility	Discharge to health facility
Transfer to emergency department or department of surgery at another facility	Discharge to health facility
Transfer to group or supportive living	Discharge to care facility

Transfer to residential care	Discharge to care facility
Died in facility	Died in facility

Discharge with support was described as discharge to a private home, condominium, or apartment with community support at home or referral to services. This did not include discharge to group or supportive living or routine discharge services such as instructions to return to their doctor or specialist. Discharge without approval described patients who left against medical advice, left without receiving a pass or leave or did not return from a pass or leave.

Another variable, "Institution To", was included to describe the place where patients were transferred (where applicable). This variable was described in descriptive analysis. Overall lengths of stay and length of stay in alternate level of care were originally presented as a continuous variable in days, but were recoded into quintiles to properly describe observations, conduct cross-tabulations, and bivariate analysis. Alternate level of care designation was also presented as a dichotomous variable of "Yes" or "No".

3.5 Data Analysis

3.5.1 Descriptive and Bivariate Analysis

Descriptive analysis was used to describe all variables available in the dataset. This was done by calculating the means, standard deviations, frequencies, percentages, percentiles, and cross-tabulations. To examine the differences in outcomes of length of stay, alternate level of care and alternate level of care days, discharge disposition and deaths, bivariate analysis was conducted using Pearson Chi-square test, Fisher's exact test and ANOVA statistics. For each outcome, bivariate analysis was conducted between young and old age-groups, and among older age groups.

3.5.2 Regression Analysis

Linear and logistics regression model building techniques were conducted to explore the factors that influence length of stay and ALC designation for all admissions and for older patient admissions. Bivariable models were initially used to select significant variables to be included in the final model. Thereafter, multivariable models including all significant variables were developed and adjusted based on level of significance. Regression models were also assessed for the presence of interaction. Interaction was assessed by including product terms of the variables considered to be biologically plausible or based on previous research into the model. Both confidence intervals and p-values were used to assess significance of interaction terms. Significant interactions were also explored graphically and included in the regression diagnostics.

The goal of regression is to produce the best-fitting, most parsimonious, and biologically plausible model. In linear regression models, the beta coefficient was used to indicate the strength of the relationship between independent variables and dependent variable (length of stay). After several model building strategies and iterations (Appendix C), postestimation diagnostics including the adjusted R-square, F-test, residual and outlier analysis, normality analysis, and homoscedasticity analysis were used to determine the suitability of the final multivariable linear regression model.

In logistic regression, the beta coefficient was exponentiated to obtain the odds ratio which was used to estimate the strength of the relationship between independent variables and the dependent variable (ALC designation). Similarly, following several model building strategies and iterations (Appendix C) several model building strategies and iterations, postestimation diagnostics including as model specification test and the Homer-Lemeshow goodness-of-fit test were used to estimate the suitability of the final multivariable logistic regression model. A p-value greater than 0.05 was indicative of model suitability.

In order to perform these analyses, data was explored and analyzed using Stata software (v.17) (97). The Stata software was used for univariate, bivariate, and regression analyses.

3.6 Ethical Considerations

Ethical approval for secondary use of data was sought from the University of Saskatchewan Research Ethics Committee. Operational approval was also obtained from the Saskatchewan Health Authority. To ensure that patients' identities are kept confidential, only de-identified patient records were used for the study and data was encrypted. Copies of these documents are available (Appendix A).

3.7 Knowledge Translation

Integrated knowledge translation approaches were taken to ensure that this study was useful for the knowledge users. Stakeholder engagement meetings were held before and after the study was conducted. These meetings involved the principal investigators of this study as well as the team of care providers of the Dube Centre at RUH, Saskatoon, Saskatchewan. The first meeting was conducted to guide the research focus and objectives. The second meeting was a focus group discussion in which the results from the study were presented to the care providers to obtain feedback and discuss recommendations and possible policy implications. Excerpts from this meeting are included in the discussion.

Chapter 4: Results

4.1 Descriptive Analysis

The following describes de-identified, in-patient records of patient admissions between 2012 and 2019 into Royal University Hospital's in-patient psychiatric unit (Dube Centre). Data was obtained from the Admissions, Discharge, and Transfer Database of the Saskatchewan Health Authority. All variables and their corresponding descriptions are available (Appendix B). In this database,

patient demographic data is collected at admission. For patients who have been admitted previously, this demographic data is verified and updated at readmission. In addition, demographic and clinical data is often verified and updated at time of discharge.

In all, 5,373 admissions were recorded during the study period. This included 2,876 index admissions and 2,497 readmissions. Index admissions refer to the first admission for a patient during the study period. Readmissions were subsequent admission into the hospital during the study period. Table 4.1 presents the descriptive characteristics of the study population stratified by age groups.

Table 4. 1- Population characteristics, all psychiatric admissions, Royal University Hospital, Saskatoon, 2012-2019 (n=5,373)

Population Characteristics	**(18 – 64) years (n = 5,020)**	**(65+) years (n = 353)**	**Total (n = 5,373)**
Sex			
• Female	2,335 (46.5%)	216 (61.2%)	2,551 (47.5%)
• Male	2,685 (53.5%)	137 (38.8%)	2,822 (52.5%)
Address			
• Saskatchewan	4,931 (98.2%)	350 (99.1%)	5,281 (98.3%)
• Other Province	79 (1.6%)	3 (0.9%)	82 (1.5%)
• Unknown	10 (0.2%)	0	10 (0.2%)
Rural/ Urban			
• Rural	1,079 (21.5%)	85 (24.1%)	1,164 (21.7%)
• Urban	3,931 (78.3%)	268 (75.9%)	4,199 (78.1%)
• Unknown	10 (0.2%)	0	10 (0.2%)
ICD-10 CA Diagnosis			
• Organic disorders	32 (0.6%)	50 (14.2%)	82 (0.8%)
• Substance abuse	778 (15.5%)	5 (1.4%)	783 (1.5%)
• Schizophrenia	1,395 (27.8%)	84 (23.8%)	1,479 (27.5%)
• Mood disorders	1,913 (38.1%)	170 (48.2%)	2,083 (38.8%)
• Other Mental and Behavioural Disorders	868 (17.3%)	37 (10.5%)	905 (16.8%)
• Non- Mental and Behavioural Disorders	34 (0.7%)	7 (2.0%)	41 (0.8%)
Comorbidities			
• No	2,176 (43.5%)	171 (48.4%)	2,347 (43.7%)

• Yes	2,844 (56.5%)	182 (51.6%)	3,026 (56.3%)
Secondary Diagnosis			
• No	3,837 (76.4%)	234 (66.3%)	4,071 (75.8%)
• Yes	1183 (23.6%)	119 (33.7%)	1,302 (24.2%)
External Injuries			
• No	4,723 (94.1%)	329 (93.2%)	5,052 (94.0%)
• Yes	297 (5.9%)	24 (6.8%)	321 (6.0%)
Discharge Disposition			
• Without formal support[&]	4,111 (81.9%)	216 (61.2%)	4,327 (80.5%)
• With formal support[&]	223 (4.4%)	67 (19.0%)	290 (5.4%)
• Care home	187 (3.7%)	38 (10.8%)	225 (4.2%)
• Health facility	232 (4.6%)	25 (7.1%)	257 (4.8%)
• Without approval[&]	260 (5.2%)	2 (0.6%)	262 (4.9%)
• Died	7 (0.1%)	5 (1.4%)	12 (0.2%)
30-day admission			
• No	4,485 (89.3%)	336 (95.2%)	4,821 (89.7%)
• Yes	535 (10.7%)	17 (4.8%)	552 (10.3%)
Length of Stay			
• 1st Quintile	1,287 (25.6%)	23 (6.5%)	1.310 (24.4%)
• 2nd Quintile	949 (18.9%)	28 (7.9%)	977 (18.2%)
• 3rd Quintile	922 (18.4%)	48 (13.6%)	970 (18.1%)
• 4th Quintile	974 (19.4%)	93 (26.4%)	1,067 (19.9%)
• 5th Quintile	888 (17.7%)	161 (45.6%)	1,049 (19.5%)
ALC Designation			
• No	4,931 (98.2%)	323 (91.5%)	5,254 (97.8%)
• Yes	89 (1.8%)	30 (8.5%)	119 (2.2%)
ALC LOS Quintiles			
• 1st Quintile	20 (22.5%)	6 (20.0%)	26 (21.9%)
• 2nd Quintile	11 (12.4%)	11 (36.7%)	22 (18.5%)
• 3rd Quintile	18 (20.2%)	6 (20.0%)	24 (20.2%)
• 4th Quintile	19 (21.4%)	4 (13.3%)	23 (19.3%)
• 5th Quintile	21 (23.6%)	3 (10.0%)	24 (20.1%)

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

4.1.1 Age and Sex

Of the index admissions, 1,362 patients (47.3%) were female and 1,514 (52.7%) were male. The mean patient age was 38 years (± 16.2 years) while the modal and median ages were 18 and 35 years respectively (range: 18-99 years). Of all admissions, including both index and readmissions,

2,551 admissions (47.5%) were female patients and 2,882 (52.5%) were males. Figure 4.1 shows the sex distribution of all admissions. The mean age of admission was 38 years (± 15.8 years). Most admissions (n = 5,020; 93.4%) were patients between the ages of 18 – 64 years; others were patients aged 65 years and older, (n= 353; 6.6%) (Table 4.2). When these two age-groups are further divided, approximately half of admissions were by patients aged 18 – 35 years (51.2%) as shown in Figure 4.2.

Figure 2- Sex distribution, all psychiatric admissions, Royal University Hospital, Saskatoon, 2012-2019 (n=5,373)

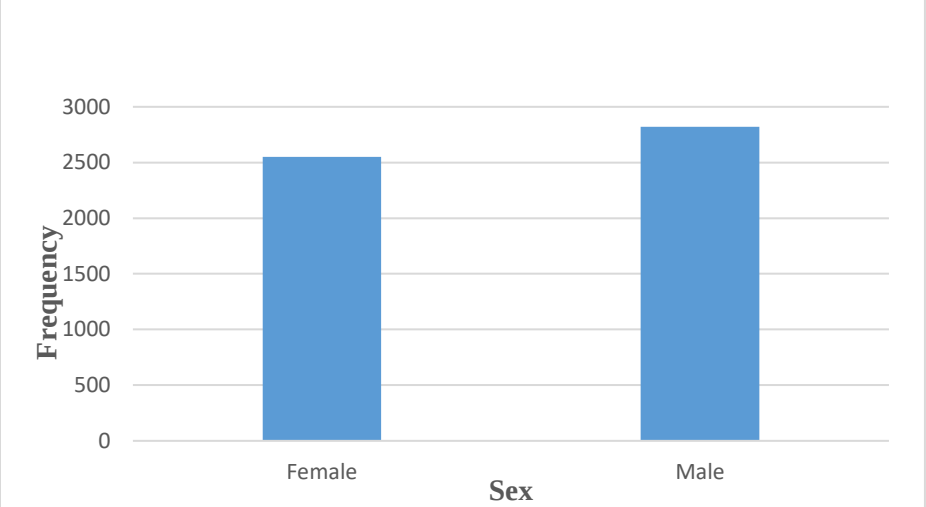
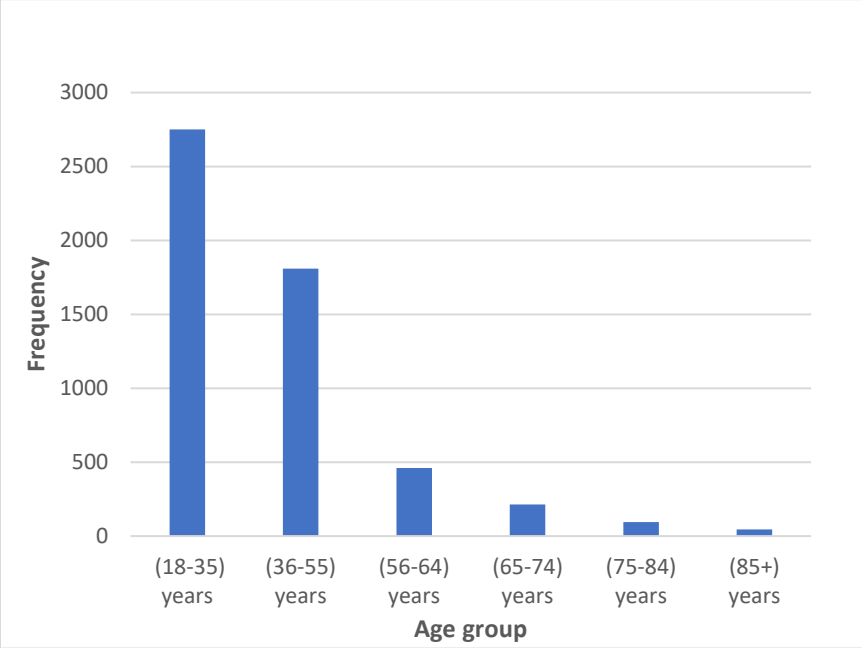


Table 4. 2- Age distribution, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

Age groups	Frequency	Percentage (%)
(18-64) years	5,020	93.4%
(65+) years	353	6.6%
Total	**5,373**	**100%**

Figure 3- Age group distribution, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)



Among patients aged 18 – 64 years, about 47% of admissions were females whiles 53% were males. However, among those aged 65 years and older, 61% were females and 39%, males. (Table 4.3)

Table 4. 3- Age and sex distribution, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Sex n (%)		
Age	**Female**	**Male**	**Total**
(18-64) years	2,335 (46.5%)	2,685 (53.5%)	5,020 (100%)
(65+) years	216 (61.2%)	137 (38.8%)	353 (100%)
Total	**2,551 (47.5%)**	**2,822 (52.5%)**	**5,373 (100%)**

4.1.2 Patients' Address

According to Statistics Canada, rural areas are small towns, villages and other populated areas with less than 1,000 population according to the census. Urban areas, on the other hand, are areas with at least 1,000 population and a density of 400 or more people per square kilometer (98,99). The majority of admissions (n= 5,281; 98.3%) were patients who identified Saskatchewan (postal code beginning with S) as their address. Of these, 1,147 (21.7%) were from rural areas, and 4,134 (78.3%) were from urban areas. There were also patients from other provinces and territories such as Newfoundland and Labrador, Nova Scotia, Quebec**,** Ontario, Manitoba, Alberta, British Columbia, and the Northwest territories and Nunavut (n=82; 1.5%). Patient admissions from rural areas in these provinces were 17 (20.7%) while 65 (79.3%) were from urban locations. Of all admissions, 10 observations (0.2%) were unknown.

4.1.3 Main Diagnosis

The main diagnosis or the most responsible diagnosis for each admission was the diagnosis attributed to the longest stay by the most responsible physician. All diagnoses were grouped according to the chapters and sub-chapters in the ICD-10 CA guidelines as shown in table 4.4. Nearly all admissions in the unit (n= 5,332; 99.2%) had main diagnosis for mental and behavioural disorders. Other admissions were for diagnoses relating to endocrine, nutritional, and metabolic diseases, nervous disorders, pregnancy and childbirth related disorders, congenital malformations, abnormal clinical findings, injury and poisoning, and factors influencing health status (Table 4.5). Of admissions due to mental and behavioural disorders, more than one-third were attributable to mood disorders (n= 2083; 39.1%), while schizophrenia accounted for 27.7%. Disorders due to psychoactive substance use was the third major diagnosis, accounting for 14.7% of admissions (Table 4.6).

Table 4. 4- ICD-10 CA code descriptions, chapters, and sub-chapters of all diagnoses of psychiatric inpatients, Royal University Hospital, Saskatoon 2012-2019

ICD-10 CA Chapter	Description	Sub-Chapter Description
E	Endocrine, nutritional, and metabolic diseases (E00-E90)	Disorders of other endocrine glands (E20-E35)
F	Mental and behavioural disorders (F00-F99)	Organic, including symptomatic, mental disorders (F00-F09)
		Mental and behavioural disorders due to psychoactive substance use (F10-F19)
		Schizophrenia, schizotypal and delusional disorders (F20-F29)
		Mood [affective] disorders (F30-F39)
		Neurotic, stress-related and somatoform disorders (F40-F48)
		Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)
		Disorders of adult personality and behaviour (F60-F69)
		Mental retardation (F70-F79)
		Disorders of psychological development (F80-F89)
		Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)
		Unspecified mental disorder (F99)
G	Diseases of the nervous system (G00-G99)	Extrapyramidal and movement disorders (G20-G26)
		Other degenerative diseases of the nervous system (G30-G32)
O	Pregnancy, childbirth, and the puerperium (O00-O99)	Other obstetric conditions, not elsewhere classified (O94-O99)
Q	Congenital malformations, deformations, and chromosomal abnormalities (Q00-Q99)	Other congenital malformations (Q80-Q89)
R	Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)
T	Injury, poisoning, and certain other consequences of external causes (S00-T98)	Poisoning by drugs, medicaments, and biological substances (T36-T50)

		Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)
Z	Factors influencing health status and contact with health services (Z00-Z99	Persons encountering health services for examination and investigation (Z00-Z13)
		Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)
		Persons encountering health services in other circumstances (Z70-Z76)

Table 4. 5- Most responsible diagnosis distribution, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

ICD-10 CA Diagnosis	**Frequency**	**Percentage (%)**
Endocrine diseases (E00-E90)	1	0%
Mental and behavioural disorders (F00-F99)	5332	99.2%
Nervous System Disorders (G00-G99)	12	0.2%
Pregnancy & Childbirth Related (O00-O99)	1	0.2%
Congenital malformations (Q00-Q99)	3	0.1%
Abnormal Clinical & Lab findings(R00-R99)	16	0.3%
Injury & Poisoning (S00-T98)	5	0.1%
Factors influencing health status (Z00-Z99	3	0.1%
Total	**5,373**	**100%**

Table 4. 6- Distribution of mental and behavioural admissions, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,332)

Mental and behavioural disorders (ICD-10 CA Chapter F)	**Frequency**	**Percentage (%)**
Mood [affective] disorders (F30-F39)	2083	39.1%
Schizophrenia, schizotypal and delusional disorders (F20-F29)	1479	27.7%
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	783	14.7%

Neurotic, stress-related and somatoform disorders (F40-F48)	527	9.9%
Disorders of adult personality and behaviour (F60-F69)	217	4.1%
Organic, including symptomatic, mental disorders (F00-F09)	82	1.5%
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	76	1.4%
Disorders of psychological development (F80-F89)	54	1%
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	27	0.5%
Mental Retardation (F70-F79)	2	0%
Unspecified mental disorder (F99)	2	0%
Total	**5,332**	**100%**

When diagnosis is stratified according to age group for index admissions, older adults aged 65 and older are more represented in organic, symptomatic mental disorders compared to those between 18 and 64 years (Table 4.7). The same pattern is observed for all admissions (Table 4.8).

Table 4. 7- Diagnosis according to age groups, psychiatric index admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 2,876)

	Age groups n (%)						
ICD-10 CA Diagnosis	**(18 – 35) years**	**(36 – 55) years**	**(56 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
Organic, including symptomatic, mental disorders (F00-F09)	6 (10.5%)	4 (7.0%)	8 (14.0%)	16 (28.1%)	13 (22.8%)	10 (17.5%)	**57 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	286 (64.8%)	130 (29.5%)	22 (5.0%)	2 (0.5%)	1 (0.2%)	0 (0%)	**441 (100%)**
Schizophrenia, schizotypal and delusional disorders (F20-F29)	346 (50.2%)	224 (32.5%)	65 (9.4%)	34 (4.9%)	14 (2.0%)	6 (0.9%)	**689 (100%)**
Mood [affective] disorders (F30-F39)	512 (43.9%)	421 (36.1%)	132 (11.3%)	63 (5.4%)	27 (2.3%)	12 (1.0%)	**1,167 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	160 (48.2%)	124 (37.3%)	25 (7.5%)	17 (5.1%)	6 (1.8%)	0 (0%)	**332 (100%)**

Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	38 (73.1%)	9 (17.3%)	4 (7.7%)	1 (1.9%)	0 (0%)	0 (0%)	**52 (100%)**
Disorders of adult personality and behaviour (F60-F69)	38 (59.4%)	23 (35.9%)	1 (1.6%)	2 (3.1%)	0 (0%)	0 (0%)	**64 (100%)**
Mental retardation (F70-F79)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Disorders of psychological development (F80-F89)	26 (83.9%)	4 (12.9%)	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	**31 (100%)**
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	15 (83.3%)	3 (16.7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**18 (100%)**
Extrapyramidal and movement disorders (G20-G26)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	**1 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	0 (0%)	2 (33.3%)	0 (0%)	3 (50.0%)	1 (16.7%)	0 (0%)	**6 (100%)**
Other congenital malformations (Q80-Q89)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	6 (54.5%)	4 (36.4%)	0 (0%)	0 (0%)	0 (0%)	1 (9.1%)	**11 (100%)**
Poisoning by drugs, medicaments, and biological substances (T36-T50)	3 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**3 (100%)**
Persons encountering health services for examination and investigation (Z00-Z13)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Persons encountering health services in other	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**

circumstances (Z70-Z76)							
Total	**1,438 (50.0%)**	**950 (33.0%)**	**258 (9.0%)**	**139 (4.8%)**	**62 (2.2%)**	**29 (1.0%)**	**2,876 (100%)**

Table 4. 8- Diagnosis according to age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,343)

	Age groups n (%)						
ICD-10 CA Diagnosis	**(18 – 35) years**	**(36 – 55) years**	**(56 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
Disorders of other endocrine glands (E22)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Organic, including symptomatic, mental disorders (F00-F09)	10 (12.2%)	12 (14.6%)	10 (12.2%)	20 (24.4%)	16 (19.5%)	14 (17.1%)	**82 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	492 (62.8%)	254 (32.4%)	32 (4.1%)	4 (0.5%)	1 (0.1%)	0 (0%)	**783 (100%)**
Schizophrenia, schizotypal and delusional disorders (F20-F29)	793 (53.6%)	477 (32.3%)	125 (8.5%)	54 (3.6%)	21 (1.4%)	9 (0.6%)	**1,479 (100%)**
Mood [affective] disorders (F30-F39)	914 (43.9%)	759 (36.4%)	240 (11.5%)	104 (5.0%)	46 (2.2%)	20 (1.0%)	**2,083 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	259 (49.2%)	197 (37.4%)	40 (7.6%)	21 (4.0%)	9 (1.7%)	1 (0.2%)	**527 (100%)**
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	55 (72.4%)	14 (18.4%)	5 (6.6%)	2 (2.6%)	0 (0%)	0 (0%)	**76 (100%)**
Disorders of adult personality and behaviour (F60-F69)	136 (62.7%)	74 (34.1%)	3 (1.4%)	4 (1.8%)	0 (0%)	0 (0%)	**217 (100%)**

Mental retardation (F70-F79)	1 (50.0%)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**2 (100%)**
Disorders of psychological development (F80-F89)	49 (90.7%)	4 (7.4%)	1 (1.9%)	0 (0%)	0 (0%)	0 (0%)	**54 (100%)**
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	20 (74.1%)	7 (25.9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**27 (100%)**
Unspecified mental disorder (F99)	1 (50.0%)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**2 (100%)**
Extrapyramidal and movement disorders (G20-G26)	1 (50.0%)	0 (0%)	0 (0%)	1 (50.0%)	0 (0%)	0 (0%)	**2 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	0 (0%)	2 (20.0%)	3 (30.0%)	3 (30.0%)	1 (10.0%)	1 (10.0%)	**10 (100%)**
Other obstetric conditions, not elsewhere classified (O94-O99)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Other congenital malformations (Q80-Q89)	3 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**3 (100%)**
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	10 (62.5%)	5 (31.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**16 (100%)**
Poisoning by drugs, medicaments, and biological substances (T36-T50)	3 (75.0%)	1 (25.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**4 (100%)**
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	1 (100%)	0 (0%)	0 (0%	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Persons encountering health services for examination and investigation (Z00-Z13)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**

Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Persons encountering health services in other circumstances (Z70-Z76)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Total	**2,750 (51.2%)**	**1,810 (33.7%)**	**460 (8.6%)**	**213 (4.0%)**	**94 (1.8%)**	**46 (0.9%)**	**5,373 (100%)**

4.1.4 Comorbidities

According to the Canadian Institute of Health Information ICD-10 CA Coding Standards, a comorbidity is a condition that coexists in addition to the most responsible diagnosis at the time of admission or develops subsequently after admission and meets at least one of the following criteria of significance: requires treatment beyond maintenance of the pre-existing condition, increases the length of stay by at least 24 hours and/or significantly affects the treatment received (100). A list of codes used to define comorbidities according to Statistics Canada is included in Appendix B. Comorbidities in the Discharge Abstract Database (DAD) are coded as 1 for pre-admit comorbidities or 2 for post-admit comorbidities (100). In this study, both pre-admit and post-admit comorbidities for all admissions were grouped together. Of all admissions, 3,026 (43.7%) had at least one comorbidity while 2,347 (56.3%) admissions had none (Table 4.9). The highest number of comorbidities per admission was 13, however, the average number of comorbidities was similar across the age groups among those with at least one comorbidity (Table 4.10).

Table 4. 9- Comorbidities according to age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,343)

	Presence of Comorbidities during admission n (%)		
Age groups	**No**	**Yes**	**Total**

(18 – 35) years	1,126 (41.0%)	1,624 (59.1%)	**2,750 (100%)**
(36 – 55) years	840 (46.4%)	970 (53.6%)	**1,810 (100%)**
(56 – 64) years	210 (45.7%)	250 (54.4%)	**460 (100%)**
(65 – 74) years	103 (48.4%)	110 (51.6%)	**213 (100%)**
(75 – 84) years	49 (52.1%)	45 (47.9%)	**94 (100%)**
(85+) years	19 (41.3%)	27 (58.7%)	**46 (100%)**
Total	**2,347 (43.7%)**	**3,026 (56.3%)**	**5,373 (100%)**

Table 4. 10- Number of comorbidities summary by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 3,026)

	Comorbidities		
Age	**Mean (Range)**	**Standard Deviation**	**Frequency**
(18 – 35) years	2 (1 – 11)	1.2	1,624
(36 – 55) years	2 (1 – 13)	1.2	970
(56 – 64) years	2 (1 – 6)	1.0	250
(65 – 74) years	2 (1 – 5)	1.0	110
(75 – 84) years	2 (1 – 5)	1.1	45
(85+) years	2 (1 – 6)	1.4	27
Total	**2**	**1.2**	**3,026**

4.1.5 Secondary Diagnosis

A secondary diagnosis is a condition for which a patient may or may not have received treatment that has been assigned an ICD-10 CA code but does not meet any of the criteria of significance previously outlined (100). Three-quarters of all admissions had no secondary diagnoses (n = 4,071; 75.8%) while others (n = 1,302; 24.2%) had at least one (Table 4.11). The highest number of

secondary diagnoses per admission was 8 and the highest average number of secondary diagnoses across all age groups was 2 (Table 4.12).

Table 4. 11- Secondary diagnosis according to age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,343)

	Presence of Secondary Diagnosis during admission n (%)		
Age Group	**No**	**Yes**	**Total**
(18 – 35) years	2,148 (78.1%)	602 (21.9%)	**2,750 (100%)**
(36 – 55) years	1,358 (75.0%)	452 (25.0%)	**1,810 (100%)**
(56 – 64) years	331 (72.0%)	129 (28.0%)	**460 (100%)**
(65 – 74) years	141 (66.2%)	72 (33.8%)	**213 (100%)**
(75 – 84) years	64 (68.1%)	30 (31.9%)	**94 (100%)**
(85+) years	29 (63.0%)	17 (37.0%)	**46 (100%)**
Total	**4,071 (75.8%)**	**1,302 (24.2%)**	**5,373 (100%)**

Table 4. 12- Number of secondary diagnoses summary statistics by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 1,302)

	Secondary Diagnosis		
Age groups	**Mean (Range)**	**Standard Deviation**	**Frequency**
(18 – 35) years	1 (1 – 8)	0.8	602
(36 – 55) years	1 (1 – 4)	0.6	452
(56 – 64) years	1 (1 – 6)	0.9	129
(65 – 74) years	1 (1 – 4)	0.8	72
(75 – 84) years	2 (1 – 5)	0.9	30
(85+) years	2 (1 – 3)	0.7	17
Total	**1**	**0.8**	**1,302**

4.1.6 External Injury

External injury refers to causes of injury, poisoning and adverse events related to morbidity and mortality. Some of the external injuries among the study population during the study period included intentional self-poisoning, accidental poisoning, intentional self-harm, adverse effects in therapeutic use, falls, assaults, and others. The place of occurrence of external injury was either specified or unspecified. Only 6% (n= 321) of all admissions had external injuries (Table 4.13). The highest number of external injuries per admission was 8. Among all age groups, admissions of patients aged between 75 – 84 years had the highest average number of external injuries (Table 4.14).

Table 4. 13- External injury according to age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,343)

	Presence of External Injury during admission n (%)		
Age Group	**No**	**Yes**	**Total**
(18 – 35) years	2,593 (94.3%)	157 (5.7%)	**2,750 (100%)**
(36 – 55) years	1,711 (94.5%)	99 (5.5%)	**1,810 (100%)**
(56 – 64) years	419 (91.1%)	41 (8.9%)	**460 (100%)**
(65 – 74) years	199 (93.4%)	14 (6.6%)	**213 (100%)**
(75 – 84) years	88 (93.6%)	6 (6.6%)	**94 (100%)**
(85+) years	42 (91.3%)	4 (8.7%)	**46 (100%)**
Total	**5,052 (94.0%)**	**321 (6.0%)**	**5,373 (100%)**

Table 4. 14- Number of external injuries summary statistics by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 321)

External Injury			
Age	**Mean (Range)**	**Standard Deviation**	**Frequency**
(18 – 35) years	2 (1 – 8)	1.0	157
(36 – 55) years	2 (1 – 7)	1.1	99
(56 – 64) years	2 (1 – 5)	1.0	41
(65 – 74) years	2 (1 – 4)	1.0	14
(75 – 84) years	3 (1 – 5)	1.6	6
(85+) years	2 (1 – 2)	0.5	4
Total	**2**	**1.1**	**321**

4.1.7 Admit and Discharge Nursing Unit

Nearly all admissions were for psychiatric reasons (99.2%) during the study period and the most responsible physician for all the admissions specialized in psychiatry (100%). As shown in Tables 4.15, most admissions were into (n = 4,811; 89.5%) and discharged from (n = 4799; 89.3%) the in-patient psychiatry unit (Dube Center).

Table 4. 15- Admit and Discharge nursing unit, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

Unit	**Admit**		**Discharge**	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**
Children Emergency Services Unit	1	0%	1	0
5000 Surgery Unit	10	0.2%	5	0.1%
5100 Postpartum Unit	12	0.2%	32	0.6%
5300 Orthopedics Unit	7	0.1%	2	0%
6000 Cardiology/CVS Unit	11	0.2%	3	0.1%
6100 Medicine Unit	2	0%	2	0%
6200 Medicine Unit	54	1.0%	8	0.1%
6300 Neurosciences Unit	8	0.1%	5	0.1%
Antepartum Unit	3	0.1%	0	0

Coronary Care Unit	2	0%	0	0
Clinical Teaching Unit	6	0.1%	1	0%
Direct Admit Unit	1	0%	1	0%
Day Surgery Unit	18	0.3%	75	1.4%
Delivery Unit	1	0%	0	0
In-Patient Psychiatry Unit	4811	89.5%	4799	89.3%
Child In-Patient Psychiatry Unit	9	0.2%	8	0.1%
Electro-Convulsive Therapy Unit	2	0%	43	0.8%
Electro-Convulsive Therapy Unit (Overflow)	1	0%	23	0.4%
Emergency In-Patient Unit	325	6.0%	295	5.5%
Emergency Room Consult Unit	7	0.1%	10	0.2%
Emergency Trauma Unit	0	0	1	0%
Flex 3000 Unit	1	0%	0	0
Intensive Care Unit	24	0.4%	3	0.1%
Mental Health and Minor Assessment Care Unit	38	0.7%	34	0.6%
Post Anaesthetic Care Unit	1	0%	0	0
Patient In-Patient Overflow Unit	17	0.3%	1	0%
Post Anaesthetic Care Unit (Overflow)	1	0%	0	0
Total	**5373**	**100%**	**5373**	**100%**

4.1.8 Discharge Disposition

The majority of patient admissions (n = 4,327; 80.5%) were discharged home without formal support. Others were either discharged with formal support (n = 290; 5.4%), transferred to another health facility (n = 257; 4.8%), transferred to care homes (n = 225; 4.2%) or discharged without approval (n = 262; 4.9%). Less than 1% (n = 12; 0.2%) of admissions resulted in death in the

facility. Table 4.16 shows the frequency distribution of the discharge disposition for all admissions. For patients who were either discharged home with support or transferred to other facilities such as nursing homes, residential care facilities or other health facilities, the institution to and frequency distribution is available (Appendix B).

Table 4. 16- Discharge disposition, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

Discharge Disposition	Frequency	Percentage (%)
Without Formal Support[&]	4327	80.5%
With Formal Support[&]	290	5.4%
Care facility	225	4.2%
Health facility	257	4.8%
Without approval[&]	262	4.9%
Died in Facility	12	0.2%
Total	**5373**	**100%**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

Almost all admissions resulting in discharge home without formal support were of patients aged between 18 and 64 years (95%). Admissions resulting in discharge without approval were mostly those aged between 18 and 64 years (99%) (Table 4.17).

Table 4. 17- Discharge disposition by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Age group n (%)		
Discharge Disposition	**(18 – 64) years**	**(65+) years**	**Total**
Without Formal Support[&]	4,111 (95.0%)	216 (5.0%)	**4,327 (100%)**

With Formal Support[&]	223 (76.9%)	67 (23.1%)	**290 (100%)**
Care facility	187 (83.1%)	38 (16.9%)	**225 (100%)**
Health facility	232 (90.3%)	25 (9.7%)	**257 (100%)**
Without approval[&]	260 (99.2%)	2 (0.8%)	**262 (100%)**
Died in Facility	7 (58.3%)	5 (41.7%)	**12 (100%)**
Total	**5,020 (93.4%)**	**353 (6.6%)**	**5,373 (100%)**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

Majority of admissions aged between 18 and 64 years were discharge home without formal support. Only a third of older patient admissions resulted in discharge home without formal support (Table 4.18). More than half of admissions of patients aged 85 years and above resulted in discharge home without formal support and transfer to a care facility. About 10% resulted in transfer to a health facility. This demographic also had the highest proportion of death in facility compared to other age groups (4.4%).

Table 4. 18- Discharge disposition by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Discharge Disposition n (%)						
Age group	**Without Formal Support[&]**	**With Formal Support[&]**	**Care Facility**	**Health Facility**	**Without Approval[&]**	**Died in Facility**	**Total**
(18 – 35) years	2,279 (82.8%)	108 (3.9%)	105 (3.8%)	123 (4.5%)	133 (4.8%)	2 (0.1%)	**2,750 (100%)**
(36 – 55) years	1,478 (81.7%)	72 (3.9%)	60 (3.3%)	80 (4.4%)	116 (6.4%)	4 (0.2%)	**1,810 (100%)**
(56 – 64) years	354 (77.0%)	43 (9.4%)	22 (4.8%)	29 (6.3%)	11 (2.4%)	1 (0.2%)	**460 (100%)**

(65 – 74) years	140 (65.7%)	41 (19.2%)	17 (8.0%)	10 (4.7%)	2 (0.9%)	3 (1.4%)	**213 (100%)**
(75 – 84) years	61 (64.9%)	14 (14.9%)	9 (9.6%)	10 (10.6%)	0 (0)	0 (0)	**94 (100%)**
(85+) years	15 (32.6%)	12 (26.1%)	12 (26.1%)	5 (10.9%)	0 (0)	2 (4.4%)	**46 (100%)**
Total	**4,327 (80.5%)**	**290 (5.4%)**	**225 (4.2%)**	**257 (4.8%)**	**262 (4.9%)**	**12 (0.2%)**	**5,373 (100%)**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

When discharge disposition is also dichotomized into "Home Discharge" and "Others". Table 4.19 shows the distribution of discharge home versus other locations across the age groups. About 86% of patients were discharged home (with or without support) compared to others (discharge without approval, transfer to a care/health facility or death in facility)

Table 4. 19- Discharge disposition (Home vs Others) by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Discharge Disposition n (%)		
Age Group	**Home Discharge**	**Others**	**Total**
(18 – 35) years	2,387 (86.8%)	363 (13.2%)	**2,750 (100%)**
(36 – 55) years	1,550 (85.6%)	260 (14.4%)	**1,810 (100%)**
(56 – 64) years	397 (86.3%)	63 (13.7%)	**460 (100%)**
(65 – 74) years	181 (84.9%)	32 (15.0%)	**213 (100%)**
(75 – 84) years	75 (79.8%)	19 (41.3%)	**94 (100%)**
(85+) years	27 (58.7%)	19 (41.3%)	**46 (100%)**
Total	**4,617 (85.9%)**	**756 14.1%)**	**5,373 (100%)**

4.1.9 Readmissions within 30 days of Prior Discharge

During the study period, 552 (10.3%) readmissions were recorded within 30 days of prior discharge. Of these, 96.9% were patients between 18 – 64 years, while others (3.1%) were 65 years and older. Table 4.20 shows the age distribution of readmissions within 30 days of prior discharge. Overall, older patients had lesser readmissions within 30 days.

Table 4. 20- Readmissions within 30 days of prior discharge by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Readmissions within 30 days of prior discharge n (%)		
Age Group	**No**	**Yes**	**Total**
(18 – 35) years	2,456 (89.3%)	294 (10.7%)	**2,750 (100%)**
(36 – 55) years	1,604 (88.6%)	206 (11.4%)	**1,810 (100%)**
(56 – 64) years	425 (92.4%)	35 (7.6%)	**460 (100%)**
(65 – 74) years	203 (95.3%)	10 (4.7%)	**213 (100%)**
(75 – 84) years	90 (95.7%)	4 (4.3%)	**94 (100%)**
(85+) years	43 (93.5%)	3 (6.5%)	**46 (100%)**
Total	**4,821 (89.7%)**	**552 (10.3%)**	**5,373 (100%)**

Among those readmitted within 30 days of prior discharge, Table 4.21 presents the discharge outcomes by age groups. Most readmissions within 30 days resulted in home discharge without formal support and none resulted in death in the facility.

Table 4. 21- Discharge disposition by age groups, readmissions within 30 days of prior discharge, Royal University Hospital, Saskatoon 2012-2019 (n = 552)

	Discharge Disposition n (%)

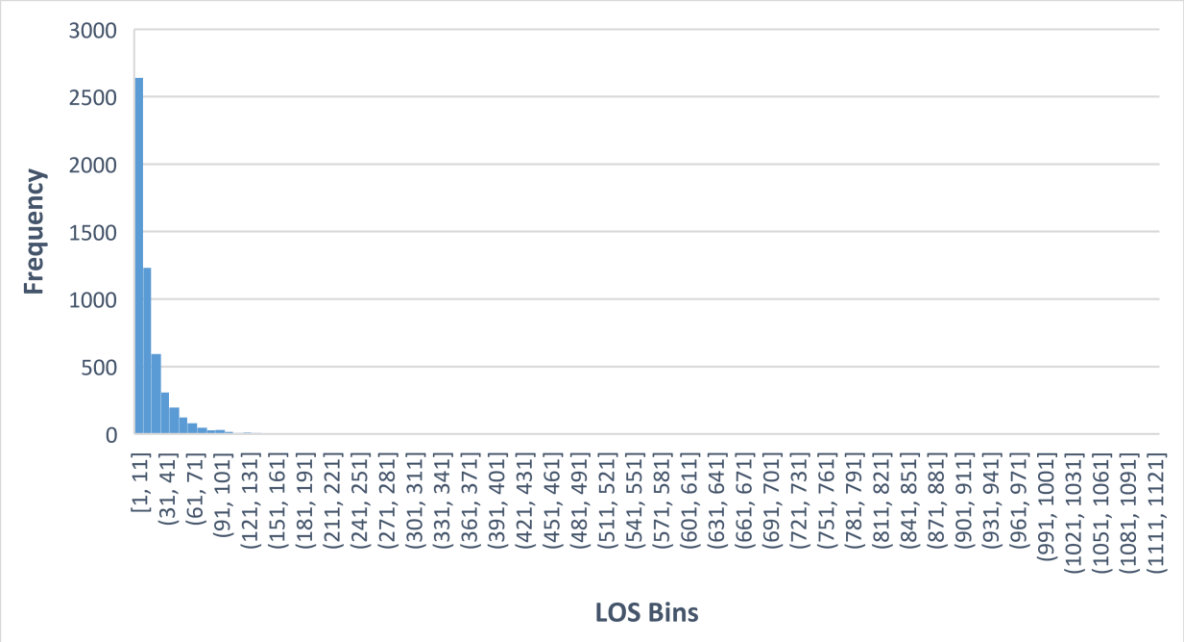
Age group	Without Formal Support[&]	With Formal Support[&]	Care Facility	Health Facility	Without Approval[&]	Died in Facility	Total
(18 – 35) years	216 (73.5%)	15 (5.1%)	23 (7.8%)	18 (6.1%)	22 (7.5%)	0 (0)	**294 (100%)**
(36 – 55) years	157 (76.2%)	13 (6.3%)	5 (2.4%)	17 (8.3%)	14 (6.8%)	0 (0)	**206 (100%)**
(56 – 64) years	29 (82.9%)	3 (8.6%)	1 (2.8%)	2 (5.7%)	0 (0)	0 (0)	**35 (100%)**
(65 – 74) years	6 (60.0%)	4 (40.0%)	0 (0)	0 (0)	0 (0)	0 (0)	**10 (100%)**
(75 – 84) years	3 (75.0%)	1 (25%.0)	0 (0)	0 (0)	0 (0)	0 (0)	**4 (100%)**
(85+) years	0 (0)	2 (66.7%)	1 33.3%)	0 (0)	0 (0)	0 (0)	**3 (100%)**
Total	**411 (74.4%)**	**38 (6.9%)**	**30 (54.5%)**	**37 (6.7%)**	**36 (6.5%)**	**0 (0)**	**552 (100%)**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

4.1.10 Length of Stay

The length of stay was defined as the period between admission date and discharge date. The average length of stay for all patient admissions was 20 days (±33.7). The shortest length of stay was 1 day while the longest was 1,117 days (3.06 years). The mode and median length of stay was 1 day and 12 days respectively. From the histogram showing the distribution of the LOS (Figure 4.3), the distribution is positively skewed (skewness statistic= 12.2).

Figure 4- Length of stay (LOS) distribution, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)



Although the longest stay throughout the study period was recorded by a younger patient, the average length of stay was shorter (19 days) for younger patient admissions compared to 35 days for older patient admissions (Table 4.22). When the length of stay statistics is further divided into the smaller age groups, the shortest stay among those aged 85 years and older was 2 days compared to 1 day in all other groups. In addition, patients aged 85 years and older had the highest average stay of about 40 days (Table 4.23).

Table 4. 22- Length of stay summary statistics by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay (days)		
Age group	**Mean**	**Standard Deviation**	**Frequency**
(18-64) years	19 (1 – 1,117)	33.2	5,020
(65+) years	35 (1 – 434)	37.0	353
Total	**20**	**33.7**	**5,373**

Table 4. 23- Length of stay summary statistics by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay (days)		
Age	**Mean**	**Standard Deviation**	**Frequency**
(18 – 35) years	19 (1 – 1,117)	38.4	2,750
(36 – 55) years	18 (1 – 396)	24.3	1,810
(56 – 64) years	24 (1 – 271)	29.5	460
(65 – 74) years	35 (1 – 434)	41.6	213
(75 – 84) years	34 (1 – 187)	28.2	94
(85+) years	39 (2 -136)	29.9	46
Total	**20**	**33.7**	**5,373**

When the length of stay is divided into quintiles, the majority of patients (n= 4,324; 80.5%) had a length of stay less than or equal to 28 days (Table 4.24).

Table 4. 24- Length of stay quintiles, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

LOS Quintiles (days)	Frequency (n)	Percentage (%)	Cumulative Percentage (%)
1st Quintile (1 – 5)	1,310	24.4%	24.4%
2nd Quintile (6 – 9)	977	18.2%	42.6%
3rd Quintile (10 – 15)	970	18.1%	60.6%
4th Quintile (16 – 28)	1,067	19.9%	80.5%
5th Quintile (29 – 1,117)	1,049	19.2%	100%
Total	**5,373**	**100%**	

Compared to admissions for younger patients, patients aged 65 years and older were more represented in higher quintiles of length of stay (Table 4.25).

Table 4. 25- Length of stay quintiles by age-groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay Quintiles n (%)					
Age Group	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
(18 – 35) years	732 (26.6%)	529 (19.2%)	496 (18.0%)	521 (19.0%)	472 (17.2%)	**2,750 (100%)**
(36 – 55) years	449 (24.8%)	327 (18.1%)	345 (19.1%)	355 (19.6%)	334 (18.4%)	**1,810 (100%)**
(56 – 64) years	80 (17.4%)	83 (18.0%)	80 (17.4%)	106 (23.0%)	111 (24.1%)	**460 (100%)**
(65 – 74) years	31 (14.6%)	20 (9.4%)	38 (17.8%)	48 (22.5%)	76 (35.7%)	**213 (100%)**
(75 – 84) years	14 (14.9%)	13 (13.8%)	4 (4.3%)	25 (26.6%)	38 (40.4%)	**94 (100%)**
(85+) years	4 (8.7%)	5 (10.9%)	7 (15.2%)	15 (26.1%)	18 (39.1%)	**46 (100%)**
Total	1,310 (24.4%)	977 (18.2%)	970 (18.1%)	1,067 (19.9%)	1,049 (19.5%)	**5,373 (100%)**

When the length of stay quintiles were cross tabulated with diagnoses for all admissions (Table 4.26), some conditions were disproportionately represented in the higher quintiles. These conditions include mental retardation, disorders of psychological development, and behavioural syndromes associated with physiological disturbances and physical factors. A further breakdown of length of stay by diagnosis according to older and younger age groups is available (Appendix C). Length of stay statistics for each diagnosis is shown in Table 4.27.

Table 4. 26- Length of stay quintiles by diagnoses, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay Quintiles n (%)					
ICD-10 CA Diagnosis	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
Disorders of other endocrine glands (E22)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**

Organic, including symptomatic, mental disorders (F00-F09)	12 (14.6%)	7 (8.5%)	13 (15.9%)	26 (31.7%)	24 (29.3%)	**82 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	315 (40.2%)	187 (23.9%)	135 (17.2%)	100 (12.8%)	46 (5.9%)	**783 (100%)**
Schizophrenia, schizotypal and delusional disorders (F20-F29)	194 (13.2%)	202 (13.7%)	267 (18.1%)	401 (27.1%)	415 (28.1%)	**1,479 (100%)**
Mood [affective] disorders (F30-F39)	444 (21.3%)	387 (18.6%)	405 (19.4%)	415 (19.9%)	432 (20.7%)	**2,083 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	209 (39.7%)	122 (23.2%)	83 (15.6%)	67 (12.7%)	46 (8.3%)	**527 (100%)**
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	14 (18.4%)	7 (9.2%)	12 (15.8%)	11 (14.5%)	32 (42.1%)	**76 (100%)**
Disorders of adult personality and behaviour (F60-F69)	86 (39.6%)	52 (24.0%)	34 (15.7%)	25 (11.5%)	20 (9.2%)	**217 (100%)**
Mental retardation (F70-F79)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	**2 (100%)**
Disorders of psychological development (F80-F89)	7 (13.0%)	5 (9.3%)	10 (18.5%)	12 (22.2%)	20 (37.0%)	**54 (100%)**
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	10 (37.0%)	4 (14.8%)	7 (25.9%)	5 (18.5%)	1 (3.7%)	**27 (100%)**
Unspecified mental disorder (F99)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**2 (100%)**
Extrapyramidal and movement disorders (G20-G26)	0 (0%)	0 (0%)	0 (0%)	1 (50.0%)	1 (50.0%)	**2 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	0 (0%)	1 (10.0%)	1 (10.0%)	0 (0%)	8 (80.0%)	**10 (100%)**
Other obstetric conditions, not elsewhere classified (O94-O99)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Other congenital malformations (Q80-Q89)	0 (0%)	1 (33.3%)	1 (33.3%)	0 (0%)	1 (33.3%)	**3 (100%)**
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	10 (62.5%)	1 (6.3%)	2 (12.5%)	2 (12.5%)	1 (6.3%)	**16 (100%)**

Poisoning by drugs, medicaments, and biological substances (T36-T50)	4 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**4 (100%)**
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Persons encountering health services for examination and investigation (Z00-Z13)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	**1 (100%)**
Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	**1 (100%)**
Persons encountering health services in other circumstances (Z70-Z76)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Total	**1,310 (24.4%)**	**977 (18.2%)**	**970 (18.1%)**	**1,067 (19.9)**	**1,049 (19.5%)**	**5,373 (100%)**

Table 4. 27- Length of stay summary statistics by diagnosis, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay (days)		
ICD-10 CA Diagnosis	**Mean (Range)**	**Standard Deviation**	**Frequency**
Disorders of other endocrine glands (E22)	6	0	1
Organic, including symptomatic, mental disorders (F00-F09)	37 (1 – 434)	68.5	82
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	10 (1 – 158)	13.1	783
Schizophrenia, schizotypal and delusional disorders (F20-F29)	25 (1 -617)	33.0	1,479
Mood [affective] disorders (F30-F39)	19 (1 – 271)	21.4	2,083
Neurotic, stress-related and somatoform disorders (F40-F48)	12 (1 – 187)	18.4	527
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	38 (1 – 268)	45.6	76
Disorders of adult personality and behaviour (F60-F69)	14 (1 – 336)	30.0	217
Mental retardation (F70-F79)	191 (41 – 341)	212	2

Disorders of psychological development (F80-F89)	85 (1 -1117)	188.9	54
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	10 (1 -30)	8.0	27
Unspecified mental disorder (F99)	2 (1 – 2)	0.7	2
Extrapyramidal and movement disorders (G20-G26)	24 (17 – 30)	9.2	2
Other degenerative diseases of the nervous system (G30-G32)	60 (7 – 182)	53.0	10
Other obstetric conditions, not elsewhere classified (O94-O99)	2	0	1
Other congenital malformations (Q80-Q89)	24 (6 -55)	26.7	3
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	10 (1 -66)	16.6	16
Poisoning by drugs, medicaments, and biological substances (T36-T50)	2 (1 – 3)	1	4
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	3	0	1
Persons encountering health services for examination and investigation (Z00-Z13)	19	0.0	1
Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)	25	0.0	1
Persons encountering health services in other circumstances (Z70-Z76)	1	0.0	1
Total	**20**	**33.7**	**5,373**

4.1.11 Alternate Level of Care (ALC)

Patients who occupied a bed but did not require the intensity of care provided in the unit were designated ALC. The length of ALC designation was also recorded. Throughout the study period, only 119 patient admissions (2.2%) were designated as Alternate Level of Care (ALC). Of these, 89 admissions (74.8%) were between 18 and 64 years while 30 admissions (25.2%) were aged 65 and older. More than half of ALC designations were males (n = 68; 57.1%) compared to 42.9% in female admissions (n = 51). For admissions designated as ALC during the study period, the

average number of days spent in ALC designation was 35 days (±53.9). The mode and median ALC length of stay was 7 days and 15 days respectively. The longest period of ALC designation was 315 days and the shortest was 1 day. The mean age of those designated ALC was 48 years (±21.9).

Among patients who were designated ALC during the study period, younger patient admissions aged 18 – 64 years had longer ALC days compared to older patient admissions (Table 4.28). However, admissions by patients aged 65 – 74 years recorded the highest average ALC days while those aged 85 years and older had the least ALC days (Table 4.29).

Table 4. 28- ALC Length of stay summary statistics by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

ALC Length of Stay (days)			
Age groups	**Mean (Range)**	**Standard Deviation**	**Frequency**
(18-64) years	37 (1 – 287)	51.8	89
(65+) years	28 (1 -315)	60	30
Total	**35**	**53.9**	**119**

Table 4. 29- ALC length of stay summary statistics by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

ALC Length of Stay (days)			
Age	**Mean**	**Standard Deviation**	**Frequency**
(18 – 35) years	35 (1 – 229)	44.6	42
(36 – 55) years	36 (1 – 287)	63.2	28
(56 – 64) years	42 (1 – 172)	50.9	19
(65 – 74) years	54 (6 – 315)	98.0	10
(75 – 84) years	18 (1 – 97)	26.0	13
(85+) years	10 (1 -25)	7.8	7
Total	**35**	**53.9**	**119**

As shown in Table 4.30, almost 80% of patient admissions had an ALC length of stay less than or equal to 45 days. Of admissions of patients aged between 18-64 years, 89 (1.8%) were designated ALC during the study period. The remaining 30 patient admissions with ALC designation were aged 65 and above (8.5% of older adult admissions). Table 4.31 further shows the age group distribution according to ALC quintiles.

Table 4. 30- ALC length of stay quintiles, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

ALC LOS Quintiles (days)	**Frequency (n)**	**Percentage (%)**	**Cumulative Percentage (%)**
1st Quintile (1 – 6)	26	21.9%	21.9%
2nd Quintile (7-10)	22	18.5%	40.3%
3rd Quintile (11 – 20)	24	20.2%	60.5%
4th Quintile (21 – 45)	23	19.3%	79.8%
5th Quintile (46 – 119)	24	20.2%	100%
Total	**119**	**100%**	

Table 4. 31- ALC length of stay quintiles by age-groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

	ALC Length of Stay Quintiles n (%)					
Age Group (years)	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
(18 – 35) years	9 (18.0%)	7 (14.0%)	9 (18.0%)	13 (26.0%)	12 (24.0%)	**50 (100%)**
(36 – 55) years	10 (27.0%)	6 (16.2%)	8 (21.6%)	5 (13.5%)	8 (21.6%)	**37 (100%)**
(56 – 64) years	5 (38.5%)	0 (0%)	4 (30.8%)	2 (15.4%)	2 (15.4%)	**13 (100%)**
(65 – 74) years	1	4	2	0	1	**8**

	(12.5%)	(50.0%)	(22.0%)	(0.0%)	(12.5%)	**(100%)**
(75 – 84) years	0 (0%)	4 (57.1%)	1 (14.3%)	2 (28.6%)	0 (0%)	**7 (100%)**
(85+) years	1 (25.0%)	1 (25.0%)	0 (0%)	1 (25.0%)	1 (25.0%)	**4 (100%)**
Total	**26 (21.9%)**	**22 (18.5%)**	**24 (20.2%)**	**23 (19.3%)**	**24 (20.2%)**	**119 (100%)**

When ALC quintiles were cross tabulated with diagnoses, organic, including symptomatic, mental disorders; schizophrenia, schizotypal and delusional disorders; disorders of psychological development, and degenerative diseases of the nervous system were more represented in higher ALC length of stay quintiles (Table 4.32). The average length of stay for each diagnosis is shown in Table 4.33.

Table 4. 32- ALC length of stay quintiles by diagnosis, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

	ALC Length of Stay Quintiles n (%)					
ICD-10 CA Diagnosis	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
Organic, including symptomatic, mental disorders (F00-F09)	2 (13.3%)	4 (26.7%)	4 (26.7%)	3 (20.0%)	2 (13.3%)	**15 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	2 (20.0%)	1 (10.0%)	2 (20.0%)	5 (20.0%)	0 (0%)	**10 (100%)**
Schizophrenia, schizotypal and delusional disorders (F20-F29)	11 (26.2%)	7 (16.7%)	7 (16.7%)	7 (16.7%)	10 (23.8%)	**42 (100%)**
Mood [affective] disorders (F30-F39)	6 (21.4%)	6 (21.4%)	7 (25.0%)	4 (14.3%)	5 (17.9%)	**28 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	3 (30.0%)	3 (30.0%)	1 (10.0%)	0 (0.0%)	3 (30.0%)	**10 (100%)**
Disorders of adult personality and behaviour (F60-F69)	0 (0%)	0 (0%)	2 (100%)	0 (0.0)	0 (0%)	**2 (100%)**
Mental retardation (F70-F79)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	**1 (100%)**

Disorders of psychological development (F80-F89)	1 (14.3%)	1 (14.3%)	1 (14.3%)	3 (42.9%)	1 (14.3%)	**7 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	1 (33.3%)	0 (0%)	0 (0%)	1 (33.3%)	1 (33.3%)	**3 (100%)**
Other congenital malformations (Q80-Q89)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0.0)	**1 (100%)**
Total	**26 (21.6%)**	**22 (18.5%)**	**24 (20.2%)**	**23 (19.3%)**	**24 (20.2%)**	**119 (100%)**

Table 4. 33- ALC length of stay summary statistics by diagnosis, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

	ALC LOS (days)		
ICD-10 CA Diagnosis	**Mean (Range)**	**Standard Deviation**	**Frequency**
Organic, including symptomatic, mental disorders (F00-F09)	52 (1 – 315)	101.7	15
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	20 (1 – 43)	14.6	10
Schizophrenia, schizotypal and delusional disorders (F20-F29)	32 (1 – 172)	39.4	42
Mood [affective] disorders (F30-F39)	23 (1 – 124)	29.3	28
Neurotic, stress-related and somatoform disorders (F40-F48)	37 (1 – 124)	49.1	10
Disorders of adult personality and behaviour (F60-F69)	17 (16 – 17)	0.7	2
Mental retardation (F70-F79)	174	0	1
Disorders of psychological development (F80-F89)	47 (1 – 229)	81.0	7
Other degenerative diseases of the nervous system (G30-G32)	64 (6 – 162)	85.6	3
Other congenital malformations (Q80-Q89)	49	0	1
Total	**35**	**53.9**	**119**

Although the admission with the longest stay recorded during the study period was not designated ALC, the average length of stay among those designated ALC during the study period was longer (80 days) compared to those who were not (19 days) (Table 4.34).

Table 4. 34- Length of stay summary statistics by ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	Length of Stay (days)		
ALC Designation	**Mean (Range)**	**Standard Deviation**	**Frequency**
No	19 (1 – 1,117)	30.3	5,254
Yes	80 (1 – 506)	84.4	119
Total	**20**	**33.7**	**5,373**

Among those designated ALC, more than one-third of admissions resulted in discharge home without formal support, about one-third of patients were transferred to a health facility and more than 20% were discharged to a care home. Only one of ALC designations resulted in death in the facility (Table 4.35). ALC designations divided based on age groups and discharge disposition are available (Appendix C).

Table 4. 35- Discharge disposition by ALC designations, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

	ALC Designation n (%)		
Discharge Disposition	**No**	**Yes**	**Total**
Without Formal Support[&]	4,285 (81.6%)	42 (35.3%)	**4,327 (80.5%)**
With Formal Support[&]	278 (5.3%)	12 (10.1%)	**290 (5.4%)**
Care facility	199 (3.8%)	26 (21.8%)	**225 (4.2%)**
Health facility	220 (4.2%)	37 (31.1%)	**257 (4.8%)**
Without approval[&]	261 (5.0%)	1 (0.8%)	**262 (4.9%)**
Died in Facility	11 (0.2%)	1 (0.8%)	**12 (0.2%)**
Total	**5,254 (100%)**	**119 (100%)**	**5,373 (100%)**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

4.2 Bivariate Analysis

Because of their very lengthy lengths of stay, admissions with the following most responsible diagnoses were excluded:

- Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59), including **74 younger patient admissions and 2 older patient admissions**.
- Mental retardation (F70-F79), **including 2 younger patient admissions only**.
- Disorders of psychological development (F80-F89), **including 54 younger patient admissions only**.

As a result, **132 observations** were excluded for bivariate analysis.

4.2.1 All Age groups (18- 64 years; 65 years and older)

A. Length of Stay

As shown in Table 4.36, there was a significant difference in the length of stay quintiles between older adults and other ages (Pearson's $Chi^2 = 229.6$; p-value: <0.001).

Table 4. 36- Chi-square statistics LOS Quintiles by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

	Age groups n (%)		
Length of Stay (days)	**18 – 64 years**	**65+ years**	**Total**
1st Quintile (1 – 5)	1,267 (98.3%)	22 (1.7%)	**1,289 (100%)**
2nd Quintile (6 – 9)	937 (97.1%)	28 (2.9%)	**965 (100%)**
3rd Quintile (10 – 15)	901 (95.0%)	47 (5.0%)	**948 (100%)**
4th Quintile (16 – 28)	951 (91.1%)	93 (8.9%)	**1,044 (100%)**
5th Quintile (29 – 1,117)	834 (83.8%)	161 (16.2%)	**995 (100%)**
Total	**4,890 (93.3%)**	**351 (6.7%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 229.6; p-value: **<0.001**

To identify if there were differences in LOS quintiles among all the age groups, ANOVA test was conducted (Table 4.37), and the results were significant (Prob>F = <0.001). Post hoc diagnostics were also conducted to identify the group pairs where these differences were. Results showed significant differences among most groups pairs (Table 4.38).

Table 4. 37- ANOVA statistics, LOS Quintiles by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 5,241)

Source	Partial SS	df	MS	F	Prob>F
Model	548.41311	5	109.68262	54.44	**<0.001**
Age group (Between groups)	548.41311	5	109.68262	54.44	**<0.001**
Residual (Within groups)	10547.153	5,235	2.014738		
Total	**11095.566**	**5,240**	**2.1174745**		

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Number of observations: 5,241; R-squared: 0.0494

Root MSE: 1.41941; Adjusted R-squared: 0.0485

Bartlett's equal-variances test: chi2(5) = 18.2159 Prob>chi2 = 0.003

Table 4. 38- Post hoc diagnostics, LOS by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 5,241)

	Difference in Means (p-value)		
Group vs Group	**Bonferroni**	**Scheffe**	**Sidak**
(18 - 35) vs (36-55) years	0.072 (1.000)	0.072 (0.743)	0.072 (0.792)
(18 - 35) vs (56-64) years* **	0.537 (<0.001)	0.537 (<0.001)	0.537 (<0.001)
(18 - 35) vs (65-74) years* **	1.160 (<0.001)	1.160 (<0.001)	1.160 (<0.001)
(18 - 35) vs (75-84) years* **	1.303	1.303	1.303

	(<0.001)	(<0.001)	(<0.001)
(18 - 35) vs (84+) years* **	1.381 (<0.001)	1.381 (<0.001)	1.381 (<0.001)
(36-55) years vs (56-64) years* **	0.465 (<0.001)	0.465 (<0.001)	0.465 (<0.001)
(36-55) years vs (65-74) years* **	1.089 (<0.001)	1.089 (<0.001)	1.089 (<0.001)
(36-55) years vs (75-84) years* **	1.232 (<0.001)	1.232 (<0.001)	1.232 (<0.001)
(36-55) years vs (84+) years* **	1.309 (<0.001)	1.309 (<0.001)	1.309 (<0.001)
(56-64) years vs (65-74) years* **	0.624 (<0.001)	0.624 <0.001	0.624 (<0.001)
(56-64) years vs (75-84) years* **	0.767 (<0.001)	0.767 (<0.001)	0.767 (<0.001)
(56-64) years vs (84+) years* **	0.844 (0.002)	0.844 (0.011)	0.844 (0.002)
(65-74) years vs (75-84) years	0.143 (1.000)	0.143 (0.985)	0.143 (1.000)
(65-74) years vs (84+) years	0.220 (1.000)	0.220 (0.969)	0.220 (0.998)
(75-84) years vs (84+) years	0.077 (1.000)	0.077 (1.000)	0.077 (1.000)

*** *Significant at significant level (α) = 0.05*

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

B. Alternate Level of Care and Alternate Level of Care Length of Stay

Between older adult admissions and others, there was a significant difference in the ALC designation (Pearson's Chi^2 = 75.0; p-value: <0.001). There was also a significant difference in the number of ALC days between both groups (Pearson's Chi^2 = 9.5; p-value: 0.050).

Table 4. 39- Chi-square statistic ALC by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 5,241)

	Age groups n (%)		
ALC Designation	**18 – 64 years**	**65+ years**	**Total**
No	4,809 (93.7%)	321 (6.3%)	**5,130 (100%)**
Yes	81	30	**111**

	(73.0%)	(27.0%)	**(100%)**
Total	**4,890 (93.3%)**	**351 (6.7%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 75.0; p-value: **<0.001**

Table 4. 40- Chi-square statistics, ALC length of stay by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 111)

	Age groups n (%)		
ALC Length of Stay	**18 – 64 years**	**65+ years**	**Total**
1st Quintile (1 – 6)	19 (76.0%)	6 (24.0%)	**25 (100%)**
2nd Quintile (7-10)	10 (47.6%)	11 (52.4%)	**21 (100%)**
3rd Quintile (11 – 20)	17 (73.9%)	6 (26.1%)	**23 (100%)**
4th Quintile (21 – 45)	16 (80.0%)	4 (20.0%)	**20 (100%)**
5th Quintile (46 – 119)	19 (86.4%)	3 (13.6%)	**22 (100%)**
Total	**81 (73.0%)**	**30 (27.0%)**	**111 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 9.5; p-value: **0.050**

Pearson's Chi^2 test and ANOVA tests were used to identify if there were any significant differences in ALC designation and ALC days respectively across all the age groups. While there was a significant difference in ALC designation (Pearson's Chi^2 = 127.9; p-value: <0.001), there was no significant difference in ALC days across all the age groups (Prob>F: 0.255).

Table 4. 41- Chi-square statistics, ALC designation by age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

	Age groups n (%)						
ALC	**(18 – 35) years**	**(36 – 55) years**	**(56 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
No	2,610 (50.9%)	1,764 (34.4%)	435 (8.5%)	201 (3.9%)	81 (1.6%)	39 (0.8%)	**5,130 (100%)**
Yes	35 (31.5%)	27 (24.3%)	19 (17.1%)	10 (9.0%)	13 (11.7%)	7 (6.3%)	**111 (100%)**
Total	**2,645 (50.5%)**	**1,791 (34.2%)**	**454 (8.7%)**	**211 (4.0%)**	**94 (1.8%)**	**46 (0.9%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi^2 = 127.9; p-value: **<0.001**

Table 4. 42- ANOVA statistics, ALC length of stay by Age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 111)

Source	**Partial SS**	**df**	**MS**	**F**	**Prob>F**
Model	13.664325	5	2.732865	1.34	0.255
Age group	13.664325	5	2.732865	1.34	0.255
Residual	214.89423	105	2.0466117		
Total	**228.55856**	**110**	**2.0778051**		

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Number of observations: 111; R-squared: 0.0598

Root MSE: 1.4306; Adjusted R-squared: 0.0150

Bartlett's equal-variances test: chi2(5) = 1.6734 Prob>chi2 = 0.892

C. Discharge Disposition

There was a significant difference in the discharge outcomes between the older adult admissions and younger admissions (Pearson's $Chi^2 = 235.1$; p-value: <0.001).

Table 4. 43- Chi-square statistics, Discharge disposition by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 5,241)

	Age groups n (%)		
Discharge Disposition	**(18 – 64) years**	**(65+) years**	**Total**
Without formal support[&]	4,014 (94.9%)	214 (5.1)	**4,228 (100.0%)**
With formal support[&]	216 (76.3%)	67 (23.7%)	**283 (100.0%)**
Care facility	179 (82.5%)	38 (17.5%)	**217 (100.0%)**
Health facility	219 (89.7%)	25 (10.3%)	**244 (100.0%)**
Without approval[&]	256 (99.2%)	2 (0.8%)	**258 (100.0%)**
Died in facility	6 (54.5%)	5 (45.5%)	**11 (100.0%)**
Total	**4,890 (93.3%)**	**351 (6.7%)**	**5,241 (100%)**

[¶¶]*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

Pearson's Chi-square statistic = 235.1; p-value**: <0.001**

To further observe differences in discharge home compared to other locations among all the age groups, Pearson's Chi-square test was conducted. There was a significant difference between discharge home (with or without formal support), and other discharge outcomes (discharge without approval, transfer to a care/health facility or death in facility) (Pearson's $Chi^2 = 34.7$; p-value: <0.001).

Table 4. 44- Chi-square statistics, Discharge disposition by Age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 ((n = 5,241)

	Age groups n (%)						
Discharge Outcome	**(18 – 35) years**	**(36 – 55) years**	**(56 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
Home	2,304 (51.1%)	1,535 (34.0%)	391 (8.7%)	179 (4.0%)	75 (1.7%)	27 (0.6%)	**4,511 (100.0%)**
Others	341 (46.7%)	256 (35.1%)	63 (8.6%)	32 (4.4%)	19 (2.6%)	19 (2.6%)	**730 (100%)**
Total	**2,645 (50.5%)**	**1,791 (34.2%)**	**454 (8.7%)**	**211 (4.0%)**	**94 (1.8%)**	**46 (0.9%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 34.7; p-value**: <0.001**

D. Deaths

Although a small number of deaths was recorded during the study period, there was a significant difference observed between the older adult admissions and others (Pearson's $Chi^2 = 26.5$; p-value: <0.001).

Table 4. 45- Chi-square statistics, Deaths by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

	Age groups n (%)		
Deaths	**(18 – 64) years**	**(65+) years**	**Total**
No	4,884 (93.4%)	346 (6.6%)	**5,230 (100%)**
Yes	6 (54.5%)	5 (45.5%)	**11 (100%)**
Total	**4,890 (93.3%)**	**351 (6.7%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 26.5; p-value: **<0.001.**

When this was further divided into smaller age groups, significant difference was observed across all the age groups (Pearson's Chi^2 = 55.0; p-value: <0.001; Fisher's exact = <0.001)

Table 4. 46- Chi-square & Fisher's exact statistics, Deaths by age group, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241).

	Age groups n (%)						
Deaths	**(18 – 35) years**	**(36 – 55) years**	**(56 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
No	2,643 (50.5%)	1,788 (34.2%)	453 (8.7%)	208 (4.0%)	94 (1.8%)	44 (0.8%)	**5,230 (100.0%)**
Yes	2 (18.2%)	3 (27.3%)	1 (9.1%)	3 (27.3%)	0 (0)	2 (18.2%)	**11 (100%)**
Total	**2,645 (50.5%)**	**1,791 (34.2%)**	**454 (8.7%)**	**211 (4.0%)**	**94 (1.8%)**	**46 (0.9%)**	**5,241 (100%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 55.0; p-value: **<0.001**

Fisher's exact p-value**: <0.001**

4.2.2 Older age groups

A. Length of Stay

Using one-way ANOVA statistics to observe for differences in LOS quintiles, there was no significant difference among the older age groups (Prob>F: 0.420).

Table 4. 47- ANOVA statistics LOS Quintiles by Older age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 351)

Source		Partial SS	df	MS	F	Prob>F
Model		2.5771304	2	1.2885652	0.87	0.420
Age group		2.5771304	2	1.2885652	0.87	0.420
Residual		515.24053	348	1.4805762		
Total		**517.81766**	**350**	**1.479479**		

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Number of observations: 351; R-squared: 0.0050

Root MSE: 1.21679; Adjusted R-squared: -0.0007

Bartlett's equal-variances test: chi2(2) = 2.4365 Prob>chi2 = 0.296

B. Alternate level of Care and Alternate Level of Care Length of Stay

There was a significant difference in the ALC designation among the older age groups (Pearson's Chi^2 = 9.9; p-value: 0.007), but there was no significant difference in the number of ALC days (Prob>F: 0.483).

Table 4. 48- Chi-square statistics, ALC by older age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 351)

	Age groups n (%)			
ALC	**(65 – 74) years**	**(75 -84) years**	**(85+) years**	**Total**
No	201 (62.6%)	81 (25.2%)	39 (12.2%)	**321 (100%)**
Yes	10 (33.3%)	13 (43.3%)	7 (23.3%)	**30 (100%)**
Total	**211 (60.1%)**	**93 (26.8%)**	**46 (13.1%)**	**351 (100.0%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 9.9; p-value: **0.007**

Table 4. 49- ANOVA statistic ALC length of stay by older age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 30)

Source	Partial SS	df	MS	F	Prob>F
Model	2.3787546	2	1.1893773	0.75	0.483
Older age group	2.3787546	2	1.1893773	0.75	0.483
Residual	42.987912	27	1.5921449		
Total	**45.366667**	**29**	**1.5643678**		

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Number of observations: 30; R-squared: 0.0524

Root MSE: 1.2618; Adjusted R-squared: -0.0178

Bartlett's equal-variances test: chi2(2) = 0.4041 Prob>chi2 = 0.817

C. Discharge Disposition

There was a significant difference in discharge disposition among older

age-groups (Pearson's Chi^2 = 30.2; p-value: 0.001).

Table 4. 50- Chi-square statistics Discharge disposition by older age groups, psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 351).

	Age Groups n (%)			
Discharge Disposition	**(65 - 74) years**	**(75 -84) years**	**(85+) years**	**Total**
Without formal support[&]	138 (64.5%)	61 (28.5%)	15 (7.0%)	**214 (100.0%)**

With formal support[&]	41 (61.2%)	14 (20.9%)	12 (17.9%)	**67 (100.0%)**
Care facility	17 (44.7%)	9 (23.7%)	12 (31.6%)	**38 (100.0%)**
Health facility	10 (40.0%)	10 (40.0%)	5 (20.0%)	**25 (100.0%)**
Without approval[&]	2 (100.0%)	0 (0)	0 (0)	**2 (100.0%)**
Died in facility	3 (60.0%)	0 (0)	2 (40.0%)	**5 (100.0%)**
Total	**211 (60.1%)**	**93 (26.8%)**	**46 (13.1%)**	**351 (100.0%)**

[¶¶]*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

Pearson's Chi-square statistic = 30.2; p-value: **0.001**

When home discharge was compared to other discharge outcomes, there was also a significant difference among the older age groups (Pearson's $Chi^2 = 16.2$; p-value: <0.001).

Table 4. 51- Chi-square statistics, Discharge home versus others by older age groups, psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 351)

	Age Groups n (%)			
Discharge Outcome	**(65 – 74) years**	**(75 -84) years**	**(85+) years**	**Total**
Home	179 (63.7%)	75 (26.7%)	27 (9.6%)	**281 (100%)**
Others	32 (45.7%)	19 (27.1%)	19 (27.1%)	**70 (100.0%)**
Total	**211 (60.1%)**	**93 (26.8%)**	**46 (13.1%)**	**351 (100.0%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 16.2; p-value: **<0.001**

D. Deaths

No significant difference was observed in deaths among older patients (Pearson's Chi^2 = 4.2; p-value: 0.125; Fisher's exact p-value: 0.129).

Table 4. 52- Chi-square & Fisher's exact statistics, Deaths by Older age groups, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 351)

	Age groups n (%)			
Deaths	**(65 – 74) years**	**(75 -84) years**	**(85+) years**	**Total**
No	208 (60.1%)	94 (27.2%)	44 (12.7%)	**346 (100%)**
Yes	3 (60.0%)	0 (0)	2 (40.0%)	**5 (100.0%)**
Total	**211 (60.1%)**	**93 (26.8%)**	**46 (13.1%)**	**351 (100.0%)**

¶¶*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

Pearson's Chi-square statistic = 4.2; p-value: 0.125

Fisher's exact p-value**:** 0.129

4.3 Linear Regression Analysis

As result of their lengthy lengths of stay, admissions with the following most responsible diagnoses were excluded:

- Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59), including **74 younger patient admissions and 2 older patient admissions**.
- Mental retardation (F70-F79), **including 2 younger patient admissions only**.
- Disorders of psychological development (F80-F89), **including 54 younger patient admissions only**.

As a result, **132 observations** were excluded for bivariate analysis. In addition, diagnoses were categorized as follows:

Table 4. 53- Diagnoses for regression analyses, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

Diagnoses[¶¶]	**Frequency (n)**	**Percentage (%)**	**Cumulative Percentage (%)**
Non-Mental and Behavioural Disorders	41	0.8%	0.8%
Organic, including symptomatic, mental disorders (F00-F09)	82	1.6%	2.4%
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	783	14.9%	17.3%
Schizophrenia, schizotypal and delusional disorders (F20-F29)	1,479	28.2%	45.5%
Mood [affective] disorders (F30-F39)	2,083	39.7%	85.2%
Other Mental and Behavioural Disorders	773	14.8%	100%
Total	**5,241**	**100%**	

[¶¶]*Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

4.3.1 Univariate Linear Regression Analysis

All Admissions

Table 4.54 presents results of unadjusted, simple linear regression models for all admissions. Age, admit or discharge units, ALC designation, discharge disposition, diagnosis, presence, or absence and the number of multimorbidity, and 30-day readmission were all significant predictors of length of stay.

Table 4. 54- Unadjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

Variables	**Beta Coeff.**	**95% CI**	**P > t**	**F**	**Prob > F**	**Adjusted R^2**
Age	0.27	0.22 – 0.31	<0.001	135.29	**<0.001**	0.025
Age (groups) 65+ years 18 – 64 years^^	17.42	14.58 – 20.25	<0.001	145.17	**<0.001**	0.027
Age (groups) (36-55) yrs. (56-64) yrs. (65-74) yrs. (75-84) yrs. (85+) yrs. (18–35) yrs.^^	 0.60 7.50 18.03 17.37 21.71	 -0.96 – 2.17 4.90 – 10.09 14.37 – 21.68 12.00 – 22.73 14.11 – 29.32	 0.449 <0.001 <0.001 <0.001 <0.001	35.86	**<0.001**	0.032
Sex Female Male^^	-0.73	-2.17 – 0.70	0.317	1.00	0.317	0.000
Location** Urban Rural^^	2.85	1.11 – 4.59	0.001	10.24	0.317	0.001
Province** Saskatchewan Other Province^^	4.68	-1.11 – 10.47	0.113	2.51	0.113	0.000
Admit Unit Dube Centre Other units^^	10.27	7.93 – 12. 60	<0.001	74.35	**<0.001**	0.014
Discharge Unit Dube Centre Other unit^^	8.96	6.65 – 11.27	<0.001	57.72	**<0.001**	0.011
ALC Yes No^^	57.00	52.25 – 61.74	<0.001	555.16	**<0.001**	0.096

Discharge With formal support[&] Care facility Health facility Without approval[&] Died in facility W/O formal support[&]^^	 8.90 30.83 16.73 -10.31 28.29	 5.85 – 11.96 27.36 – 34.29 13.45 – 20.01 -13.50 – -7.12 13.27 – 43.32	 <0.001 <0.001 <0.001 <0.001 <0.001	96.32	**<0.001**	0.083
Diagnoses[¶¶] Organic disorder Substance abuse Schizophrenia Mood disorders Other MB[n] Non-MB[n]^^	 13.73 -12.70 2.37 -3.92 -10.54	 4.03 – 23.43 -20.83 – -4.57 -5.66 – 10.40 -11.92 – 4.07 -18.67 – -2.41	 0.006 0.002 0.563 0.336 0.011	53.37	**<0.001**	0.0476
Comorbidities Yes No^^	 3.53	 2.08 – 4.98	 <0.001	23.01	**<0.001**	0.004
# Comorbidities	3.20	2.63 – 3.78	<0.001	119.27	**<0.001**	0.022
Secondary Dia. Yes No^^	 4.75	 3.08 – 6.42	 <0.001	31.19	**<0.001**	0.006
# Secondary Diagnoses	4.20	3.19 – 5.22	<0.001	65.27	**<0.001**	0.012
External Injury Yes No^^	 10.37	 7.34 – 10.41	 <0.001	45.03	**<0.001**	0.008
# External Injury	3.87	2.59 – 5.15	<0.001	35.24	**<0.001**	0.007
Readmission_30 Yes No^^	 2.46	 0.10 – 4.81	 0.041	4.17	**0.041**	0.001

 # = Number of
MB[n] =Mental and Behavioural disorders
***10 observations invalid*
^^Reference category
[¶¶]Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.
[&] Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

Older Admissions

Among the elderly, there were fewer significant predictors of LOS in the unadjusted model. These were rural or urban location, ALC designation, discharge to care facility, number of comorbidities, presence of external injuries. Table 4.55 shows the results of unadjusted, simple linear regression models for older adult admissions.

Table 4. 55- Unadjusted regression model, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n = 351)

Variable	**Beta Coeff.**	**95% CI**	**P > t**	**F**	**Prob > F**	**Adjusted R^2**
Age	0.26	-0.24 – 0.77	0.309	1.04	0.309	0.000
Age (groups) (75-84) yrs. (85+) yrs. (65-74) yrs.^^	 -0.66 3.69	 -9.72 – 8.40 -8.20 – 15.58	 0.886 0.542	0.23	0.795	-0.004
Sex Female Male^^	 -0.58	 -8.58 – 7.42	 0.887	0.02	0.887	-0.003
Location Urban Rural^^	 11.23	 2.17 – 20.29	 0.015	5.95	**0.015**	0.014
Province Saskatchewan Other Prov.^^	 19.48	 -22.80 – 61.77	 0.365	0.82	0.366	-0.001
Admit Unit Dube Centre Other units^^	 5.02	 -7.98 – 18.01	 0.448	0.58	0.448	-0.001
Discharge Unit Dube Centre Other units^^	 13.30	 -1.85 – 32.45	 0.080	3.08	0.080	0.006
ALC Yes No^^	 46.89	 33.86 – 59.93	 <0.001	50.05	**<0.001**	0.123
Discharge With formal support& Care facility Health facility Without approval& Died in facility W/O formal support&^^	 6.17 20.07 4.82 -30.24 3.66	 -3.94 – 16. 28 7.36 – 32.79 -10.45 – 20.08 -81.55 – 21.06 -29.02 – 36.33	 0.231 0.002 0.535 0.247 0.826	2.35	**0.041**	0.019

ICD-10 CA Diagnosis¶¶				0.09	0.993	-0.0131
Organic	-9.18	-38.80 – 20.43	0.542			
Substance abuse	-8.14	-51.11 – 34.83	0.710			
Schizophrenia	-6.31	-35.18 – 22.56	0.668			
Mood disorders	-6.80	-35.10 – 21.51	0.637			
Other MB[n]	-6.03	-36.41 – 24.36	0.697			
Non-MB[n]^^						
Comorbidities				2.99	0.085	0.006
Yes	6.82	-0.94 – 14.58	0.085			
No^^						
# Comorbidities	5.47	2.20 – 8.76	0.001	10.78	**0.001**	0.027
Secondary Dia.				0.01	0.944	-0.003
Yes	-0.30	-8.55 – 7.95	0.943			
No^^						
# Secondary Diagnoses	1.68	-3.10 – 6.45	0.490	0.48	0.490	-0.002
External Injury				3.78	**0.053**	0.008
Yes	15.18	0.18 – 30.54	0.053			
No^^						
# External Injury	3.04	-3.77 – 9.85	0.380	0.77	0.380	-0.001
Readmission_30				0.22	0.636	-0.002
Yes	4.37	-13.78 – 22.51	0.636			
No^^						

 # = Number of
MB[n] =Mental and Behavioural disorders
^^ Reference category
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.
& Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

4.3.2 Multivariable Linear Regression Analysis

All Admissions

After several sensitivity analyses (available in Appendix C), Table 4.56 shows the results of the final, multiple linear regression models for all admissions. Age remained a significant predictor of length of stay, so did ALC designation, transfers to care homes or health facilities, diagnosis of organic disorders, admit unit and the number of external injuries. Significant interactions were

also observed between transfer to a health facility and age, age and number of comorbidities, discharge status and number of secondary diagnoses, male sex, and diagnoses of organic disorders, ALC designation and discharge to a care home, diagnosis of organic disorders and 30-day readmission and male sex and 30-day readmissions.

Table 4. 56- Adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

Variable	**Beta Coefficient**	**Standard Error**	**95% CI**	**p-value**
Age	0.14	0.03	0.08 – 0.19	**<0.001**
Sex Male Female^^	 -7.75	 7.25	 -21.97 – 6.46	 0.285
ALC Designation Yes No^^	 31.27	 3.67	 24.08 – 38.46	 **<0.001**
Readmission Yes No^^	 -15.62	 12.12	 -39.38 – 8.15	 0.198
Discharge Disposition With formal support[&] Care facility Health facility Without approval[&] Died in facility W/O formal support[&]^^	 -5.10 29.14 15.37 -1.42 3.00	 3.68 3.93 3.87 4.73 23.03	 -12.32 – 2.12 21.43 – 36.85 7.78 – 22.96 -10.69 – 7.85 -42.15 – 48.16	 0.166 **<0.001** **<0.001** 0.765 0.896
ICD-10 CA Diagnosis[¶¶] Organic disorders Substance abuse Schizophrenia Mood disorders Other MB[n] Non-MB[n]^^	 -18.34 -9.59 1.69 -2.49 10.04	 6.66 5.29 5.24 5.24 5.33	 -31.40 – -5.28 -19.97 – 0.78 -8.59 – 11.96 -12.76 – 7.78 -20.50 – 0.42	 **0.006** 0.070 0.748 0.634 **0.060**
Admit Unit DUBE Centre Other units^^	 9.16	 1.09	 7.03 – 11.29	 **<0.001**
# Comorbidities	0.59	0.67	-0.73 – 1.90	0.384
# Secondary Diagnosis	0.44	0.55	-0.64 – 1.52	0.425
# External Injuries	1.62	0.62	0.40 – 2.83	**0.009**
Discharge Status * Age				

With formal support[&]	0.12	0.07	-0.02 – 0.26	0.089
Care facility	-0.13	0.08	-0.29 – -0.03	0.112
Health facility	-0.28	0.09	-0.45 – -0.11	**0.001**
Without approval[&]	-0.10	0.13	-0.35 – 0.15	0.430
Died in facility	-0.9	0.35	-0.78 – 0.60	0.800
W/O formal support[&]^^				
Age * # Comorbidities	0.07	0.02	0.03 – 0.10	<**0.001**
Discharge * # Secondary Diagnoses				
With formal support[&]	4.61	1.88	0.92 – 8.30	**0.014**
Care facility	-16.44	2.04	-20.45 – -12.43	<**0.001**
Health facility	-8.27	1.55	5.24 – 11.30	<**0.001**
Without approval[&]	-0.77	2.02	-4.73 – 3.19	0.704
Died in facility	18.52	5.45	7.83 – 29.20	**0.001**
W/O formal support[&]^^				
Sex * Diagnoses[¶¶]				
Male*Organic disorder	17.81	8.95	-0.26 – 35.35	**0.047**
Male*Substance abuse	7.05	7.44	-7.53 – 21.64	0.343
Male* Schizophrenia	9.23	7.37	-5.22 -23.68	0.210
Male* Mood disorders	7.99	7.32	-6.36 – 22.34	0.275
Male* Other MB	9.29	7.43	-5.28 – 23.86	0.211
ALC * Discharge Status				
Yes*With formal support[&]	-0.86	8.55	-17.63 – 15.91	0.920
Yes*Care home	71.35	6.55	58.50 – 84.20	<**0.001**
Yes*Health facility	3.77	5.73	-7.46 – 15.01	0.511
Yes*Without approval[&]	-16.93	23.07	-62.16 – 28.30	0.463
Yes*Died in facility	-25.60	24.56	-73.74 – 22.54	0.297
Readmission_30 * Diagnoses[¶¶]				
Yes*Organic disorder	96.37	14.88	67.19 – 125.54	<**0.001**
Yes*Substance abuse	14.45	12.39	-9.83 – 38.74	0.243
Yes* Schizophrenia	18.62	12.36	-5.42 – 42.66	0.129
Yes* Mood disorders	11.46	12.26	-12.57 – 35.49	0.350
Yes* Other MB	11.72	12.36	-12.51 – 35.95	0.343
Readmission_30 * Sex				
Yes*Male	5.51	2.17	1.26 – 9.76	**0.011**

 # = Number of

MB[n] =Mental and Behavioural disorders

^^ Reference category

[¶¶] Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.

[&] Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

F-statistic = 43.80; Prob > F = <0.001

Number of observations = 5,241; Adjusted R^2 = 0. 2688

Postestimation tests and Regression Diagnostics

Interaction Plots

Figure 5- Interaction plot, discharge disposition and age, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

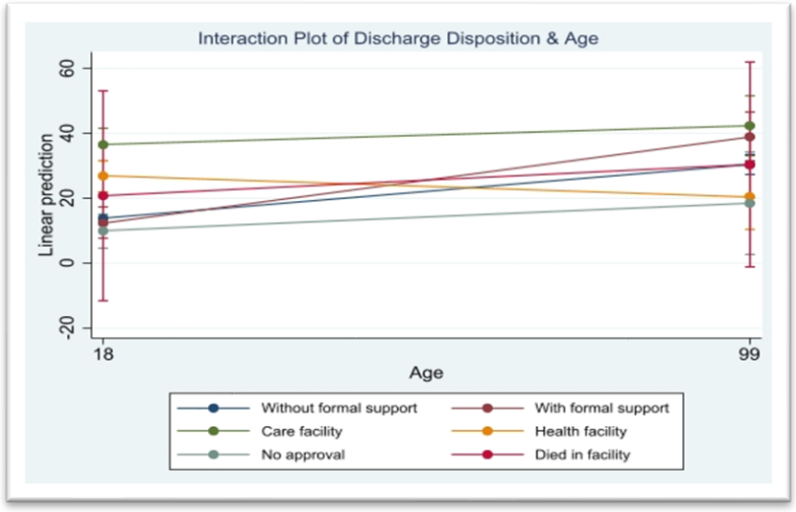


Figure 6- Interaction plot, age and number of comorbidities, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

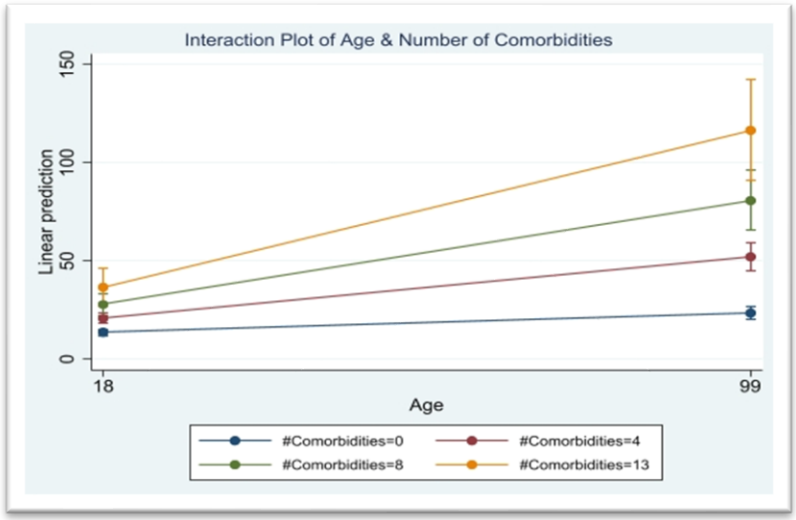


Figure 7- Interaction plot, discharge disposition and number of secondary diagnoses, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

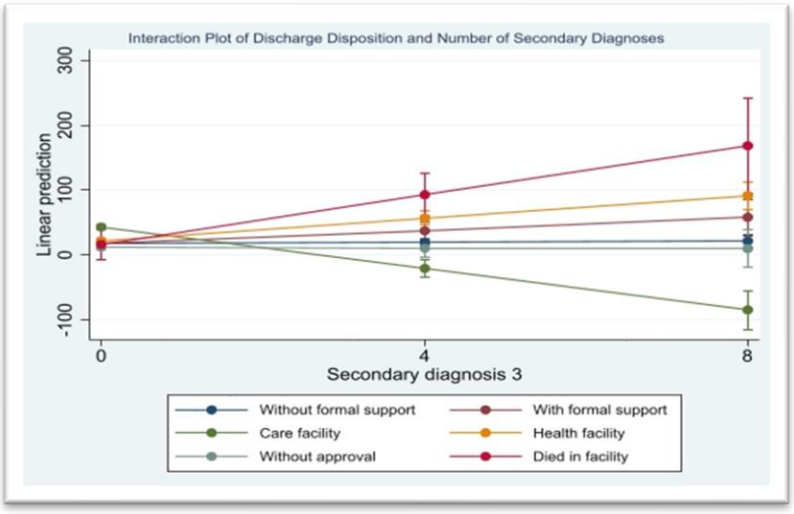


Figure 8- Interaction plot, sex and diagnoses, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

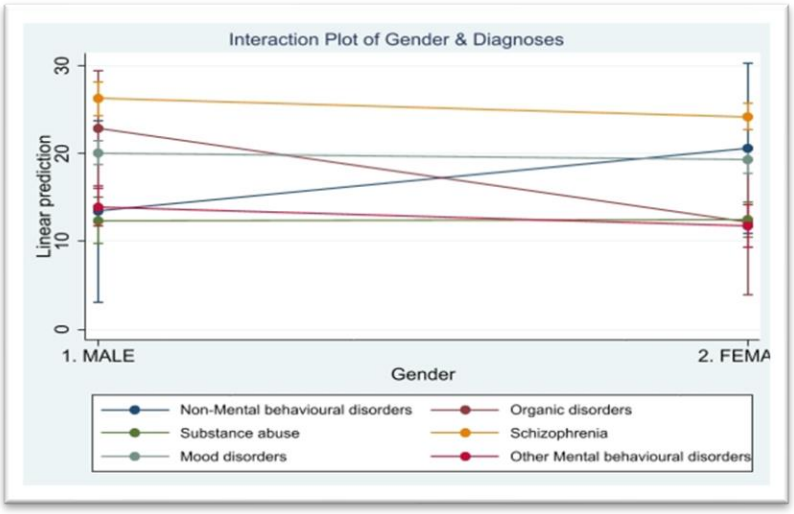


Figure 9- Interaction plot, discharge disposition and ALC designation, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

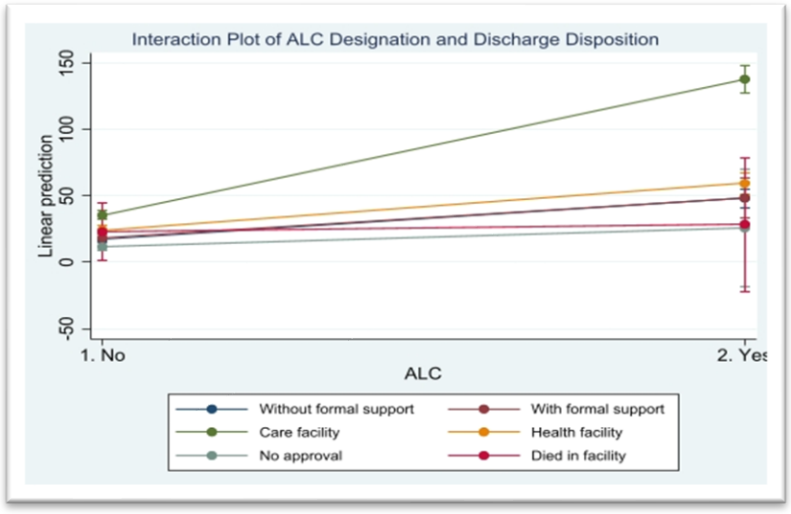


Figure 10- Interaction plot, 30-day readmission and diagnoses, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

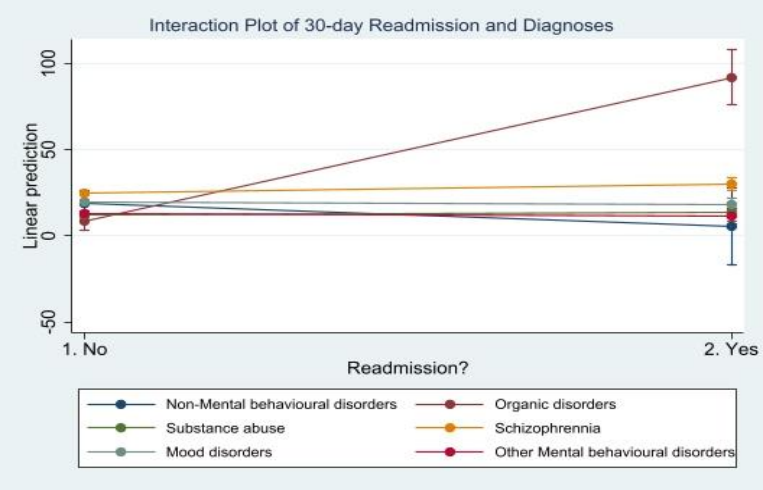
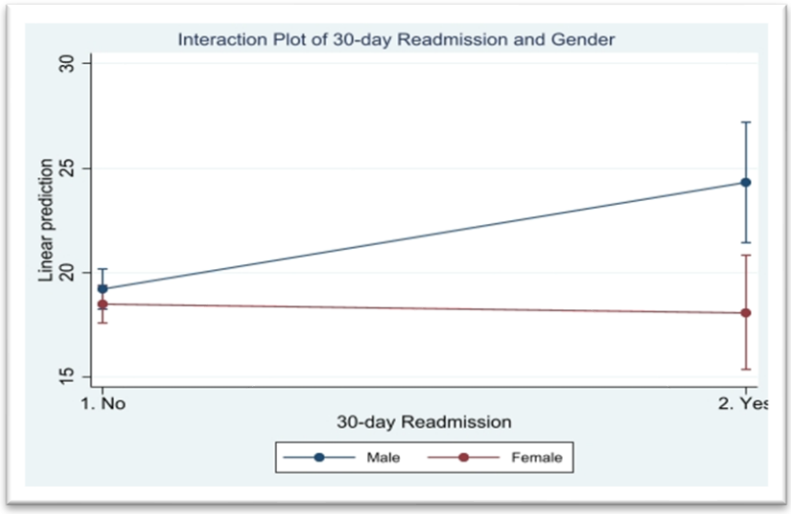


Figure 11- Interaction plot, 30-day readmission and sex, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)



Tests for Normality, Homoscedasticity, Linearity, and Outlier Analysis

Figure 12- Q-Q Plot, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

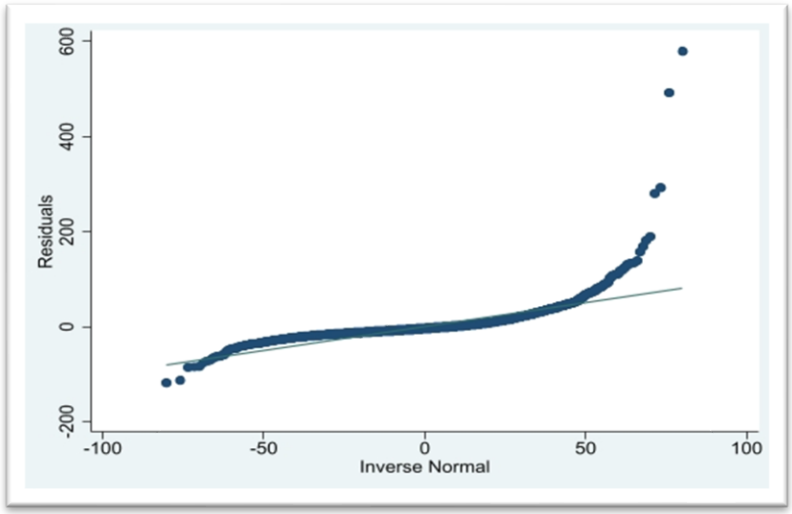


Figure 13- Residual vs Fitted Values, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

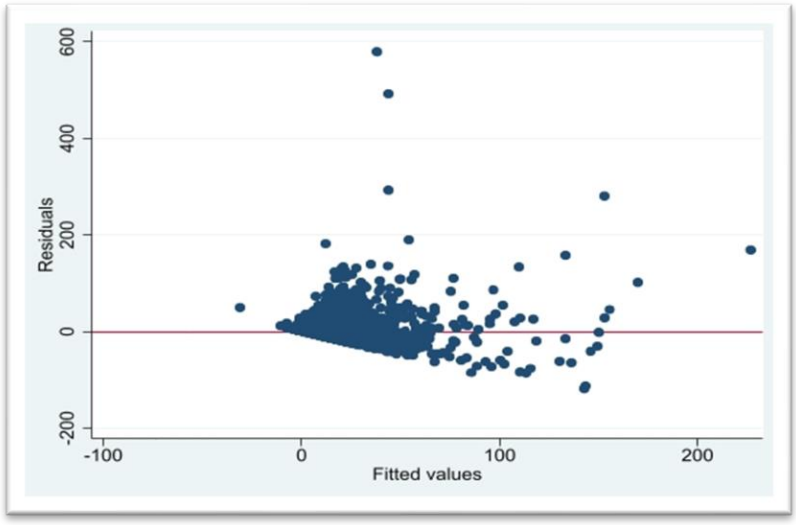


Figure 14- Leverage vs Residuals, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)

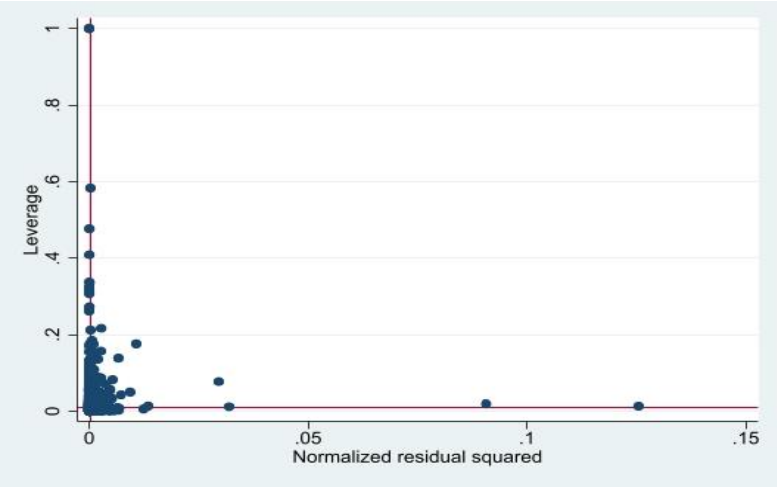
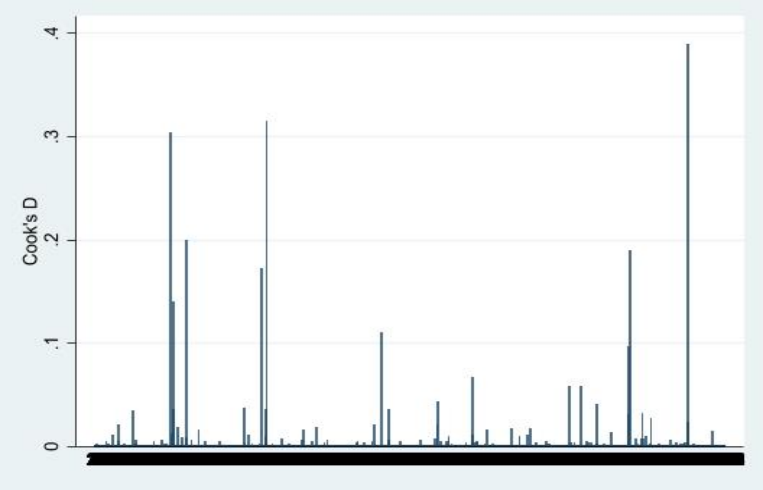


Figure 15- Cook's Distance Bar Plot, adjusted regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,241)



Older Admissions

Table 4.57 shows the results of the final, multiple linear regression models for older adult admissions. ALC designation, discharge to care facility, number of comorbidities were significant predictors of length of stay. Significant interactions were found between ages above 74 years and ALC designation and between transfer to a care home or health facility and the number of secondary diagnoses

Table 4. 57- Adjusted linear regression model, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

Variable	**Beta Coefficient**	**Standard Error**	**95% CI**	**p-value**
Age (75-84) yrs. (85+) yrs. (65-74) yrs.^^	 -1.25 2.87	 4.34 5.98	 -9.78 – 7.29 -8.91 – 14.64	 0.774 0.632
Sex Female Male^^	 -1.00	 3.66	 -8.19 – 6.20	 0.785
ALC Designation Yes No^^	 106.47	 1.72	 83.42 – 129.52	 <**0.001**
Discharge Status With formal support[&]	 1.68	 5.56	 -9.25 – 12.62	 0.762

Care facility	14.04	6.89	0.49 – 27.59	**0.042**
Health facility	-18.12	9.27	-36.35 – 0.11	**0.051**
Without approval[&]	-26.54	32.70	-90.88 – 37.79	0.418
Died in facility	-3.31	19.35	-41.38 – 34.77	0.864
W/O formal support[&]^^				
# Comorbidities	4.93	1.52	1.94 – 7.91	**0.001**
# Secondary Diagnosis	-5.82	3.22	-12.15 – 0.52	0.072
Age * ALC				
(75-84) yrs.*Yes	-75.46	15.25	-105.45– -45.46	<**0.001**
(85+) yrs.*Yes	-94.73	17.70	-129.56 – -59.91	<**0.001**
Discharge Status * # Secondary Diagnoses				
With formal support[&]	-6.43	5.92	-5.21 – 18.07	0.278
Care facility	-12.24	6.10	-24.25 – -0.24	**0.042**
Health facility	16.32	7.16	2.23 – 30.41	**0.023**
Without approval[&]	5.82	46.19	-85.04 – 96.68	0.900
Died in facility	-42.58	30.57	-102.71 – 17.55	0.165

^^ *Reference category*
 # = Number of
[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

F-statistic = 6.88; Prob > F = <0.001
Number of observations = 351; Adjusted R^2 = 0. 2321

Postestimation tests and Regression Diagnostics

Interaction Plots

Figure 16- Interaction plot, age and ALC designation, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

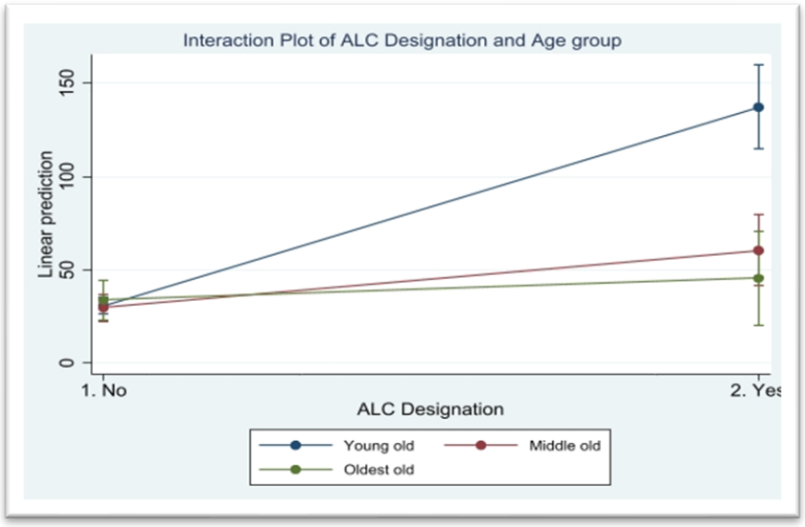
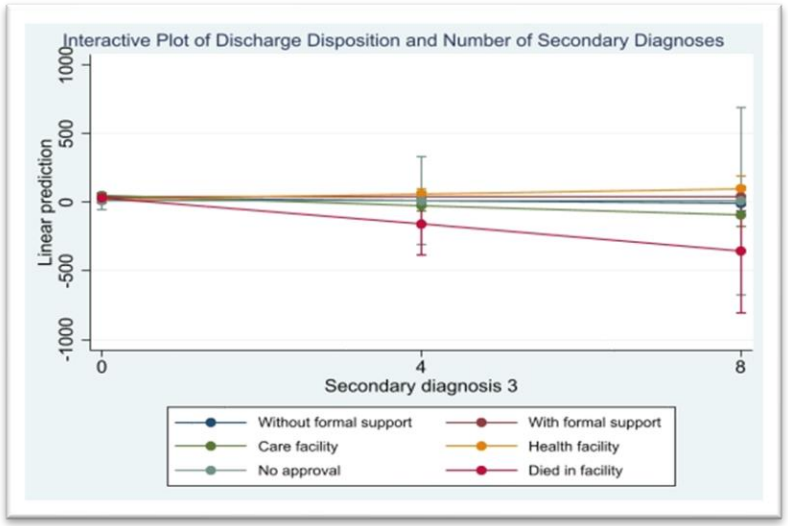


Figure 17- Interaction plot, Discharge Disposition and number of secondary diagnoses, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)



Tests for Normality, Homoscedasticity, Linearity, and Outlier Analysis

Figure 18- Q-Q plot, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

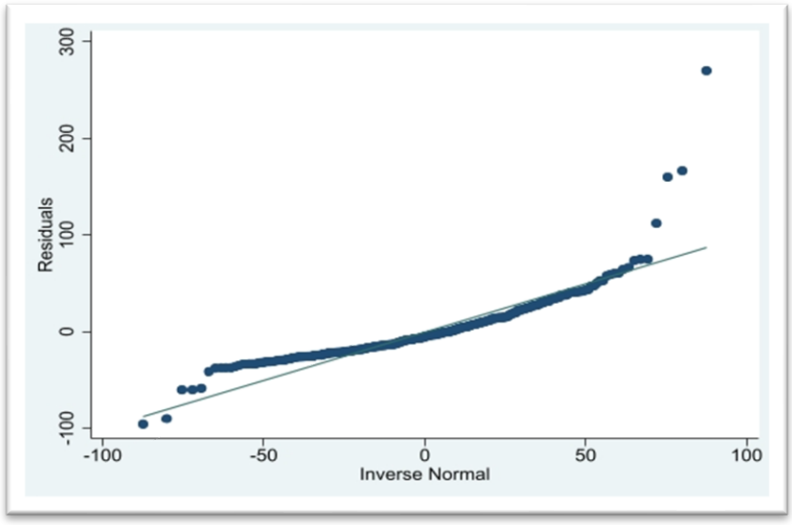


Figure 19- Residual vs Fitted values plot, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

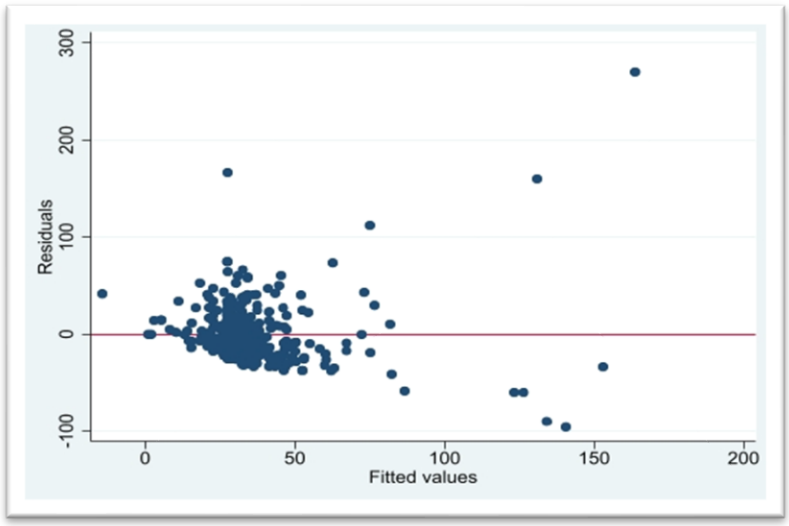


Figure 20- Leverage vs Residuals plot, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

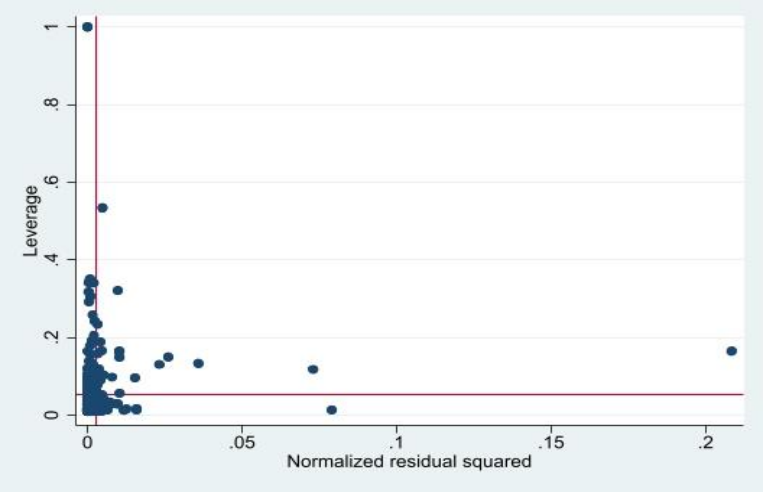
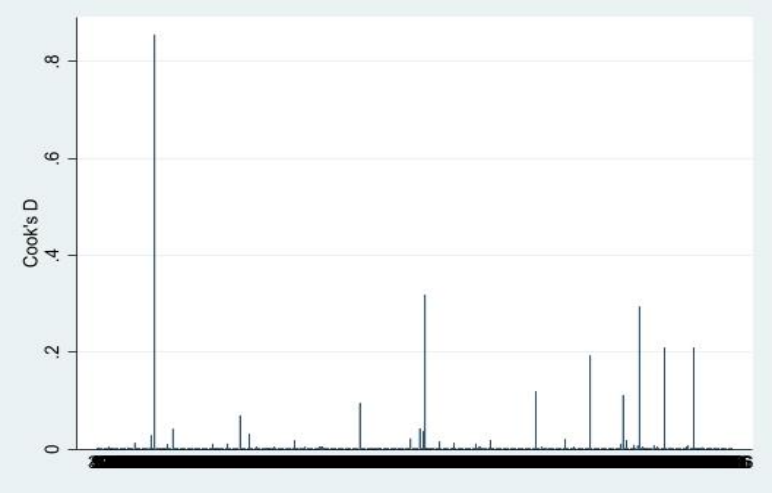


Figure 21- Cook's distance bar plot, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)



4.4 Logistic Regression Analysis

4.4.1 Univariate Logistic Regression

All Admissions

Table 4.58 shows the results of the unadjusted, simple logistic regression models for all admissions. Age, location, discharge disposition, diagnoses and multimorbidity were significant predictors of ALC designation.

Table 4. 58- Unadjusted regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n =5,241)

Variable	Odds Ratio	95% CI	P > z	Log Like.	LR chi(1)	Prob >chi2	Pseudo R^2
Age	1.04	1.03 – 1.05	<0.001	-511.56	52.26	<**0.001**	0.049
Age (groups) 65+ years 18 -64 years^^	5.55	3.60 – 8.56	<0.001	-514.93	45.52	<**0.001**	0.042
Age (groups) (36-55) yrs. (56-64) yrs. (65-74) yrs. (75-84) yrs. (85+) yrs. (18–35) yrs.^^	 1.14 3.26 3.71 11.97 13.38	 0.69 – 1.89 1.84 – 5.75 1.81 – 7.60 6.10 – 23.48 5.60 – 31.98	 0.608 <0.001 <0.001 <0.001 <0.001	-502.74	69.91	<**0.001**	0.065
Sex Female Male^^	1.05	0.72 – 1.54	0.788	-537.66	0.07	0.788	0.001
Location** Urban Rural^^	2.11	1.18 – 3.79	0.012	-533.66	7.63	**0.006**	0.007
Province** Saskatchewan Other Prov.^^	1.77	0.24 – 12.82	0.573	-537.29	0.38	0.535	0.000
Admit Unit DUBE Centre Other units^^	1.74	0.81 – 3.77	0.157	-536.52	2.35	0.125	0.002
Discharge Unit DUBE Centre Other units^^	1.21	0.63 – 2.34	0.564	-537.52	0.35	0.554	0.000
Discharge With formal support& Care facility	 3.84 13.02	 1.89 – 7.75 7.69 – 22.04	 <0.001 <0.001	-455.18	165.03	<**0.001**	0.154

Health facility Without approval[&] Died in facility W/O formal support[&]^^	17.53 0.41 10.47	10.91 – 28.98 0.06 – 2.97 1.31 – 83.73	<0.001 0.376 0.027				
ICD-10 CA Diagnosis[¶¶] Organic disorder Substance abuse Schizophrenia Mood disorders Other MB[n] Non-MB[n]^^	 2.07 0.12 0.27 0.13 0.15	 0.64 – 6.70 0.04 – 0.40 0.09 – 0.79 0.04 – 0.38 0.45 – 0.47	 0.224 0.001 0.017 <0.001 0.001	-507.01	61.37	<**0.001**	0.0571
Comorbidities Yes No^^	 1.29	 0.88 – 1.90	 0.197	-536.84	1.69	0.193	0.002
No of Comorbidities	1.21	1.07 – 1.36	0.002	-533.66	8.06	**0.005**	0.008
Secondary Diagnosis Yes No^^	 5.15	 3.49 – 7.58	 <0.001	-502.74	69.90	<**0.001**	0.065
# Secondary Diagnoses	2.54	2.18 – 2.95	<0.001	-502.74	127.34	<**0.001**	0.118
External Injury Yes No^^	 2.16	 1.20 – 3.90	0.011	-534.97	5.44	**0.020**	0.005
# External Injuries	1.35	1.09 – 1.67	0.005	-534.68	6.02	**0.014**	0.006
Readmission_30 Yes No^^	 1.15	 0.64 – 2.07	 0.632	-537.58	0.22	0.638	0.000
Died Yes No^^	 4.65	 0.59 – 36.68	 0.144	-536.97	1.44	0.230	0.001

 # = Number of

MB[n] =Mental and Behavioural disorders

*** 10 observations invalid*

^^Reference category

[¶¶] Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.

[&] Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

Older Admissions

Table 4.59 shows the results of the unadjusted, simple logistic regression models for older adult admissions.

Table 4. 59- Unadjusted regression model, predictors of ALC designation, older adult admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n = 351)

Variable	**Odds Ratio**	**95% CI**	**P > z**	**Log Like.**	**LR chi(1)**	**Prob >chi2**	**Pseudo R^2**
Age	1.07	1.02 – 1.11	0.005	-98.67	7.60	**0.006**	0.037
Age (groups) (75-84) yrs. (85+) yrs. (65-74) yrs.^^	 3.23 3.61	 1.36 – 7.65 1.29 – 10.05	 0.008 0.014	-97.64	9.65	**0.008**	0.047
Sex Female Male^^	 1.06	 0.49 – 2.27	 0.883	-102.46	0.02	0.883	0.000
Location Urban Rural^^	 3.04	 0.89 – 10.28	 0.074	-100.40	4.14	**0.042**	0.020
Admit Unit DUBE Centre Other Units^^	 0.52	 0.18 – 1.45	 0.208	-101.76	1.42	0.234	0.007
Discharge Unit DUBE Centre Other unit^^	 0.73	 0.22 – 13.37	 0.603	-102.31	0.32	0.575	0.002
Discharge With formal support[&] Care facility Health facility Without approval[&] Died in facility W/O formal support[&]^^	 0.96 6.33 7.93 1.00 5.1	 0.26 – 3.58 2.37 – 16.88 2.70 – 23.35 0.52 – 49.93	 0.947 <0.001 <0.001 0.162	-90.77	23.03	**<0.001**	0.113
ICD-10 CA Diagnosis[¶¶] Organic Substance abuse Schizophrenia Mood disorders Other MB[n] Non-MB[n]^^	 0.87 1 0.19 0.08 0.32	 0.15 – 5.09 0.03 – 1.21 0.01 – 0.49 0.05 – 2.25	 0.885 0.079 **0.007** 0.254	-89.45	25.13	**<0.001**	0.1232
Comorbidities Yes	 1.27	 0.60 – 2.70	 0.538	-102.28	0.38	0.537	0.002

No^^							
# Comorbidities	1.21	0.91 – 1.60	0.191	-101.68	1.58	0.209	0.008
Secondary Diag. Yes No^^	3.87	1.78 – 8.44	0.001	-96.40	12.13	**0.001**	0.059
# Secondary Diagnoses	2.50	1.74 – 3.59	<0.001	-89.88	25.18	**<0.001**	0.123
External Injury Yes No^^	1.59	0.44 – 5.66	0.477	-102.24	0.46	0.497	0.002
# External Injuries	1.30	0.78 – 2.10	0.331	-102.07	0.80	0.371	0.004
Readmission_30 Yes No^^	1.46	0.32 – 6.70	0.629	-102.36	0.22	0.643	0.001
Died Yes No^^	2.73	0.30 – 25.26	0.376	-102.15	0.64	0.423	0.003

MB^n =Mental and Behavioural disorders
^^ Reference category
 # = Number of
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.
& Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

4.4.2 Multivariable Logistic Regression

All Admissions

Table 4.60 shows the results of the final, multiple logistic regression models for all admissions.

Table 4. 60- Adjusted logistic regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

Variable	**Odds Ratio**	**Standard Error**	**95% CI**	**p-value**
Age (65+) yrs. (18 – 64) yrs.^^	2.88	0.87	1.58 – 5.21	**0.001**
Discharge Status With formal support& Care facility Health facility	 1.72 7.25 11.32	 0.70 2.23 3.01	 0.77 – 3.83 3.97 – 13.24 6.72 – 19.06	 0.187 **<0.001** **<0.001**

Without approval[&] Died in facility W/O formal support[&]^^	0.29 3.11	0.31 3.48	0.04 – 2.35 0.35 – 27.81	0.247 0.310
Rural / Urban** Urban Rural^^	2.45	0.81	1.28 – 4.69	**0.007**
ICD-10 CA Diagnosis[¶¶] Organic disorders Substance abuse Schizophrenia Mood disorders Other MB[n] Non-MB[n]^^	2.36 1.00 1.13 0.58 0.81	2.43 1.06 1.12 0.58 0.86	0.29 – 19.06 0.12 – 7.98 0.16 – 7.89 0.08 – 4.16 0.10 – 6.58	0.442 0.998 0.901 0.589 0.841
# Comorbidities	3.14	1.67	1.10 – 8.91	**0.032**
# Secondary Diagnoses	2.51	0.24	2.08 – 3.03	**<0.001**
# External Injuries	1.33	0.23	0.92 – 1.91	0.124
# Secondary Diagnoses * # External Injuries	0.81	0.07	0.68 – 0.96	**0.014**
ICD-10 CA Diagnosis[¶¶] * # Comorbidities Organic disorders Substance abuse Schizophrenia Mood disorders Other MB	 0.38 0.29 0.32 0.37 0.28	 0.23 0.16 0.18 0.20 0.17	 0.11 – 1.25 0.09 – 0.88 0.11 – 0.94 0.13 – 1.09 0.09 – 0.92	 0.110 **0.029** **0.038** 0.071 **0.036**

MB[n] =Mental and Behavioural disorders
^^ Reference category
*** 10 observations invalid*
 # = Number of
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.
[&] Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

Log likelihood = -380.98 LR chi^2 = 313.00; Prob > F = <0.001
Number of observations = 5,231; Pseudo R^2 = 0. 2912

Postestimation Tests and Regression Diagnostics

Interaction Plots

Figure 22- Interaction plot, number of secondary diagnoses and external injury, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

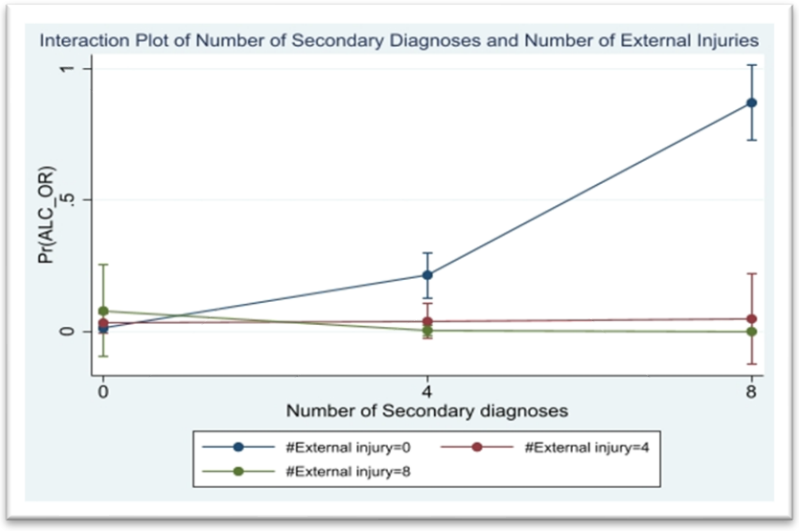
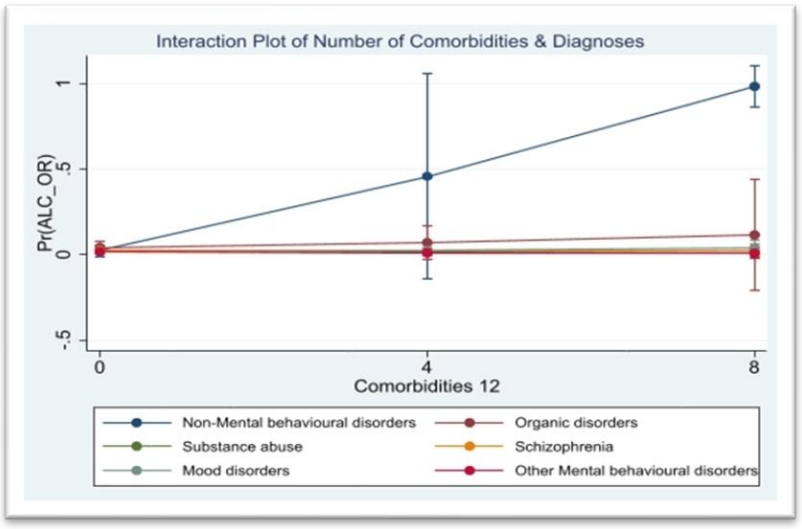


Figure 23- Interaction plot, diagnoses and number of comorbidities, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)



Goodness of Fit Test

Hosmer–Lemeshow chi2(8) = 5.92
No of groups= 10
Homer-Lemeshow Chi^2 = **0.6567**

Model Specification Test

Table 4. 61- Model specification test, final logistic regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

ALC Designation	Coefficient	Standard Error	95% CI	p-value
_hat	0.84	0.16	0.52 – 1.16	**<0.001**
_hatsq	-0.03	0.03	-0.09 – 0.03	0.309

(Iterations omitted); Log likelihood = -380.48
LR chi^2 = 313.99; Prob > F = <0.001
Number of observations = 5,231; Pseudo R^2 = 0. 2921

Older Admissions

Table 4.62 shows the results of the final, multiple logistic regression models for older adult admissions.

Table 4. 62- Adjusted logistic regression model, predictors of ALC Designation, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 349)

Variable	Odds Ratio	Standard Error	95% CI	p-value
Age	1.12	0.05	1.03 – 1.23	**0.012**
Sex Female Male^^	 0.87	 0.43	 0.33 – 2.28	 0.778
Discharge Status With formal support& Care facility Health facility Without approval& Died in facility W/O formal support& ^^	 0.53 3.80 6.39 1 4.90	 0.38 2.14 4.34 (empty) 5.98	 0.13 – 2.17 1.26 – 11.48 1.69 – 24.15 0.45 – 53.65	 0.375 **0.018** **0.006** 0.193
Location Urban Rural^^	 5.37	 3.94	 1.29 – 22.56	 **0.021**
# Secondary Diagnosis	2.45	0.51	1.62 – 3.69	**<0.001**

^^ *Reference category*
 # = Number of
& *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

Log likelihood = -76.27; LR chi^2 = 52.04; Prob > F = <0.001
Number of observations = 349; Pseudo R^2 = 0. 2544

Postestimation Tests and Regression Diagnostics

Goodness of Fit Test

Hosmer–Lemeshow $chi^2(8) = 3.07$
No of groups= 10
Homer-Lemeshow Chi^2 = **0.9301**

Model Specification Test

Table 4. 63- Model Specification Test, Adjusted logistic regression model, predictors of ALC Designation, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 349)

ALC Designation	Coefficient	Standard Error	95% CI	p-value
_hat	1.11	0.33	0.45 – 1.76	0.001
_hatsq	0.03	0.08	-0.13 – 0.19	0.706

(Iterations omitted); Log likelihood = -76.20
LR chi^2 = 52.18; Prob > F = <0.001
Number of observations = 349; Pseudo R^2 = 0. 2551

Chapter 5: Discussion

5.1 Summary of Main Findings

Research Objective 1: Are there differences in in-patient outcomes such as length of stay, alternate level of care designation, alternate level of care days, discharge disposition, and deaths between age-groups in a general psychiatric unit?

There were significant differences between older (65 years and above) and younger (18-64 years) patient admissions and in all outcomes explored in this study. However, among older age groups, only mortality and discharge disposition were significantly different. These findings support the hypothesis that older and younger patients in the general psychiatric ward have different outcomes and these differences are often in favour of younger patients.

Research Objective 2: What factors influence length of stay and ALC designation among all admissions and older patient admissions in a general psychiatric unit in Royal University Hospital?

Among all admissions, significant predictors of length of stay include age, ALC designation, discharge disposition, admit nursing unit and external injuries. There were significant interactions between discharge disposition and age, discharge disposition and secondary diagnoses, discharge disposition and ALC designation, age and comorbidities, diagnoses and sex, diagnoses and 30-day readmission as well as between 30-day readmission and sex. Among older adult admissions, ALC designation, discharge disposition, and comorbidities were significant predictors of length of stay. There were also significant interactions between age and ALC designation as well as discharge disposition and secondary diagnoses. In both older and younger patient admissions, ALC designation was the major predictor of length of stay.

Significant predictors of ALC designation among all admissions included age, discharge disposition, place of residence (rural/urban), and multimorbidity. There were also significant interactions between secondary diagnoses and external injuries and between diagnoses and comorbidities. For older adult admissions, age, discharge disposition, place of residence (rural/urban) and secondary diagnoses were significant predictors of length of stay. Urban or rural location was also a predictor of ALC designation but not length of stay. Sex was neither a predictor of length of stay nor ALC designation.

Overall, the variables explored in this study predicted about less than 30% of length of stay variance. There is a need to explore and examine how other variables contribute to length of stay and delayed discharges.

5.2 Interpretation of Results

This study provides a large population of psychiatric admissions in Royal University Hospital, Saskatoon, Saskatchewan. During the study period, admissions were more likely to be younger patients (93% compared to 7%). The number of admissions during the study period also decreased with increasing age groups since those aged 18-35 years had the most admissions (51.8%) and the oldest, aged 85 years and older had the least admissions (0.9%). The prevalence of older adults in the Royal University Hospital psychiatric units falls within the range reported in similar studies in hospital settings (28). This wide difference between older and younger adults may be attributable to the lower prevalence of mental health disorders among seniors reported in many epidemiologic studies (101), or lower rates of mental health service utilization among the elderly (102). Mental health problems in older adults are also often missed since many older adults seek treatments from general practitioners (103). Despite their smaller population, we have observed large and important

differences in the demographic and clinical outcomes between younger and older patient admissions at the Royal University Hospital.

Only the male and female sexes was included in the study dataset. Therefore, analysis was limited to these sexes. It is clear that sex as a biological construct was used in this dataset. Gender, a social construct, intersects with several demographic factors and these interactions can highlight the actual realities of men and women in a population. Therefore, it is important that databases capture more information than sex-disaggregated data (104). In this study, sex distribution among younger patients was relatively even (47% female admissions compared to 53% males), however older patient admissions were more likely to be female (61% compared to 39%). In a similar study conducted in Ontario, Canada, older adults in acute psychiatric units were also more likely to be women (61% older women compared to 51% younger women) (28). Some studies have shown that compared to men, women live longer and are therefore more likely to have a greater burden of morbidity and disability in later life. In addition, women are more likely to utilize health services compared to men (105–107). This sex difference in older patients can be explained by this. As expected, most admissions were by patients from Saskatchewan (98.3%). Compared to seniors (0.9%), more younger patient admissions (1.6%) were by patients from other provinces. Overall, more than one-fifth of admissions (21.7%) were of patients from rural locations. Among older patient admissions, this proportion was almost one quarter (24.1%). In rural locations, the responsibility of psychiatric care is shared among other medical services since there are fewer mental health and psychiatric services in these areas (108). This might explain why a substantial percentage of patients were from rural locations. Sadly, there is little to no research on the geographical and age-related needs and utilization of psychiatric services in Canada (108).

Most patients had a most responsible diagnosis of a mental and behavioral disorder according to the ICD-10 CA guidelines. The most common diagnoses observed were mood disorders, schizophrenia, and disorders due to psychoactive substance use. This was consistent for both index admissions and all admissions. Similar results were reported by the Canadian Institute of Health Information between 2009 and 2010 on mental health services in both general hospitals and psychiatric hospitals in Canada (109). Among the elderly, mood and affective disorders were responsible for almost half of admissions (48.2%). This was followed by schizophrenia and schizotypal disorders (23.8%) and then organic disorders (14.2%). However, among those with organic disorders, elderly admissions were more prevalent (61%). These three conditions in addition to disorders due to psychoactive substance abuse represent the most common mental diagnoses among Canadian older adults according to the Mental Health Commission of Canada (4). More than half of the entire population had at least one comorbidity. Contrary to previous studies where comorbid medical conditions are more prevalent among older adults (28), the proportion of the presence of comorbidities was similar across all age groups. Although the average number of comorbidities for all age groups was 2, older patient admissions had less comorbidities (in total) compared to those younger.

We observed a general increase in proportion of those with secondary diagnoses with increasing age. Those aged 75 years and older had the highest average number of secondary diagnoses. The proportion of the presence of external injuries were highest for patient admissions between 56- 64 years and those aged 85 years and older (8.9% and 8.7% respectively). Just like comorbidities, the highest number of secondary diagnoses and external injuries were recorded by younger patient admissions; however, those between 75-84 years had the highest mean external injuries among all age groups. There is increasing evidence on the severe implications of multimorbidity on survival

in chronic conditions especially in older adults (110–112). Therefore, while older patients were more likely to have at least one coexisting morbidity, younger patients had the highest number of multimorbidity.

Younger patient admissions were more likely to result in home discharge with or without formal support and discharge without approval. Discharge without formal support was described as discharge to a private residence with community support at home or referral to services. Discharge without approval was described as leaving against medical advice, without a pass or not returning from a pass. The oldest age groups, 85 years and older, were most represented in transfers to care facilities and to health facilities. Although the general proportion of admissions resulting in death was very low, older patient admissions, particularly those aged 85 and above, had much higher rates of death in the facility compared to those younger. When discharge disposition is dichotomized into home discharge versus others, we observed a decrease in home discharge with increasing age groups. Similar findings were observed by another study conducted between older and younger patients where older psychiatric patients were more likely to die in facility, discharged to a nursing home, or discharged with supportive services while younger patients were more likely to be discharged home without support or be discharged without approval (113). In another review, younger age was a predictor for discharge against medical advice (114).

Of all admissions, 10.2% of admissions resulted in 30-day readmissions and of these, only 3.1% were older adult admissions. A previous study conducted in Ontario found that 13% of a population-based cohort of older adults were readmitted and 20% of readmissions resulted in death in the facility (115). In this study, compared to older adult admissions, more younger patient admissions were associated with 30-day readmissions. Among those readmitted within 30 days of prior discharge, more younger patients were discharged without approval or transferred to a care

facility or health facility. However, no 30-day readmission resulted in death in the facility. There is limited research conducted on readmission in acute care settings. Readmission rates are useful in examining the performance and quality of the healthcare system. They can also inform on patient transitions from the community or other discharge dispositions to the hospital and vice versa. In older adults who may transition across home care, community support, long-term care and acute care, readmissions assessment can improve management and aid discharge planning (115).

In many studies, age and physical function has been shown to influence discharge destinations and readmissions (115–117). Much more important predictors of discharge disposition and readmissions identified by previous studies among older adults are frailty, functional status, cognitive status and caregiver availability (33,68,115,117–119). There is limited information on frailty and cognitive or functional status in the Canadian administrative databases for acute care and this has made it difficult to postulate and identify the appropriate relationship between these factors and health outcomes. Some authors have suggested that this relevant information be included in acute care data repositories in order to facilitate robust research on acute care patients particularly older adults (55).

Mental diagnoses are often associated with longer hospital stays and this relationship is influenced by age. Statistics Canada reports that compared to other admissions, lengths of stay for patients with mental diagnosis was two and half times longer and older patients had even longer stays. For example, among 20-year-old patients, mean lengths of stay for those without a mental diagnosis was about 3 days compared to about 12 days for those with a mental diagnosis. Among 70-year-old patients, those without a mental diagnosis had an average length of stay of 8 days compared to 27 days for those with a mental diagnosis (120). In this study, we observed a marked difference in length of stay quintiles between older and younger patient admissions. The average length of stay

for all admissions was 20 days and a similar pattern with respect to age was observed. Among admissions for patients between 18 and 64 years, the mean length of stay was 19 days compared to 35 days for admissions by patients aged 65 years and above. When this is further observed across narrower age bands, the average length of stay increased with increasing age groups. The average length of stay for young adult admissions aged between 18 and 35 years was 19 days while that of the oldest old (85 years and older) was 39 days. When length of stay was divided into quintiles, older patient admissions were more represented in the 4th and 5th quintiles compared to younger patient admissions.

Overall, some diagnoses were associated with longer length of stays compared to others. These included behavioural syndromes associated with physiological disturbances and physical factors (F50-F59), mental retardation (F70-F79), disorders of psychological development (F80-F89), other degenerative diseases of the nervous system (G30-G32). In older patient admissions however, nearly all diagnoses were associated with longer lengths of stay. Approximately 69% of older adults were represented in the 4th and 5th length of stay quintiles compared to 37% for younger patient admissions. In previous studies, diagnoses such as psychosis, mania or bipolar disorders and substance abuse have been associated with longer lengths of stay (121–123). Illness severity, especially in psychiatric units, have also been shown to also be associated with lengths of stay (123,124). However, because of a lack of detailed clinical information available in the dataset, illness severity other than the diagnostic category was difficult to measure in this study.

Throughout the study period, only about 2% of admissions were designated alternate level of care. Although on the lower end, this falls within the 2-7% range of ALC designations in Canada (44). Schizophrenia and schizotypal disorders were responsible for 35% of all ALC designations while mood disorders and organic disorders were attributable for about 24% and 13% respectively. Of

these conditions, more admissions with diagnoses for organic disorders were designated ALC - approximately 18%, compared to 3% and 1% for schizophrenia and mood disorders respectively. This finding corresponds to analyses by CIHI where dementia was found to be the most common diagnosis in ALC designations (120).

Among younger patient admissions, ALC designations constituted only about 1.8% of all admissions compared to 8.5% of older adult admissions. Despite representing only about 7% of the entire population, older adults were responsible for about 16% of all ALC designations. Older patients generally make up the majority of ALC designations usually because they are awaiting discharge into long-term care homes (125). Younger patient admissions were, however, associated with longer ALC days compared to older adult admissions. The average age of patients designated ALC during the study period was 48 years. This age is lower than previous findings in which the average age of ALC designation was 80 years (43,44). ALC designation was found to increase length of stay by about 61 days. In similar studies, those designated ALC were shown to spend an average of 31 days compared to 3 days for those who were not (42). Compared to the other discharge dispositions, more admissions designated ALC were discharged home without formal support (35%) closely followed by discharge to a health facility (31%) and care facility (22%). For older patients admissions designated ALC, discharge was more likely to be to a care facility or transfer to a health facility. According to the CIHI, the foremost destination for ALC designations was to a long-term care facility (43%) while 25% were discharged home (44). Only one admission designated ALC resulted in death, and this was an older patient aged between 65-74 years.

A few diagnoses were excluded from bivariate and regression analysis. This was done to remove outliers in the study while ensuring that the sample was representative of the study population. As specified in the study objectives, bivariate analysis was conducted between older and younger

patient admissions as well as within older patient admissions. With respect to length of stay, there was a significant difference between older patient and younger patient admissions (p-value: <0.001). Post-hoc ANOVA diagnostics revealed that there were significant differences in mean length of stay between the different age groups. Similar findings were observed between adults and seniors with schizophrenia in Ontario (126). There were also significant differences in ALC designation (p-value: <0.001) and ALC length of stay (p-value: 0.050) between older and younger patients. This difference remained significant for ALC designation when the age groups were further divided (p-value: <0.001). However, there was no difference in ALC length of stay among the smaller age groups (Prob>F: 0.255). Though few studies have examined age-related differences in ALC days, some studies have found significant age-related differences in ALC designation among mental health patients (127). There was a significant difference in the various discharge dispositions between older and younger patient admissions (p-value: <0.001). When discharge disposition was divided into home discharge versus others, there was significant difference among the different age groups (p-value: <0.001). Despite the small proportion of deaths in the cohort, there were significant age-related differences in deaths between older and younger patient admissions (p-value: <0.001) and across all age groups (p-value: <0.001). Few studies have also observed similar results in discharge disposition and deaths between older and younger patients in psychiatric inpatients (113).

Among older age groups, there was no significant difference in length of stay (Prob>F: 0.420), ALC days (Prob>F: 0.483), and deaths (p-value: 0.129). However, there were significant differences in discharge disposition, both within various categories of discharge disposition (p-value: 0.001) and when discharge was divided into home discharge versus others (p-value: <0.001) and ALC designation (p-value: 0.007). A similar study conducted in China among older age groups

admitted to the emergency room found significant differences in the length of stay in the emergency department and discharge disposition from the emergency department. Differences in mortality rates were also significant across the older age groups with the oldest old (aged 85 years and older) having the highest death rates (128).

Several patient demographics and clinical characteristics predicted length of stay. In many studies, age has been shown to be a significant predictor of length of stay in psychiatric units and older adults often spend longer days in acute care (129,130). However, some studies have also found that age is not a significant predictor or length of stay (124). In this study, each additional year of age above 18 years was associated with approximately an additional LOS of 0.3 days (8 hours). Compared to younger patients, older patent admissions spent about 17 more days in acute psychiatric care. When ages are further divided into groups, we observed a gradient increase in LOS. Generally, we observed that the higher the age, the longer the length of stay and those aged 85 years and older had the longest stay of about 22 days longer compared to those aged between 18 and 35 years. However, in older adult admissions, age by itself, was not a significant predictor of length of stay.

Using the adjusted R-square as a measure of the proportion of variance in length of stay, the biggest predictors of length of stay for all admissions were ALC designation (9.6%), discharge disposition (8.3%) and diagnoses (4.8%). Compared to those who were not designated ALC, those who were designated ALC had additional LOS of 57 days. In older adults, ALC designation accounted for additional 47 days compared to non-ALC patient admissions. It is evident that ALC designation delays discharge and severely increases length of stay (42). Among older patient admissions, discharge to a care facility was the only significant discharge disposition and accounted for an additional LOS of 20 days compared to those discharged home without formal support. For all

patient admissions, those who were discharged to a care facility had an additional LOS of about 31 days. This is very likely since most patients who are designated ALC are often awaiting discharge to long-term care homes (42,125). Those who died had an additional LOS of 28 days, those who were transferred to a health facility had an additional LOS of 17 days and those discharged without formal support had additional LOS of about 9 days. However, those who were discharged without approval had the least LOS with 10 days less compared to those discharged home without formal support. Similar findings have been observed in England where people who self-discharge (or are discharged without approval have shorter LOS (129). This finding is logical since patients who leave against medical approval are more likely to have mild illness and people who die in facility are more likely to have severe illness.

Of all diagnoses, diagnosis of organic disorders had the highest length of stay of additional 14 days compared to those with non- mental and behavioural disorders. while substance abuse had the least (13 days less). For older adult admissions, diagnosis was not a significant predictor of length of stay. This is likely since almost all older patients had longer lengths of stay regardless of diagnosis. In similar studies, schizophrenia, schizotypal disorders, and psychoses as well as mood disorders have been associated with longer LOS (124,130,131). Consistent with the literature, substance abuse was associated with least stays (130,132). Sex and patient's address were insignificant predictors of LOS. These findings correspond with a similar study conducted in Ontario among psychiatric inpatients, there were no sex-related differences in LOS and another in England among patients with severe mental illness where sex was not a significant predictor of LOS (129,133). However, in other studies, sex has been shown to be a significant predictor of LOS (121,130).

In the final regression model for all admissions, we observed several interactions between discharge disposition and other predictors. Among those discharged to a care home, those

designated ALC had longer lengths of stay compared to those who were not (71 days more). The interaction between discharge to a health facility and age led to a decrease in length of stay. This means that when other predictors were held constant, for every increase in age, we observed that those who were transferred to a health facility spent about 0.3 days less. Apart from discharge without approval, all discharge outcomes also showed significant interaction with the number of secondary diagnoses. Overall, those who had more secondary diagnoses and died in facility had the longest lengths of stay. Furthermore, with increasing comorbidities, increasing age led to longer lengths of stay. From the interaction plot, the highest number of comorbidities (13) resulted in the most drastic increase in length of stay with regards to age. The additive effect of comorbidities and age on length of stay has been documented in previous literature and in several chronic conditions (112,134). Although older patients were more likely to have less comorbidities compared to younger patients presumably due to survivor bias, those who survive with increased comorbidities, have worse prognosis.

We observed that males with organic disorders had significantly longer lengths compared to females (18 additional days). Similarly, males had longer lengths of stay compared to females (about 6 additional days) among those readmitted within 30 days of prior discharge. Those readmitted within 30 days of prior discharge for organic disorders also had longer lengths of stay compared to those readmitted for other diagnoses. Overall, this model predicted about 27% of variance in length of stay. Although there were a few outliers, there were no influential data points and cook's distance for all data points was below 1. A limitation of this analysis is the violation of the assumption of independence in linear regression model since this model included readmissions of same individuals throughout the study period.

For older patient admissions, ALC designation remained the biggest predictor of LOS. In the final, adjusted model, ALC designation, discharge to care facility, number of comorbidities remained significant. In terms of interactions, longer lengths of stay were observed among those aged between 65 - 74 years (often referred to as the young-old age group), who were designated ALC compared to those who were not. This is probable since among the elderly, much older adults who are designated ALC during admission are more likely to be given priority of discharge or transfer compared to those younger. Just as with all admissions, we found significant interaction between discharge disposition and secondary diagnoses among older patient admissions. With an increasing number of secondary diagnoses, those who were transferred to a care facility had shorter lengths of stay and those who were transferred to a health facility had longer lengths of stay. This model accounted for approximately 23% of variance in LOS and there were also no influential data points and cook's distance for all data points was below 1. Similarly, the assumption of independence in linear regression was violated because the model included readmissions of the same individuals throughout the study period.

Several factors also predicted ALC designation in the unadjusted logistic regression model for all admissions. One year increase in age was associated with 4% greater odds of ALC designation. The odds of ALC designation among older patient admissions was about 6 times greater than younger patient admissions. Although the odds of ALC designation among 36-55 years was not significant compared to 18-35 years, all other age groups had greater odds of ALC designation, and the odds increased with increasing age groups. The odds of ALC admissions among 85 years and older was about 13 times greater compared to 18-35 years. In addition, urban or rural place of residence, discharge disposition, diagnoses and comorbidities and secondary diagnoses were also major predictors of ALC designation. Older age especially above the age of 75 years and multiple

morbidities have been linked to increased risks of ALC designations (135,136). In addition, functional decline and cognitive impairments are associated with increased risks of ALC designation (45) but as previously noted, these cannot be measured using secondary data from the Canadian administrative databases (55). In older adult admissions, one year increase in age was associated with 7% greater odds of ALC designation. Among those aged 85 years and older, the odds of ALC designation was about 4 times compared to those aged between 65-74 years. Secondary diagnoses, mood disorders, and discharge disposition to care and health facilities were also significant predictors of ALC designation.

In the final logistic regression model for all admissions, older adults had almost thrice higher odds of ALC designation compared to those aged between 18 and 64 years. This finding corresponds to a similar study conducted in Ontario where the odds of ALC designation among patients aged 80 years and older was almost 3 times more than those aged less than 80 years (42). Transfer to a health facility was also associated with 11 times greater odds compared to admissions resulting in home discharge without formal support while those transferred to care homes had 7 times greater odds of ALC designation. The odds of ALC designation among those who resided in urban areas was twice greater than those in rural areas. Increasing comorbidity and secondary diagnoses was associated with thrice and twice the odds of ALC designation respectively. This is comparable to prior studies where comorbidities increased the odds of ALC designation (42). Diagnoses by itself was not a predictor of ALC designation but interaction between diagnosis and number of comorbidities was found to be significant. We observed that those diagnosed with substance abuse and schizophrenia had lower odds of ALC designation with increasing comorbidities. Similarly, those with more external injuries and secondary diagnoses had lower odds of ALC designation. This is very likely since ALC designation is reserved for admissions who occupy a bed but do not

require the intensity of services provided. Therefore, those with increasing external injuries (such as falls, injury, and poisoning) and secondary diagnoses may require active care and cannot be designated ALC compared to those without. This model showed satisfiable goodness of fit (p-value: 0.657) and there was no specification error as shown in the link test.

Among the older patient admissions, urban or rural location, discharge to a care facility or health facility and secondary diagnoses was associated with significantly greater odds of ALC designation. Diagnosis of mood disorder was however associated with lower odds of ALC designation. In the multivariable regression model, increasing age was associated with 12% greater odds of ALC designation. Discharge to a health facility or care home was associated with 6 times and 4 times greater odds of ALC designation. Older patients living in urban locations had about 5 times greater odds of ALC designation compared to those in rural locations. Increasing number of secondary diagnoses was also associated with 2 times the odds of ALC designation. There were no interactions observed in this model however, the model showed satisfiable goodness of fit (p-value: 0.930) and there was no specification error.

The involvement of multimorbidity, that is, comorbidities, secondary diagnoses, and external injuries as predictors of ALC designation and length of stay for all admissions older patient admissions was evident in this study. Since multimorbidity has been associated with reduced functional capacity particularly in patients with mental illnesses (137), and functional impairment has been directly linked to length of stay and ALC designation (55,138), this finding is logical. As expected, odds of ALC designation was higher among those who were discharged to a care facility or health facility in all admissions and older adult admissions. Urban living was also implicated in increased odds of ALC designation for all admissions and older admissions. Similar findings were observed in a study conducted in Ontario among seniors, where ALC designation was more

common in patients awaiting discharge to long-term care or a residential home and among patients who lived in an urban geographical location (139). The reason for this is unclear but we presume that long-term care homes in urban areas have longer waitlists compared to those in rural areas. Since the majority of patients in this study were from urban areas, this may influence the choice of the facilities patients designated ALC are transferred to.

Findings from this study were presented to the geriatric team at the Dube Centre, Royal University Hospital. Feedback included comments on the wide differences in the utilization of in-patient services, deaths, inclusion of sex-aggregated data as well as the benefits and feasibility of a separate age-specific unit for older patients. The disparity in utilization of services between older and younger patients was attributed by the prior provision of psychiatric services in long-term care. According to the head of the team, Dr Renuka-Prasad, up until recently, psychiatric services were provided in long-term care homes compared to in-patient acute care. This adds to previous explanations for the vast difference in utilization of in-patient services between older and younger patients in this unit. With regards to the inclusion of gender rather than sex-aggregated data, in recent years, gender has been identified among patients and included in data collected at the unit. We hope that this inclusion will be translated in administrative databases and health research. In addition, several factors may have contributed to deaths in the facility particularly for older patients. This includes old age and other coexisting conditions in the patients that may require care and services in other units for example, palliative care services. The team also reflected on the involvement of multimorbidity, especially secondary diagnoses and external injury in predicting length of stay and ALC designation.

With regards to the feasibility of a separate unit for older patients at the Dube Centre, the health care team were in support. They highlighted that such a unit will be beneficial for the entire

department as it will ease the implementation of **age-specific services** for older adults. They however, hoped that further research could be done comparing outcomes and predictors of lengths of stay and ALC between a general in-patient psychiatric unit and a geropsychiatric unit. To our knowledge, there are no active geropsychiatric units in Saskatoon and comparing general psychiatric units with geropsychiatric units in a different facility or different province may introduce bias as well and reduce validity in the potential study.

Although this study does not provide a comparison between a geropsychiatric unit and a general unit, we have shown that older psychiatric patients have worse outcomes compared to younger patients and believe that specialized units and services for elderly patients with psychiatric disorders can ensure that care is tailored to their specific needs which can improve their outcomes. According to CIHI, the median ALC days for mental health stays in acute care units in Canada (excluding Quebec) between 2017 and 2018 was 11 days. In this study, the median ALC days in this study was 15 days. Furthermore, the average length of stay for mental health beds in general hospitals between 2017 and 2018 in Canada (excluding Quebec) was 13 days while that of psychiatric hospitals was 67 days (140). The average length of stay in this study was 20 days. The lengths of extended stays or ALC days at the Dube Centre, RUH, was higher than the national median ALC days. Since ALC designation is the biggest predictor of length of stay, and older patients with mental illnesses have thrice the odds of ALC designation compared to younger patients, providing age-specific units can be useful in decreasing the burden of long lengths of stays. Overall, the findings from this study were accepted by the geriatric psychiatric team of health professionals at the Dube Centre, Royal University Hospital.

5.3 Conclusions and Recommendations

- Age is a predictor of both length of stay and ALC designation and older patients are of higher risks of both. Older patients with mental illnesses have needs which differ from younger patients and require a different type of care. This is the reason for the specialty of geriatric medicine. Although geriatrics are based on an arbitrary age of 65 years, there are different groups of geriatric patients. The differences between these types of patients may be wide or slim, and the decision to admit an older patient into a separate geriatric unit is based on each patient's characteristics and the specialists involved (141). A separate geriatric unit especially for older patients with mental illnesses, is useful to provide care, which is independent from other services, but in close connection to other departments including medical and rehabilitation services. Additionally, a geropsychiatric unit can provide the added benefits of a separate unit for training geriatric psychiatrists to discover more efficient methods of caring for the elderly, prevent geriatric syndromes, reduce length of stay, delayed discharges, monitor and improve functional and cognitive status, increase the likelihood of home discharges, reduce the in-hospital mortality and mortality after discharge, and reduce the cost of hospital expenditure (141). From existing literature, we have seen that these units can be developed with little to no resources (19,30,142) and the cost-analysis of these units show huge returns on investments and save healthcare dollars (30,31,143,144).
- For older adults, geriatric syndromes such as functional and cognitive status, as well as illness severity predict lengths of stays and delayed discharges more than demographic characteristics (55). This is particularly important for psychiatric patients however, secondary data from administrative databases in Saskatchewan do not capture these factors. Standardized measures such as frailty index, Activities for Daily Living (ADL),

Instrumental Activities for Daily Living (IADL), Mini-Mental State Examination (MMSE), Cognitive Performance Scale (CPS) and their derivatives can be included in routinely collected administrative data and other health information databases to enable future researchers to explore how these factors contribute to length of stay, delayed discharges and how they interact with other predictors.

- ALC designation is the biggest predictor of length of stay. It has been described by some authors as health system inefficiency which is influenced by patient-level characteristics and to a greater extent, organizational and system factors (43,135,145). As a result, patient characteristics may not be sufficient to predict ALC designation. Future research can explore how system-level and organizational factors contribute to delayed discharge in Saskatoon. This can influence policy making in the efficient allocation of funds and development of more efficient schemes to address such gaps in the healthcare system. In addition, older adults have three times the odds of ALC designation compared to younger patients. Since ALC designation is the biggest predictor of length of stay, older adults who are designated ALC contribute to the burden of long lengths of stay. This has huge implications on health care costs for the government, for patients and their caregivers. Therefore, providing age-specific services and specialized units for older patients with psychiatric disorders can increase the efficiency of the health care system and reduce these costs.
- Several studies have explored how comorbidities influence outcomes in psychiatric admissions (110,134), however, fewer studies have explored other multimorbidity such as secondary diagnoses and external injuries especially among older adults. In this study, although the average number of comorbidities were similar across the age groups, older

adults aged 75 years and above had the highest average number of secondary diagnoses and external injuries. In addition, comorbidities, secondary diagnoses, and external injuries influenced both length of stay and ALC designation either as individual predictors or by interacting with other predictors. Future research can examine, in detail, how various sources of multimorbidity can influence delayed discharge and other health outcomes in psychiatric patients especially with respect to age. In addition, since the linear regression model in this study did not account for repeat admissions by the same individuals, future studies can consider other analytic approaches for repeated measures over time.

5.4 Strengths and Limitations

Our study has several strengths. Because of the use of routinely collected administrative data, results are not subject to bias associated with primary data collection. The large population allows an in-depth analysis of patients admitted at the psychiatric unit at Royal University Hospital, Saskatoon, Saskatchewan. It adds valuable information on age-related differences in outcomes as well as predictors of length of stay and delayed discharge. Moreover, our study emphasizes the need to focus on older adults and develop better age-appropriate structures and processes in the delivery of care to older adults.

However, findings from this study are only as accurate as the validity of the data source. Although the validity of the Discharge Abstract Database, an administrative database that routinely collects provincial health data such as the Admissions, Discharge, and Transfer data from all acute care facilities in all Canadian provinces is assessed annually, the quality of the Admissions, Discharge, and Transfer database has not been assessed at this time to our knowledge. We observed few data quality issues such as separate admissions with the same unique identifiers, however, most of these

errors were rectified in the data cleaning process. Furthermore, important variables including information on socioeconomic status was not collected. The cross-sectional nature of the study is another limitation. As the design of this study was a cross-sectional series, the assumption of independence in linear regression analyses was violated and may therefore provide biased estimates of degree of change in the length of stay by the predictors in the model. Moreover, data for this study was obtained from Royal University Hospital in Saskatoon, an urban health facility, hence findings may not be generalizable to other settings. Finally, results from the bivariate and regression analysis excluded sub-groups of diagnoses, therefore, results of bivariate and regression analyses do not apply to all psychiatric disorders.

Despite these limitations, our study has observed and highlighted differences in patient outcomes based on age groups and has added to the knowledge of existing literature, information on predictors of lengths of stay and delayed discharges. We hope that these findings and recommendations provided can be applied to current practices in psychiatry and geriatric psychiatry in order to improve the quality of care and reduce disparities in health care.

Appendix A: Ethics Approval

DATA SHARING AGREEMENT

THIS DATA SHARING AGREEMENT (the "**Agreement**") is made as of the 15th day of September, 2021 (the "**Effective Date**").

BETWEEN

UNIVERSITY OF SASKATCHEWAN
a statutory corporation continued under *The University of Saskatchewan Act, 1995* of
Saskatchewan, having an address for the conduct of its business at
Room 223 - Thorvaldson Building, 110 Science Place,
Saskatoon, SK S7N 5C9
(the "**USask**")

AND

SASKATCHEWAN HEALTH AUTHORITY
a not-for-profit body corporate continued pursuant to
The Provincial Health Authority Act (Saskatchewan),
having its head office at
Saskatoon City Hospital, 701 Queen Street
Saskatoon, Saskatchewan S7K 0M7
(hereinafter, "**SHA**")

AND

DR. MAUREEN ANDERSON
a faculty member at the University of Saskatchewan
having an address at
University of Saskatchewan
Department of Community Health and Epidemiology
Rm 3247- E wing - Health Sciences
104 Clinic Place
Saskatoon, Saskatchewan, Canada S7N 2Z4

(hereinafter, the **"Researcher"**)
(USask and Researcher collectively referred to as "**University**")

WHEREAS the University, through its faculty member Dr. Maureen Anderson, Department of Public Health and Epidemiology, College of Medicine, desires to perform a research project titled "Geriatric psychiatric patients in the Dubé Centre: a retrospective population-based cohort study" (the "**Project**");

Appendix B: Additional Information

i. Definition of Terms

Acute: of short duration or recent onset.

Inpatient: relating to admission to the hospital for treatment or management of an illness.

Geriatric: relating to old adults, usually described as the chronological age of 65 years and above.

Psychiatric: relating to the branch of medicine focused on the diagnosis and treatment of mental, emotional, and behavioural disorders.

Length of Stay (LOS): the period a patient spends on admission in a hospital unit before death or discharge.

Alternate Level of Care (ALC): describes patients who occupy a bed in the hospital unit but do not require the intensity of care provided in the unit or setting.

Discharge Disposition: refers to a patient's anticipated location or status after discharge.

Institutionalization: confinement of a patient to a health facility for treatment for an extended period.

Activities for Daily Living (ADL): a collective term for basic skills or activities required to care for oneself without any support such as eating, mobility. It is also used to indicate functional dependence.

Hospital-associated Disability (HAD): new or additional disabilities in the activities of daily activities following hospitalization compared to pre-admission.

Admissions, Discharge and Transfer (ADT) Database: A database that records all admissions, discharges, and transfers of patients to acute care facilities

Discharge Abstract Database (DAD): a database that captures administrative, clinical, and demographic information on hospital discharges.

ii. List and Description of Variables Included in the Original Study Dataset

Table 1- List of variables extracted from Admissions, Discharge and Transfer Database of the Saskatchewan Health Authority between 2012 and 2019.

Variables	**Descriptions**
Unique ID	De-identified patient ID
Sex	Patient's sex (Male/Female)
Age & Age Group	Patient's age and age group (18-64; 65+)
Postal Code	Patient's Address (First 3 digits)
Admission Date	Date of admission
Admit Nursing Unit	Unit of admission
Discharge Date	Date of discharge
Discharge Nursing Unit	Unit of discharge
Discharge Disposition	Discharge outcome and condition
Fatal	Did patient die in the facility (Yes/No)
Institution to	Institution where patient was transferred (if applicable)
Length of Stay (LOS)	Length of stay in the facility in days
Alternate Level of Care (ALC)	Did patient have an ALC designation while in the facility (Yes/No)
Alternate Level of Care-Length of Stay (ALC LOS)	Length of stay in Alternate Level of Care Designation in days
Provider Name & Specialty	Name and Specialty of the most responsible provider while in facility
Diagnosis	Diagnosis by the most responsible physician, attributed to the longest stay.

iii. ICD-10 CA Codes for Comorbidities

Table 2- List of ICD-10 CA codes used to define Charlson Index Comorbidity

Comorbid Condition	Code Range
Myocardial infarction	I21, I22, I252
Congestive heart failure	I50, I43, I099, I110, I130, I132, I255, I420, I425, I426, I427, I428, I429
Peripheral vascular disease	I70, I71, I671, I731, I738, I739, I771, I790, I792, K551, K558, K559, Z958, Z959
Cerebrovascular disease	G45, G46, I60, I61, I62, I63, I64, I65, I66, I67, I68, I69, H340
Dementia	F00, F01, F02, F03, G30, F051, G311
Chronic obstructive pulmonary disease	J40, J41, J42, J43, J44, J45, J46, J47, J60, J61, J62, J63, J64, J65, J66, J67, I278, I279, J684, J701, J703
Connective tissue disease/ Rheumatic disease	M05, M32, M33, M34, M06, M315, M351, M353, M360
Peptic ulcer disease	K25, K26, K27, K28
Mild liver disease	B18, K73, K74, K700, K701, K702, K703, K709, K717, K713, K714, K715, K760, K762, K763, K764, K768, K769, Z944
Diabetes without complications	E101, E106, E109, E110, E111, E116, E118, E119, E130, E131, E136, E138, E139, E140, E141, E146, E149
Diabetes with complications	E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147
Paraplegia and hemiplegia	G80, G81, G82, G041, G114, G830, G831, G832, G833, G834, G39
Renal disease	N18, N19, N052, N053, N054, N055, N056, N057, N250, I120, I131, N032, N034, N035, N036, N037, Z490, N491, Z492, Z940, Z992
Cancer	C0, C1, C6, C20, C21, C22, C23, C24, C25, C26, C30, C31, C32, C33, C34, C37, C38, C39, C40, C41, C43, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C70, C71, C72, C73, C74, C75, C76, C81, C82, C83, C84, C85, C88, C90, C91, C92, C93, C94, C95, C96, C97
Moderate or severe liver disease	K704, K711, K721, K729, K765, K766, K767, I850, I859, I864, I982
Metastatic carcinoma	C77, C78, C79, C80
AIDS/HIV	B24

Source: Statistics Canada (146)

iv. Discharge Disposition

Table 3- Transfer facility, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,373)

Facility	Frequency	Percentage (%)
Discharged home without support; without approval; or died in facility	**4601**	**85.6%**
Alberta - Acute Hospital	4	0.1%
Battlefords Union Hospital	7	0.1%
Biggar Hospital	1	0%
Davidson Health Centre	1	0%
GFN- Transitional Housing	22	0.4%
General Rehab. Hospital	4	0.1%
GFN- Group Living Supportive Housing	51	0.9%
GFN-Mental Health Addiction Detox Outpatient	128	2.4%
GFN- Mental Health Addiction Detox Residence	21	0.4%
Home Care Program	63	1.2%
Home For the Aged	115	2.1%
Humboldt District Hospital	3	0.1%
Jail/Correction Centre	9	0.2%
Kindersley Integrated Health Care Facility	2	0%
La Loche Health Centre	1	0%
Lloydminster Hospital	1	0%
Moose Jaw Union Hospital	1	0%
Nursing Home	72	1.3%
Ontario Non-acute Facility	1	0%
Outlook Hospital	2	0%
Parkridge Centre (Saskatoon)	2	0%
Prince Albert - Victoria Hospital	7	0.1%

Psychiatric Hospital (SHNB North Battleford)	42	0.8%
Regina General Hospital	2	0%
Rosthern Health Centre	3	0.1%
Saskatoon - St. Paul's Hospital	3	0.1%
Saskatoon City Hospital	25	0.5%
Spiritwood & District Health Complex	1	0%
Swift Current - Cypress Regional Hospital	1	0%
Unclassified Health Institution.	169	3.1%
Wadena Hospital	1	0%
Watrous Hospital	1	0%
Wynyard Integrated Hospital	2	0%
Yorkton Regional Health Centre	4	0.1%
Total	**5373**	**100%**

Appendix C: Sensitivity Analyses

i. Descriptive Analyses

Table 1- Discharge nursing unit, all psychiatric admissions with external injuries, Royal University Hospital, Saskatoon 2012-2019 (n = 321)

	Age groups n (%)				
Discharge Nursing Unit	**(18 – 64) years**	**(65 – 74) years**	**(75 – 84) years**	**(85+) years**	**Total**
5000 Surgery	1 (0.3%)	0 (0)	0 (0)	0 (0)	**1 (0.3%)**
6000 Cardiology/ CVS	1 (0.3%)	0 (0)	0 (0)	0 (0)	**1 (0.3%)**
6100 Medicine	1 (0.3%)	0 (0)	0 (0)	0 (0)	**1 (0.3%)**
6200 Medicine	0 (0)	0 (0)	1 (16.7%)	1 (25.0%)	**2 (0.6%)**
6300 Neurosciences	1 (0.3%)	1 (7.1%)	0 (0)	0 (0)	**2 (0.6%)**
Day Surgery Unit	3 (1.0%)	0 (0)	0 (0)	0 (0)	**3 (0.9%)**
In-Patient Psychiatry Unit	269 (90.6%)	13 (92.9%)	5 (83.3%)	3 (75%)	**290 (90.3%)**
Child & Youth Inpatient Psychiatry	1 (0.3%)	0 (0)	0 (0)	0 (0)	**1 (0.3%)**
Electro-convulsive Therapy Suite	4 (1.3%)	0 (0)	0 (0)	0 (0)	**4 (1.2%)**
Emergency In-Patient Unit	12 (4.0%)	0 (0)	0 (0)	0 (0)	**12 (3.7%)**
Intensive Care Unit	3 (1.0%)	0 (0)	0 (0)	0 (0)	**3 (0.9%)**
Patient In-Patient Unit (Overflow)	1 (0.3%)	0 (0)	0 (0)	0 (0)	**1 (0.3%)**
Total	**297 (100%)**	**14 (100%)**	**6 (100%)**	**4 (100%)**	**321 (100%)**

Table 2- Length of stay quintiles by diagnosis, younger patient psychiatric admissions (aged 18 -64 years), Royal University Hospital, Saskatoon 2012-2019 (n = 5,020)

	Length of Stay Quintiles n (%)					
ICD-10 CA Diagnosis	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
Disorders of other endocrine glands (E22)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)	**1 (100%)**
Organic, including symptomatic, mental disorders (F00-F09)	8 (25.0%)	4 (12.5%)	4 (12.5%)	6 (18.8%)	10 (31.3%)	**32 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	315 (40.5%)	187 (24.0%)	134 (17.2%)	97 (12.5%)	45 (5.8%)	**778 (100%)**
Schizophrenia, schizotypal and delusional disorders (F20-F29)	190 (13.6%)	197 (14.1%)	255 (18.3%)	377 (27.0%)	376 (26.9%)	**1,395 (100%)**
Mood [affective] disorders (F30-F39)	436 (22.7%)	371 (19.4%)	385 (20.1%)	378 (19.8%)	343 (17.9%)	**1,913 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	204 (41.1%)	118 (23.7%)	79 (15.9%)	60 (12.1%)	35 (7.1%)	**496 (100%)**
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	13 (17.6%)	7 (9.4%)	11 (14.9%)	11 (14.9%)	32 (43.2%)	**74 (100%)**
Disorders of adult personality and behaviour (F60-F69)	85 (40.0%)	52 (24.4%)	34 (16.0%)	25 (11.7%)	17 (8.0%)	**213 (100%)**
Mental retardation (F70-F79)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100%)	**2 (100%)**
Disorders of psychological development (F80-F89)	7 (13.0%)	5 (9.3%)	10 (18.5%)	12 (22.2%)	20 (37.0%)	**54 (100%)**
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	10 (37.0%)	4 (14.8%)	7 (26.0%)	5 (18.5%)	1 (3.7%)	**27 (100%)**
Unspecified mental disorder (F99)	2 (100%)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (100%)**
Extrapyramidal and movement disorders (G20-G26)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100%)	**1 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	0 (0)	1 (20.0%)	0 (0)	0 (0)	4 (80.0%)	**5 (100%)**
Other obstetric conditions, not elsewhere classified (O94-O99)	1 (100%)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (100%)**

Other congenital malformations (Q80-Q89)	0 (0)	1 (33.3%)	1 (33.3%)	0 (0)	1 (33.3%)	**3 (100%)**
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	10 (66.7%)	1 (6.7%)	2 (13.3%)	1 (6.7%)	1 (6.7%)	**15 (100%)**
Poisoning by drugs, medicaments, and biological substances (T36-T50)	4 (100%)	0 (0)	0 (0)	0 (0)	0 (0)	**4 (100%)**
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	1 (100%)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (100%)**
Persons encountering health services for examination and investigation (Z00-Z13)	0 (0)	0 (0)	0 (0)	1 (100%)	0 (0)	**1 (100%)**
Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)	0 (0)	0 (0)	0 (0)	1 (100%)	0 (0)	**1 (100%)**
Persons encountering health services in other circumstances (Z70-Z76)	1 (100%)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (100%)**
Total	**1,287 (25.6%)**	**949 (18.9%)**	**922 (18.4%)**	**974 (19.4%)**	**888 (17.7%)**	**5,020 (100%)**

Table 3- Length of stay quintiles by diagnosis, older patient psychiatric admissions (aged 65 and older), Royal University Hospital, Saskatoon 2012-2019 (n = 353)

	Length of Stay Quintiles n (%)					
ICD-10 CA Diagnosis	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
Disorders of other endocrine glands (E22)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Organic, including symptomatic, mental disorders (F00-F09)	4 (8.0%)	3 (6.0%)	9 (18.0%)	20 (40.0%)	14 (28.0%)	**50 (100%)**
Mental and behavioural disorders due to psychoactive substance use (F10-F19)	0 (0)	0 (0)	1 (20.0%)	3 (60.0%)	1 (20.0%)	**5 (100%)**

Schizophrenia, schizotypal and delusional disorders (F20-F29)	4 (4.8%)	5 (5.9%)	12 (14.3%)	24 (28.6%)	39 (46.4%)	**84 (100%)**
Mood [affective] disorders (F30-F39)	8 (4.7%)	16 (9.4%)	20 (11.8%)	37 (21.8%)	89 (52.3%)	**170 (100%)**
Neurotic, stress-related and somatoform disorders (F40-F48)	5 (16.1%)	4 (12.9%)	4 (12.9%)	7 (22.6%)	11 (35.5%)	**31 (100%)**
Behavioural syndromes associated with physiological disturbances and physical factors (F50-F59)	1 (50.0%)	0 (0)	1 (50.0%)	0 (0)	0 (0)	**2 (100%)**
Disorders of adult personality and behaviour (F60-F69)	1 (25.0%)	0 (0)	0 (0)	0 (0)	3 (75.0%)	**4 (100%)**
Mental retardation (F70-F79)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Disorders of psychological development (F80-F89)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Behavioural and emotional disorders with onset usually occurring in childhood and adolescence (F90-F98)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Unspecified mental disorder (F99)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Extrapyramidal and movement disorders (G20-G26)	0 (0)	0 (0)	0 (0)	1 (100%)	0 (0)	**1 (100%)**
Other degenerative diseases of the nervous system (G30-G32)	0 (0)	0 (0)	1 (25.0%)	0 (0)	4 (75.0%)	**5 (100%)**
Other obstetric conditions, not elsewhere classified (O94-O99)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Other congenital malformations (Q80-Q89)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Symptoms and signs involving cognition, perception, emotional state, and behaviour (R40-R46)	0	0	0	1	0	1 (100%)
Poisoning by drugs, medicaments, and biological substances (T36-T50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**

Persons encountering health services for examination and investigation (Z00-Z13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Persons with potential health hazards related to socioeconomic and psychosocial circumstances (Z55-Z65)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Persons encountering health services in other circumstances (Z70-Z76)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
Total	**23 (6.5%)**	**28 (7.9%)**	**48 (13.6%)**	**93 (26.3%)**	**161 (45.6%)**	**353 (100%)**

Table 4- LOS Quintiles by age groups, readmissions within 30 days of prior discharge, Royal University Hospital, Saskatoon 2012-2019 (n = 552)

	LOS Quintiles (n %)					
Age group	**1st Quintile**	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**	**Total**
(18 – 35) years	87 (29.6%)	37 (12.6%)	53 (18.0%)	64 (21.8%)	57 (19.4%)	**294 (100%)**
(36 – 55) years	51 (24.7%)	41 (19.9%)	47 (22.8%)	30 (14.6%)	37 (18.0%)	**206 (100%)**
(56 – 64) years	2 (5.7%)	8 (22.9%)	7 (0.2%)	7 (0.2%)	11 (31.4%)	**35 (100%)**
(65 – 74) years	0 (0)	0 (0)	0 (0)	4 (40%)	6 (60%)	**10 (100%)**
(75 – 84) years	1 (25%)	0 (0)	0 (0)	0 (0)	3 (75%)	**4 (100%)**
(85+) years	1 (33.3%)	0 (0)	1 (33.3%)	0 (0)	1 (33%)	**3 (100%)**
Total	**138 (25%)**	**86 (15.6%)**	**108 (19.6%)**	**105 (19.0%)**	**115 (20.8%)**	**552 (100%)**

Table 5- Discharge disposition by age groups, ALC designation, Royal University Hospital, Saskatoon 2012-2019 (n = 119)

	Discharge Disposition n (%)

Age group	Without Formal Support[&]	With Formal Support[&]	Care Facility	Health Facility	Without Approval[&]	Died in Facility	Total
(18 – 35) years	18 (42.8%)	2 (4.8%)	8 (19.0%)	13 31.0%)	1 (2.4%)	0 (0)	**42 (100%)**
(36 – 55) years	9 (32.1%)	4 (14.3%)	5 (17.9%)	10 (35.7%)	0 (0)	0 (0)	**28 (100%)**
(56 – 64) years	5 (26.3%)	3 (15.8%)	4 (21.1%)	7 (36.8%)	0 (0)	0 (0)	**19 (100%)**
(65 – 74) years	2 (20.0%)	1 (10.0%)	5 (50.0%)	1 (10.0%)	0 (0)	1 (10.0%)	**10 (100%)**
(75 – 84) years	6 (46.2%)	1 (7.7%)	2 (15.4%)	4 (30.8%)	0 (0)	0 (0)	**13 (100%)**
(85+) years	2 (28.6%)	1 (14.3%)	2 (28.6%)	2 (28.6%)	0 (0)	0 (0)	**7 (100%)**
Total	**42 (35.3%)**	**12 (10.1%)**	**26 (21.8%)**	**37 (31.1%)**	**1 (0.8%)**	**1 (0.8%)**	**119 (100%)**

[&] *Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

ii. **Multivariable Linear Regression Analyses**

(Model: All admissions; age in groups)

Table 6- Adjusted linear regression model, predictors of length of stay, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n = 5,241)

Variable	Beta Coefficient	Standard Error	95% CI	p-value
Age (65+ years) (18 -64 years) ^^	14.60	1.62	11.42 – 17.78	**<0.001**
Sex Male Female^^	-0.60	0.68	-0.73 – 1.93	0.378
ALC Designation Yes No^^	30.35	3.68	23.14 – 37.56	**<0.001**
Readmission_30 Yes No^^	-11.60	12.02	-35.16 – 11.96	0.335

Discharge Status				
With formal support[&]	0.35	1.75	-3.08 – 3.77	0.843
Care facility	25.74	1.94	21.94 – 29.53	<**0.001**
Health facility	5.50	1.87	1.83 – 9.15	**0.003**
Without approval[&]	-4.74	1.69	-8.05 – -1.44	**0.005**
Died in facility	-12.73	13.76	-39.69 – 14.24	0.355
W/O formal support[&]^^				
ICD-10 CA Diagnosis[¶¶]				
Organic disorders	-8.22	4.69	-17.41 – 0.97	**0.079**
Substance abuse	-5.20	3.87	-12.80 – 2.39	0.179
Schizophrenia	7.08	3.82	-0.41 – 14.57	0.064
Mood disorders	-2.64	3.81	-4.83 – 10.10	0.489
Other MB[n]	-4.59	3.87	-12.19 – 3.00	0.236
Non-MB[n]^^				
Admit Unit				
DUBE Centre	9.18	1.09	7.04 – 11.31	<**0.001**
Other units^^				
# Comorbidities	2.87	0.27	2.33 – 3.41	<**0.001**
# Secondary Diagnosis	0.60	0.55	-0.48 – 1.68	0.280
# External Injuries	1.82	0.62	0.61 – 3.04	**0.003**
Discharge Status * Age				
Formal Support[&]*(65+) yrs.	-0.88	3.58	-7.89 – 6.14	0.807
Care home*(65+) yrs.	-17.55	4.45	-26.37 – -8.73	<**0.001**
Health facility*(65+) yrs.	-14.35	5.19	-24.52 – -4.17	**0.006**
Without approval[&]*(65+) yrs.	-19.37	16.21	-51.15 – 12.41	0.232
Died in facility*(65+) yrs.	11.21	17.14	-22.38 – 44.81	0.513
W/O Support[&]^^				
Discharge * # Secondary Diagnoses				
With formal support[&]	4.94	1.88	1.26 – 8.63	**0.009**
Care facility	-16.79	2.04	-20.79 – -12.79	<**0.001**
Health facility	-8.16	1.55	5.13 – 11.20	<**0.001**
Without approval[&]	-0.78	2.01	-4.73 – 3.17	0.699
Died in facility	23.48	6.08	11.56 – 35.39	**0.001**
W/O formal support[&]^^				
ALC * Discharge Status				
Yes*With formal support[&]	2.53	8.53	-14.20 – 19.25	0.767
Yes*Care home	76.20	6.56	63.35 – 89.06	<**0.001**
Yes*Health facility	3.78	5.70	-7.39 – 14.95	0.507
Yes*Without approval[&]	-17.04	23.08	-62.30 – 28.21	0.460
Yes*Died in facility	-40.93	26.11	-92.11 – 10.24	0.117
Readmission_30 * Diagnoses[¶¶]				
Yes*Organic disorder	92.43	14.81	63.40 – 121.46	<**0.001**
Yes*Substance abuse	10.77	12.28	-13.32 – 34.85	0.381
Yes* Schizophrenia	14.37	12.15	-9.46 – 38.19	0.237

Yes* Mood disorders Yes* Other MB	7.52 7.93	12.15 12.35	-16.30 – 31.35 -16.09 – 31.95	0.536 0.518
Readmission * Sex Yes*Male	5.39	2.17	1.14 – 9.63	0.013

 # = Number of
MB[n] =Mental and Behavioural disorders
^^ Reference category
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.
& Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

F-statistic = 49.92; Prob > F = <0.001
Number of observations = 5,241; Adjusted R^2 = 0. 2669

(Model: Older adult admissions; age continuous)

Table 7- Adjusted linear regression model, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 351)

Variable	**Beta Coefficient**	**Standard Error**	**95% CI**	**p-value**
Age	0.16	0.26	-0.35 – 0.67	0.536
Sex Female Male^^	 -0.71	 3.77	 -8.13 – 6.70	 0.850
ALC Designation Yes No^^	 325.71	 66.78	 194.36 – 457.07	 **<0.001**
Discharge Status With formal support& Care facility Health facility Without approval& Died in facility W/O formal support& ^^	 1.42 13.41 -17.04 -25.45 -2.23	 5.69 7.05 9.51 33.59 19.64	 -9.77– 12.61 -0.47 – 27.29 -35.75 – 1.66 -91.53 – 40.64 -40.86 – 36.40	 0.803 0.058 0.074 0.449 0.910
# Comorbidities	4.79	1.55	1.74 – 7.85	**0.002**
# Secondary Diagnosis	-6.67	3.29	-13.14 – -0.20	**0.043**
Age * ALC Yes	 -3.55	 0.85	 -5.23 – -1.87	 **<0.001**
Discharge Status * # Secondary Diagnoses With formal support	 7.51	 6.03	 -4.36 – 19.38	 0.214

Care facility	-7.18	6.09	-19.16 – 4.81	0.240
Health facility	17.42	7.44	2.79 – 32.05	**0.020**
Without approval	5.68	47.45	-87.66 – 99.02	0.905
Died in facility	-29.82	31.06	-90.92 – 31.28	0.338

 # = Number of

^^ Reference category

& Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

F-statistic = 6.15; Prob > F = <0.001

No of observations = 351; Adjusted R^2 = 0.1905

iii. Multivariable Logistic Regression Analyses

(Model: All admissions; age continuous; Discharge Disposition present)

Table 8- Adjusted logistic regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

Variable	**Odds Ratio**	**Standard Error**	**95% CI**	**p-value**
Age	1.03	0.01	1.01 – 1.04	**<0.001**
Discharge Status				
With formal support&	1.60	0.66	0.72 – 3.58	0.252
Care facility	6.94	2.13	3.80 – 12.68	**<0.001**
Health facility	10.88	2.90	6.45 – 18.35	**<0.001**
Without approval&	0.29	0.31	0.04 – 2.36	0.248
Died in facility	2.95	3.38	0.31 – 27.77	0.344
W/O formal support&^^				
Rural / Urban**				
Urban	2.46	0.82	1.28 – 4.71	**0.007**
Rural^^				
ICD-10 CA Diagnosis¶¶				
Organic disorders	2.27	2.43	0.28 – 18.59	0.445
Substance abuse	1.14	1.22	0.14 – 9.22	0.902
Schizophrenia	1.24	1.23	0.18 – 8.71	0.829
Mood disorders	0.59	0.60	0.08 – 4.27	0.602
Other MB^n	0.90	0.96	0.11 – 7.32	0.918
Non-MB^n^^				
# Comorbidities	3.34	1.76	1.19 – 9.37	**0.022**
# Secondary Diagnoses	2.55	0.25	2.10 – 3.09	**<0.001**
# External Injuries	1.32	0.25	0.92 – 1.90	0.133

# Secondary Diagnoses * # External Injuries	0.80	0.07	0.67 – 0.95	**0.013**
ICD-10 CA Diagnosis * # Comorbidities				
Organic disorders	0.37	0.22	0.11 – 1.20	0.096
Substance abuse	0.28	0.16	0.09 – 0.83	**0.022**
Schizophrenia	0.31	0.17	0.11 – 0.89	**0.030**
Mood disorders	0.35	0.19	0.12 – 1.02	**0.055**
Other MB	0.27	0.16	0.09 – 0.86	**0.026**

 # = Number of
MB[n] =Mental and Behavioural disorders
*** 10 observations invalid*
^^ Reference category
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.

& Formal support is described as community support at home or referral to services. Without approval refers to those who left against medical advice, without a pass or who did not return from a pass.

LR statistic = 318.69; Prob > F = <0.001
Number of observations = 5,231; Pseudo R^2 = 0. 2965; Log likelihood = -378.13
No of groups= 10; Hosmer–Lemeshow chi2(8) = 7.33; Homer-Lemeshow Chi^2 = 0.5016

(Model: All admissions; age continuous; Discharge Disposition absent)

Table 9- Adjusted logistic regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

Variable	**Odds Ratio**	**Standard Error**	**95% CI**	**p-value**
Age	1.03	0.01	1.02 – 1.04	**<0.001**
Rural / Urban** Urban Rural^^	2.39	0.76	1.28 – 4.44	**0.006**
ICD-10 CA Diagnosis¶¶				
Organic disorders	0.78	0.56	0.19 – 3.15	0.731
Substance abuse	0.26	0.18	0.06 – 1.05	0.058
Schizophrenia	0.34	0.22	0.09 – 1.19	0.091
Mood disorders	0.19	0.13	0.05 – 0.070	**0.013**
Other MB[n]	0.20	0.14	0.05 – 0.81	**0.024**
Non-MB[n]^^				
# Comorbidities	1.16	0.09	0.92 – 1.26	**0.035**
# Secondary Diagnoses	2.54	0.24	2.10 – 3.07	**<0.001**
# External Injuries	1.32	0.24	0.92 – 1.88	0.129
# Secondary Diagnoses * # External Injuries	0.81	0.07	0.68 – 0.96	**0.017**

 # = Number of
MB^n =Mental and Behavioural disorders
*** 10 observations invalid*
^^ Reference category
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.

LR statistic = 222.77; Prob > F = <0.001
Number of observations = 5,231; Pseudo R^2 = 0. 2072; Log likelihood = -426.09
No of groups= 10; Hosmer–Lemeshow chi2(8) = 10.32; Homer-Lemeshow Chi^2 = 0.2435

(Model: All admissions; age in groups; Discharge Disposition absent)

Table 10- Adjusted logistic regression model, predictors of ALC designation, all psychiatric admissions, Royal University Hospital, Saskatoon 2012-2019 (n= 5,231)

Variable	**Odds Ratio**	**Standard Error**	**95% CI**	**p-value**
Age (65+) yrs. (18-64) yrs.^^	3.82	1.04	2.24 – 6.51	**<0.001**
Rural / Urban** Urban Rural^^	2.39	0.76	1.28 – 4.44	**0.006**
ICD-10 CA Diagnosis¶¶ Organic disorders Substance abuse Schizophrenia Mood disorders Other MB^n Non-MB^n^^	 1.05 0.18 0.34 0.15 0.17	 0.70 0.12 0.21 0.09 0.11	 0.28 – 3.89 0.05 – 0.66 0.11 – 1.11 0.05 – 0.50 0.05 – 0.61	 0.947 **0.010** 0.074 **0.002** **0.007**
# Comorbidities	1.15	0.09	1.00 – 1.33	0.057
# Secondary Diagnoses	2.59	0.24	2.18– 3.08	**<0.001**
# External Injuries	1.32	0.23	0.94 – 1.85	0.113
# Secondary Diagnoses * # External Injuries	0.84	0.07	0.72 – 0.99	**0.041**

 # = Number of
MB^n =Mental and Behavioural disorders
*** 10 observations invalid*
^^ Reference category
¶¶ Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.

LR statistic = 213.75; Prob > F = <0.001
Number of observations = 5,231; Pseudo R^2 = 0.1988; Log likelihood = -430.60

Hosmer–Lemeshow chi2(8) = 8.69; No of groups= 10; Homer-Lemeshow Chi^2 = 0.3688

(Model: Older adult admissions; age in groups; Discharge Disposition present)

Table 11- Adjusted logistic regression model, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 349)

Variable	**Odds Ratio**	**Standard Error**	**95% CI**	**p-value**
Age				
(75-84) yrs.	3.35	1.71	1.23 – 9.12	**0.018**
(85+) yrs.	2.59	1.60	0.77 – 8.68	0.124
(65-74) yrs.^^				
Sex				
Female	0.98	0.46	0.33 – 2.27	0.969
Male^^				
Discharge Status				
With formal support[&]	0.58	0.42	0.13 – 2.43	0.452
Care facility	4.31	2.45	1.42 – 13.11	**0.010**
Health facility	6.27	4.26	1.66 – 23.70	**0.007**
Without approval[&]	1	(empty)		
Died in facility	6.99	8.65	0.62 – 78.87	0.116
W/O formal support[&]^^				
Location				**0.030**
Urban	4.82	3.49	1.16 – 19.96	
Rural^^				
# Secondary Diagnosis	2.52	0.56	1.64 – 3.89	**<0.001**

 # = Number

^^ *Reference category*

[&] *Formal support is described as community support at home or referral to services. No approval refers to those who left against medical advice, without a pass or who did not return from a pass.*

LR statistic = 55.06; Prob > F = <0.001

Number of observations = 349; Pseudo R^2 = 0. 2691; Log likelihood = -74.76

No of groups= 10; Homer-Lemeshow Chi^2 = 5.05 p-value = 0.7526

(Model: Older adult admissions; age continuous; Discharge Disposition absent)

Table 12- Adjusted logistic regression model, predictors of length of stay, older adult psychiatric admissions (aged 65 years and older), Royal University Hospital, Saskatoon 2012-2019 (n= 346)

Variable	Odds Ratio	Standard Error	95% CI	p-value
Age	1.06	0.03	1.00 – 1.11	**0.042**
Sex Female Male^^	 1.50	 0.70	 0.60 – 3.73	 0.386
ICD-10 CA Diagnosis¶¶ Organic disorders Substance abuse Schizophrenia Mood disorders Other MB^{n} Non-MB^{n}^^	 1.64 1 0.46 0.14 0.73	 1.75 (empty) 0.50 0.15 0.85	 0.20 – 13.31 1.26 – 11.48 0.02 – 1.16 0.07 – 7.16	 0.642 0.480 0.068 0.783
Location Urban Rural^^	 6.09	 4.49	 1.44 – 25.80	 **0.014**
# Secondary Diagnosis	2.50	0.54	1.64 – 3.83	**<0.001**

 # = Number of

MB^{n} =Mental and Behavioural disorders

^^ *Reference category*

¶¶ *Behavioural syndromes associated with physiological disturbances and physical factors, mental retardation, and disorders of psychological development are excluded.*

LR statistic = 55.86; Prob > F = <0.001

Number of observations = 346; Pseudo R^2 = 0. 2738; Log likelihood = -74.09

No of groups= 10; Homer-Lemeshow Chi^2 = 8.59 p-value = 0.3782

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