An Examination of the Bidirectional Relationship Between Sleep Disturbance and Antipsychotic Use Among Older Adults in Canadian Long-Term Care

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Abstract

Background: As Canada's population ages and care needs become increasingly complex, the demand for long-term care (LTC) continues to rise, emphasizing the importance of quality of care in these settings. Sleep disturbance and the potentially inappropriate use of antipsychotics are prevalent concerns in Canadian LTC facilities due to their associated adverse health outcomes. Despite the poor recognition of sleep disturbance among older adults and rising antipsychotic use in recent years, only limited research has examined the relationship between these two issues in in LTC.

Objectives: This thesis aimed to estimate the prevalence of sleep disturbance and potentially inappropriate antipsychotic use and investigate the bidirectional longitudinal association between sleep disturbance and antipsychotics and use among older adults in Canadian LTC facilities.

Methods: This thesis employed a longitudinal cohort design to conduct two studies among Canadian LTC residents aged 65 years or more using interRAI RAI-MDS 2.0 data from 2014-2025. Logistic regression was used to examine the relationship between sleep disturbance and antipsychotics, with separate models for new-onset sleep disturbance and antipsychotic initiation.

Results: Study 1 included 287,101 resident admission assessments, of which 14% reported sleep disturbance at baseline. The longitudinal analysis included 246,982 records, with 11.1% of residents experiencing sleep disturbance at follow-up. After adjustment, the final model revealed that antipsychotic use was associated with a 21% increase in the odds of new sleep disturbance compared to non-use (OR 1.21, 95% CI 1.18-1.24). Study 2 included 245,311 resident admission assessments, with 24.1% of residents reporting antipsychotic use at baseline. The longitudinal analysis included 186,335 records, with 5.4% of residents initiating antipsychotics at follow-up. Adjusted final models revealed that sleep disturbance was associated with a 32% increase in the odds of initiating antipsychotics compared no sleep disturbance (OR 1.32, 95% CI 1.23-1.40).

Conclusion: By establishing the high prevalence of antipsychotic use and sleep disturbance and identifying shared risk factors, this thesis highlights the need for non-pharmacological interventions in LTC to facilitate the reduction of unnecessary antipsychotic use. This work has significant implications for LTC practice and policy and supports continued research to improve quality of care for older adults in LTC.

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List of Abbreviations

ABS	Aggressive Behaviour Scale
ADL-H	Activities of Daily Living Hierarchy Scale
BPSD	Behavioural and Psychological Symptoms of Dementia
CBT-I	Cognitive Behaviour Therapy for Insomnia
CAP	Collaborative Action Plan
CCRS	Continuing Care Reporting System
CHESS	Changes in Health, End-Stage Disease and Signs and Symptoms Scale
CIHI	Canadian Institute for Health Information
COPD	Chronic Obstructive Pulmonary Disease
CPS	Cognitive Performance Scale
DRS	Depression Rating Scale
ISE	Index of Social Engagement
LTC	Long-Term Care
OSA	Obstructive Sleep Apnea
PLMD	Periodic Limb Movement Disorder
QI	Quality Indicator
RAI-MDS 2.0	Resident Assessment Instrument–Minimum Data Set 2.0
RBD	REM Sleep Behaviour Disorder
REM	Rapid Eye Movement
RLS	Restless Leg Syndrome
SDB	Sleep Disordered Breathing

Chapter 1: Introduction

Long-term care (LTC) in Canada encompasses a variety of care settings and services provided to individuals with complex health needs that cannot be met in the community.[1] There are over 2000 LTC facilities across the country that provide 24 hour care in congregating living facilities, offering a range of personal, medical, and social support services.[1] To ensure the well-being of an aging population with increasingly complex care needs and health challenges, there is a clear need to prioritize quality of care in LTC.[2–5]

Sleep disturbance is a particularly prominent issue in the growing population of older adults in LTC settings, where there is a higher burden of chronic illness and comorbidities that are strongly associated with poor sleep quality.[6,7] Due to the more intense and complex care needs required in LTC, the environmental, physical, behavioural, and psychosocial factors associated with sleep disturbance may also be compounded, resulting in worse sleep outcomes.[8]

The number of antipsychotics being used in LTC also raises concerns for safety and quality of care in Canada. As of 2024, reports show that one in four residents that are using antipsychotics do not have a diagnosis related to psychosis.[9] The potentially inappropriate use of antipsychotics is an important quality indicator in LTC settings, representing a standardized measure that can provide insight into the quality of care in facilities, support new initiatives, and advise program evaluation.[10,11] The reduction of inappropriate medication use in LTC should be a priority due to the risk of adverse side effects for older adults.[12]

In order to address these notable issues, this thesis uses comprehensive interRAI data collected using the Resident Assessment Instrument–Minimum Data Set 2.0 (RAI-MDS 2.0). interRAI is a non-profit organization comprised of a global network of researchers and clinicians committed to improving care practices across multiple healthcare and social service sectors.[13,14]

The interRAI instruments operate as an integrated health information system, employing standardized assessments and systematic measures to assess medically complex individuals, including those residing in LTC.[14] These assessments have consistently demonstrated high levels of reliability and validity[13–16] and are important for clinical decision making.[14] The RAI-MDS 2.0 is one instrument used in LTC facilities to collect clinical and sociodemographic information to evaluate the strengths, preferences, and needs of residents.[17] This instrument provides standardized data for functional scales that aim to support care planning and improve quality of life.[17]

This thesis will first examine the current literature on sleep disturbance and antipsychotic use, synthesizing background information to provide context for these issues in LTC and providing justification for this study. The following two chapters present separate but related studies to examine the bidirectional associations between sleep disturbance and antipsychotic use, with their own brief introduction, methods, results, and discussion sections. Study 1 in Chapter 3 specifically looks at antipsychotic use as a risk factor for the onset of new sleep disturbance for older adults in Canadian LTC, while Study 2 in Chapter 4 investigates the association between baseline sleep disturbance and initiation of antipsychotics. The final chapter will summarize the main study findings, highlight the strengths and limitations of the thesis, and consider the implications for practice, policy, and future research in LTC.

Chapter 2: Background

2.1 Sleep and aging

Sleep is an important biological function necessary for vital activities in both the brain and body, including memory, cognition, immune functioning, and metabolic regulation.[18] Sufficient sleep is essential for good health and overall quality of life. Disruption to proper sleep can result in poor physical and mental health outcomes, especially in more vulnerable populations, such as older adults.[18]

Research indicates that the risk of sleep disorders increases with age, and older adults are more likely to report light sleep, early awakenings, more frequent awakenings during the night, and daytime sleepiness.[19] Quality and duration of sleep are influenced by environmental, behavioural, and individual health factors, such as nighttime noise and light, medical and psychiatric conditions, medications, and psychosocial stressors.[20] Despite some physiological age-related changes to sleep, studies show that poor sleep quality in older adults is more reliant on these other factors, which can be addressed in order to improve sleep and other health outcomes.[21]

Research on the physiology of how sleep changes with age has shown that older adults spend less time in deep sleep and more time in the lighter sleep stages, making them prone to fragmented sleep, resulting in longer and more frequent awakenings during the night.[19,22,23] One of the most notable changes is the decrease in slow-wave sleep, which is linked to deterioration to the central nervous system and loss of the restorative functions of sleep.[19] Circadian rhythm disruptions are also common in older adults.[20] These intrinsic 24-hour cycles that govern sleep–wake patterns generally weaken with age due to reduced sensitivity to external cues in the brain's internal clock.[22] Older adults often experience a shift to falling asleep and waking earlier than younger adults, partly due to a melatonin release earlier in the day.[19,22] Chronic sleep loss can lead

to accelerated age-related neurodegenerative processes by affecting wake-activated neurons, which are involved in maintaining alertness and wakefulness.[24] These changes may contribute to neurodegeneration and cognitive decline, emphasizing the importance of maintaining healthy sleep patterns for aging populations.

2.2 Sleep disturbances among older adults

Sleep disturbances can have biological, psychological, and social consequences for older adults, and are often linked to cognitive impairment and development of neurodegenerative conditions.[22,25] Sleep disorders in older adults are associated with comorbidities, psychiatric conditions, medication use, and environmental factors.[23,26]

In Canada, the prevalence of insomnia disorder for adults is estimated to be approximately 16% of the population, while at least one insomnia symptom has been reported by 34.6%.[27] Reported sleep issues are more common in females, older adults, and individuals with comorbid physical or mental health conditions.[19,27] Since definitions and measurements of insomnia differ between studies, with use of various application of diagnostic criteria, it can be difficult to compare results among studies to determine prevalence rates among individuals with insomnia or sleep problems.[28]

Insomnia is the most prevalent sleep disorder in older adults; however, there are a number of different types of sleep disorders seen in this population.[22] Insomnia disorder is defined as the distress and daytime impairment that is associated with difficulty initiating or maintaining sleep, or early morning waking without being able to return to sleep, despite sufficient opportunity to do so.[27,29] Many of the existing interventions for sleep focus on insomnia and related symptoms. Other types of common sleep disorders include restless leg syndrome (RLS), periodic limb movement

disorder (PLMD), sleep disordered breathing (SDB), obstructive sleep apnea (OSA), and REM sleep behaviour disorder (RBD).[20–23]

2.3 Causes and outcomes of sleep disturbance

The causes and associated factors of sleep disturbances have often been considered in existing literature. Medications, chronic conditions, individual characteristics, and psychological behaviours are often linked to sleep, with many of these components also having a directional relationship with sleep.[30] One study of residents in long-term care (LTC) in several European countries found that independent predictors of insomnia included age, depression, stressful life events, fatigue, pain, and hypno-sedative drug use.[31] In another study of community-dwelling older adults, significant predictors of sleep disturbance included greater comorbidity and worsened functional status.[26] Psychosocial factors such as retirement, isolation, loneliness, and bereavement may also lead to advanced insomnia symptoms in older adults.[20]

2.3.1 Age and gender

Symptoms of insomnia and other sleep disorders have been shown to increase with age, and are highly prevalent among older adults, particularly women.[22,32] Gindin et al. showed that a one year increase in age was associated with a 1% increase in risk for insomnia.[31] Additionally, significant differences have been found between genders for factors associated with insomnia and related symptoms, such as total sleep duration, sleep quality, sleeping pill usage, appetite, and sleepiness during the day.[33]

2.3.2 Incontinence

Incontinence is a common contributor of sleep disturbance in older adults. One study among community-dwelling older adults found that individuals who reported urinary incontinence were four times more likely to experience sleep disturbances than those without.[34] Further,

nocturia, the experience of waking up multiple times per night to empty the bladder, is a frequent cause of poor sleep in older age that compromises quality of life, causing sleep loss and fragmentation.[19] In addition, nocturia can result in a greater risk of depressed mood, falls, and injury.[19,24] Some age-dependent increases in nighttime urine production may be associated with nocturia and lead to changes in circadian timing in older adults.[24]

2.3.3 Medications

Medications also have an effect on sleep quality and duration.[7] Many older adults take at least five or more prescription medications, and the number of medications taken is strongly associated with the severity of sleep disturbances.[19] Medications can cause, or contribute to, insomnia and other sleep disturbances, through either stimulation or promotion of daytime napping, and the effects of withdrawal from medications may also interfere with sleep.[20,22] A European study in LTC showed that the prevalence of insomnia was nearly two times as high among residents using sedatives compared to those who were not.[31] The use of nighttime sedating medications has predicted more total sleep in 24 hours, but not more continuous nighttime sleep.[26]

2.3.4 Medical conditions

Many chronic conditions are associated with both the predictors and consequences of sleep problems. Individuals with multiple comorbidities are at least twice as likely to report sleep problems compared to those without.[35] The more comorbidities an older adult has, the more likely they are to report a sleep complaint.[22] Heart disease and lung disease have been shown to be strongly linked to increased prevalence of sleep disturbances.[19,20] Other chronic illnesses that disrupt sleep and are associated with aging include arthritis, renal disease, chronic pain, neurological disease, congestive heart failure, asthma, COPD, and stroke.[19,21,22,28,36] These

conditions may produce physical discomfort, physiological changes, or lead to side effects from medication that would lead to disturbances in sleep.

Decreased sleep quality can be a symptom of medical, psychiatric, and neurocognitive disorders, but can also lead to the development or an increase in severity of these conditions.[22] Older adults with insomnia and other sleep deficiencies have higher incidence or increased risk of heart disease, high blood pressure, neurological disease, breathing issues, chronic pain, cancer, depression, cognitive decline, medication use, gastrointestinal diseases, neurological disorders, as well as poorer management of all chronic conditions and greater morbidity from acute illnesses.[22,24,28,31,36] Individuals with insomnia symptoms report more daytime functional impairments, and have been shown to experience lowered ability to enjoy family and social relationships; increased incidence of pain and poor health; decreased ability to accomplish daily tasks; and increased consumption of health care resources.[20]

2.3.5 Mood and psychological conditions

The association between sleep disturbance and mood disorders can also be described as reciprocal. Disturbances in sleep can be both a risk factor and a consequence of anxiety and mood disorders.[22] Anxiety and depression are the most common psychiatric conditions in which older adults report problems with sleep.[22] Psychiatric disorders can affect sleep quality and duration, and are associated with an increased risk of insomnia for older adults.[7,20] Especially for older adults within care home settings, the presence of depression symptoms has been shown to double the risk of insomnia.[31] There is also research to show that there are more sleep disturbances among those with delusions.[37] Freeman et al. conducted a study comparing a group of individuals with persecutory delusions to a sample from the community and found considerably higher rates of

insomnia in the clinical group.[38] Over half (54%) of the participants with persecutory delusions had moderate to severe insomnia, compared to only 7.4% of those without delusions.[38]

Insomnia and poor sleep are also independent risk factors for depression.[39] Taylor et al. discovered that 20% of adults with insomnia report clinically significant depression, and are ten times more likely to have depression than individuals without insomnia.[40] Sleep disturbances can also lead to poor response of treatments for depression, both pharmacological and non-pharmacological.[37]

2.3.6 Pain

Sleep disturbance and chronic pain are two highly prevalent problems that are associated with aging, and research indicates that these often under-treated conditions may have a bidirectional relationship.[24] Pain has been shown to be associated with a greater risk of insomnia, potentially due to nighttime discomfort or dysregulated sleep cycles.[28,31] The link between sleep disturbance and pain could be explained by the modification of sensory measures of pain in the body, or by possible inflammation and impaired descending pain inhibition, with loss of sleep amplifying pain. Reports of low quality sleep predict development of pain exacerbation and chronic pain, even more strongly than pain predicts sleep disturbance.[24] Treating problematic sleep behaviours could improve management of chronic pain, and vice versa.[24]

2.3.7 Sleep hygiene

Sleep hygiene is an important practice that positively influences the quality and duration of sleep by employing behavioural and lifestyle interventions, to be considered throughout the day and at bedtime.[41] These daily behaviours, routines, and changes to the environment are useful for promoting proper sleep in older adults.[2,42] Interventions can include controlling noise, temperature, and light exposure, as well as encouraging a consistent bedtime routine, regular exercise,

mindfulness and breathing techniques, and reducing napping, caffeine and alcohol during the day.[41,42] A study conducted in 2024 showed that educating LTC residents about sleep hygiene and implementing some of these practices daily can help reduce sleep disturbances in LTC settings.[42]

2.3.8 Social engagement and physical activity

Social engagement and physical activity are two major factors that are associated with sleep, with sleep disturbance and lack of social and physical activity influencing each other negatively for older adults.[8] Loneliness is an important aspect of social engagement can be used as a measure of health. A study in Germany among adults over 50 found that baseline loneliness was associated with an increase in the odds of reporting shorter duration of sleep and more sleep problems overall, even after adjusting for health status, social network variables, and depression.[43] Insomnia has been associated with lower levels of social engagement and higher levels of communication difficulties and interpersonal conflicts.[8] In addition, research shows that decreased physical activity can affect sleep patterns. Older adults who are physically fit have better quality sleep at night and overall better health outcomes.[20]

2.3.9 Other outcomes

Sleep disturbance in older adults has been directly linked to other serious health outcomes, including cognitive impairment, falls, and mortality.[19,20,24,31] There is substantial evidence to suggest that poor sleep quality may predispose older adults to a greater risk of falls. Sleep disturbance can lead to reduced response times, difficulty sustaining attention, and deficits in cognition, memory, and motor performance, which can increase the risk of falls and hip fractures.[19,20,24] Research has found a significant relationship between the severity of insomnia symptoms and falls.[44] Older adults with sleep disturbance report higher occurrence of balance,

ambulatory and visual difficulties, even after adjustment for medication use.[19] Falls can lead to a greater risk of functional impairment, fracture, and death.[24]

Sleep problems have been linked to higher rates of mortality.[31] Mortality due to common causes of death in older adults, such as heart disease or stroke, can be up to two times higher in those with sleep disturbances compared to those without.[20] Studies have shown that decreased total sleep time and poor sleep efficiency are associated with a higher risk of mortality for this population.[19]

2.4 High-risk populations

Some populations of older adults are at a higher risk of sleep disturbance and the subsequent consequences, particularly residents in LTC and individuals with dementia. LTC residents show significantly lower sleep efficiency, increased nighttime wakefulness, and sleep fragmentation compared to older adults in the community.[7,45] Literature concerning LTC settings have shown that insomnia prevalence ranges from 13% to over 30% across European countries, and at least 20% of residents regularly report poor sleep quality.[25,31,46] Recent results from Wabe et al. show that over one in five residents in Canadian LTC experience sleep disturbance, with variation of prevalence rates among provinces and facilities.[46] Individuals with dementia are also at particularly high-risk, often showing clinically significant sleep disturbances. Studies via questionnaires have found responses positive for sleep problems in 20% of individuals with dementia, but closer to 70% when measured with objective sleep measures, such as actigraphy.[47]

Environmental factors that contribute to altered circadian rhythms and sleep patterns in LTC settings include nighttime disruptions, often due to noise from roommates or care staff, and limited daytime light and outdoor exposure.[6,22,48] Circadian rhythms are often disrupted due to daytime napping and reduced exposure to bright light.[22] Residents also experience low levels of

physical activity and social interaction and an increased amount of time in bed, which can lead to sleep fragmentation throughout the day and poorer nighttime sleep quality.[6,49] Increased dependence in activities of daily living (ADLs), pain, and low nighttime staffing are also associated with lower sleep efficiency and increased reporting of poor sleep quality in LTC.[48]

Sleep has also been associated with negative outcomes in care home settings.[6] Results from Valenza et al. found a relationship between sleep quality and functional status in older adults in LTC, showing that residents with poor sleep reported less autonomy than those who did not experience sleep disturbances.[7] Residents with sufficient sleep have reported better perceived overall health, which highlights the importance of addressing sleep quality in these settings.[50]

Dementia and other neurodegenerative conditions, such as Parkinson's Disease, are also strongly associated with sleep fragmentation and other nocturnal behaviours that lead to increased sleep disturbances.[6,19] The Canadian Institute for Health Information (CIHI) has reported that 60% of residents in LTC have a diagnosis of dementia, and studies have shown that up to 70% of residents of LTC with cognitive impairment may be experiencing sleep disturbances.[9,51] Individuals with dementia in LTC often show severely fragmented sleep, spending the majority of the day and night in cycles of dozing and waking without sustained sleep or wakefulness.[20]

Recent studies have also suggested a causal relationship between sleep disturbance and the worsening of symptoms related to neurodegenerative dementia.[52] During sleep, the brain works to remove metabolic waste through the glymphatic system, which helps to support neuronal health.[52,53] The glymphatic system is a transport system that works with surrounding lymphatic vessels to export the excess interstitial fluid and proteins that require removal.[52] Recent studies have shown that aging is associated with a decrease in glymphatic flow, resulting in the protein aggregation that is linked to age-related neurodegenerative diseases, such as dementia.[52]

This relationship between dementia and sleep is bidirectional and complex. Older adults tend to spend less time in stage 3 sleep, which is when the majority of this clearance occurs.[52] When improper removal of waste caused by poor sleep leads to inflammation or neurodegeneration in the brain, this can affect the regulatory circuits that help induce sleep, therefore leading to higher waste production and lower rates of waste clearance.[53] Some research has shown that the loss of sleep associated with aging may be an early predictor in the pathology of dementia.[53]

2.5 Interventions and treatments for sleep disturbance

When managing sleep disturbance in older adults, it is important to understand that there is likely a reciprocating relationship between insomnia and chronic illness.[20,36] Sleep disturbance must be treated as its own separate issue and should not be only be considered a symptom of a disease or illness, while also keeping in mind how management of other conditions can improve sleep symptoms. Treatments for insomnia symptoms have included both non-pharmacological and pharmacological approaches. A non-pharmacological approach is recommended at the first-line treatment for sleep disturbances, in addition to deprescribing drugs that may contribute to poor sleep and appropriately treating chronic diseases and symptoms to maintain proper sleep.[51]

2.5.1 Non-pharmacological

Cognitive Behavioral Therapy for Insomnia (CBT-I) is the recommended first-line treatment for adults with insomnia and related symptoms, including those with medical and psychiatric comorbidities.[22,23,29,36] CBT-I is a multicomponent therapy that involves techniques to improve sleep, such as stimulus control, sleep restriction, cognitive restructuring, and sleep hygiene education.[23] However, despite its known efficacy, access to CBT-I remains limited. Its practice in LTC settings might be challenging due to complex health needs and conditions, including lack of mobility and cognitive impairment, and pharmacotherapy prevails as the most

prevalent treatment for older adults.[27] Behavioral treatments are effective and improve not only sleep and daytime symptoms of insomnia, but can also ameliorate some of the dysregulated mechanisms that may lead to negative behavioural outcomes and the need to initiate medication.[24]

Other environmental interventions for sleep have been shown to be effective in older adults as well. Increasing light exposure during the day can help improve sleep by regulating circadian rhythms, especially in LTC settings where indoor lighting is often insufficient to contribute to these regulation.[20,22] Light exposure can delay the circadian phase, helping individuals stay awake longer and sleep later, with sunlight as the most effective source of bright light.[20]

Physical activity and social engagement are also beneficial for maintaining and improving sleep quality in these settings.[6,23] Research shows that regular exercise affects sleep patterns by increasing total sleep time and slow-wave sleep, and delaying REM sleep onset.[20] Many LTC homes provide opportunities for structured exercise and recreational therapy. Active participation in recreation and engagement with others promotes improvements in mood, cognition, and physical health indicators, and physical activity can reduce the effects of chronic disease and psychological distress, which all have been proven to cause disturbances in sleep.[54]

2.5.2 Pharmacological

Pharmacotherapy has been shown to be an effective treatment for sleep disturbances in older adults; however, it should only be considered when non-pharmacological methods are insufficient, and they should not be a replacement for addressing the root cause of the sleep problem.[7] Medication for sleep must be used cautiously due to age-related changes in metabolism and risks of side-effects for vulnerable populations, such as excessive sedation, falls, hip fractures, and higher risk of dementia and death.[22,24] Research from Lapeyre-Mestre suggests that the long-term use of sleep medications can actually have a deleterious impact on the quality of sleep.[55]

Sedative-hypnotics are a common type of medication for used for sleep. Trazodone (an antidepressant used off-label) and melatonin are widely used but with insufficient evidence, and they are not approved for sleep in many countries.[22,56] In a Canadian survey, 46% of respondents reported that they have used a sleep aid in the previous year, and a study in Ontario found that almost one in five older adults living in the community were prescribed medication used for sleep when diagnosed with a new sleep disorder, including antidepressants and antipsychotics.[27,57] Despite many medications not being recommended for sleep needs for older adults, particularly antipsychotics, they are still being used too often in this population.[6,51]

2.6 Antipsychotics

Antipsychotics are a type of pharmaceutical that are prescribed to treat psychosis and have been in use for approximately 70 years for the management of psychotic disorders, mainly schizophrenia.[51] Antipsychotics have also been used to relieve some symptoms of dementia, such as agitation and aggression, although experts continue to recommend non-pharmacological approaches as a first-line treatment.[58]

The long-term use of antipsychotics in LTC settings is a major concern. A recent Canadian study showed that antipsychotic use was common in both assisted living (26.5% of residents) and LTC homes (31.8% of residents).[59] Results from Foebel et al. also found that the overall rate of antipsychotic use in LTC in Canada was 26.1%, excluding those with psychiatric conditions, potentially underestimating the actual rates.[60]

Nearly two-thirds of residents in LTC have a diagnosis of dementia.[9,12] Many residents in LTC are prescribed antipsychotics to treat the behavioural and psychological symptoms of dementia (BPSD), such as agitation, delusions, and hallucinations. Antipsychotics have also been prescribed to residents without active BPSD symptoms, particularly for insomnia.[12,61] BPSD

remain the most significant psychological issues for residents in LTC settings. Warnings from Health Canada and other organizations emphasize the risks of atypical antipsychotics for older adults, highlighting the uncertainty of effectiveness of these drugs in treating dementia, promoting the use of other psychosocial interventions as first-line treatments.[12,51,55,59,61,62]

Choosing Wisely Canada is a national organization that works with clinician societies to reduce unnecessary tests and treatments that expose patients to harm. They recommend against the use of antipsychotics as the first choice of treatment for BPSD or insomnia.[63] Antipsychotics do have beneficial effects for certain conditions; however, there is limited evidence on the use of antipsychotics for insomnia in older adults and their use is not encouraged for the treatment of sleep disturbances.[51,64]

2.7 Risk factors and adverse outcomes

There are a number of facility- and resident-level characteristics that are associated with the use of antipsychotic medication in each LTC home. Factors that have been associated with greater use include facility size, local prescribing practices, physician availability, staff attitudes and beliefs, as well as staff resources and training.[61,62] Further, resident demographics and characteristics have been shown to have an association with antipsychotic use, including levels of cognitive impairment, age, gender, use of other medications, and psychosocial behaviours.[59,60]

2.7.1 Cognitive impairment

Cognitive impairment and dementia are the most significant factors that increase likelihood of antipsychotic initiation in LTC.[59,60,65] Common symptoms and behaviours that lead to initiation of antipsychotics include motor agitation and aggressiveness, communication challenges, wandering, delusions, delirium, irritability, and depression.[51,59,60] Indication of these symptoms

may promote an increase in pharmacological treatment as a quick response to providing care for the resident in order to manage behaviours.

2.7.2 Age and gender

Age and gender have also been associated with antipsychotic use. Older adults are more prone to using prescription medications for insomnia in general, however, within LTC settings, younger residents are more likely to receive antipsychotics.[27,59,60] Residents who initiate antipsychotics in LTC are typically in the younger age groups, with 54% of new users under the age of 85.[60] Another study in Canadian LTC homes showed that all residents over the age of 80 had significantly lower likelihood for antipsychotic use.[59] This age-related pattern may reflect differences in clinical presentations and care needs of residents. Additionally, research shows that females are particularly at risk of using antipsychotics for insomnia, especially among older adults.[27,57] This identifies interesting potential sex differences in the identification and management of sleep disturbance in this population.

2.7.3 Medication use

Another resident-level factor that is associated with increased likelihood of using antipsychotics is the use of other psychoactive/psychotropic medications.[59,60] This includes antidepressants, anxiolytics, and sedative-hypnotics.[59] This is an additional pathway in which mood, psychological conditions, and poor sleep might lead to increased risk of antipsychotics.

2.7.4 Adverse outcomes

There is considerable concern regarding the use of antipsychotics for older adults particularly due to the side effects, which include higher risk of mortality, falls and fractures, and other serious health outcomes. Research shows that the highest risk of negative outcomes is within the first 30-40 days of initiating pharmacological treatment, no matter the outcome.[59,66]

Pharmaceuticals that are used to treat sleep problems, including antipsychotics, increase the risk of falls in older adults.[58,62] Findings from Bozat-Emre et al. suggest a greater risk of falling due to antipsychotic use among care home residents, with this effect even greater for those who are prone to wander at night.[67] One study of over 2000 LTC residents in the Netherlands found that the prescription of psychotropic drugs was associated with a three times higher risk of fall incidence, for both on a scheduled basis and as-needed basis of medication.[68] Another meta-analysis indicated that antipsychotics can increase the risk of falling by up to 50% for older adults, which is also associated with fall related injuries, such as hip fractures and head injuries.[51] These medications, due to their anticholinergic and sedative effects, can impair posture, lengthen reaction time, and reduce coordination and protective responses during falls.[20,51]

Use of antipsychotics has been linked to an increased risk of death for older adults. Literature shows that older adults who use antipsychotics, either conventionally or atypically, have a higher risk for mortality, especially those with dementia and those who reside in LTC.[12,55,66,69,70]

The side effects and negative health outcomes associated with taking antipsychotics for older adults is extensive. Results from Valenza et al. suggest that hypnotic drugs, including antipsychotics, have significant effects on the functionality of older adults, modifying their social interactions and basic ADLs.[7] Literature shows that antipsychotic medications increase the risk of stroke, pneumonia, diabetes, heart disease and other cardiovascular adverse outcomes, as well as hospitalization for older adults, particularly those with dementia.[12,51,55,59,62] In summary, the use of antipsychotic medication for sleep or symptoms of dementia is not suggested for older adults in LTC due to the severe health risks and limited evidence of effectiveness.

2.8 Reducing antipsychotics use

In accordance with Choosing Wisely's recommendations against the use of antipsychotics for BPSD or insomnia, efforts have been made to reduce antipsychotic use in Canada and worldwide.[63] When targeting treatments to reduce the potential misuse of antipsychotic drugs in LTC, it is important to identify individuals and facilities that have the characteristics that lead to an increased risk, and many existing interventions have been successful in doing so.[60,62] Facilities that conducted regular reviews of residents on antipsychotics showed reduced use, and training for care staff on how to reduce and manage BPSD using person-centred approaches proved effective as well.[12,71]

Despite these recommendations and positive results, antipsychotic use remains high. Due to the national effort and effective interventions put in place, reports of antipsychotics use in Canadian LTC were at a low prior to the COVID-19 pandemic.[62,72] Yet, the potentially inappropriate use of antipsychotics in Canadian LTC homes overall has since increased for both newly admitted and long-stay residents.[62,72,73] Turcotte et al. discovered a higher usage of antipsychotics for residents without a diagnosis of psychosis in all provinces during the pandemic period[72], and reports from CIHI show that the potentially inappropriate use of antipsychotics in LTC increased from 20.2% to 24.5% in just 5 years (2019-2024).[9]

2.9 Research gaps and rationale

This thesis intended to fill gaps in the current literature for sleep disturbance and antipsychotic use among older adults in Canadian LTC. Sleep disturbance is an underrepresented issue for this population, and there is minimal research on the role of antipsychotics in the development of sleep issues, especially for older adults in LTC. With the high use of antipsychotics in LTC, it is critical to understand the effect of antipsychotics on sleep quality. Despite some

research suggesting an association between antipsychotic use and sleep disturbance for LTC residents[46], this issue has not been explored comprehensively, particularly in the Canadian context. Further, sleep disturbance is often included in association with BPSD, but few studies actually isolate sleep disturbance as a specific predictor of initiation of antipsychotics. Similarly, there are limited studies that pointedly target improvements in sleep in order to reduce prescription of antipsychotics.

The findings from this study can offer valuable insight into the risk factors associated with sleep disturbance for older adults in Canadian LTC facilities, informing future strategies to improve sleep and health outcomes in this population. In addition, this information can provide the opportunity to identify an area of reducing potentially inappropriate use of antipsychotics, advising changes in prescribing practices in LTC settings and leading to improved quality of care.

2.10 Research aims and objectives

The overall objectives of this thesis are to investigate the bidirectional longitudinal associations between sleep disturbance and the potentially inappropriate use of antipsychotics among older adults in Canadian LTC facilities. Chapter 2 aims to determine the prevalence of sleep disturbance for the sample and investigate the role of antipsychotic use in new-onset sleep disturbance. Chapter 3 aims to establish the prevalence of antipsychotic use and examine the role of sleep disturbance in the initiation of antipsychotic use for the study population.

Using standardized data captured using the interRAI Resident Assessment Instrument–Minimum Data Set 2.0, this thesis will address the following research questions:

1. What is the prevalence of sleep disturbance and antipsychotic use among older adults in Canadian LTC facilities?
2. Is antipsychotic use associated with an increased risk of new-onset sleep disturbance among older adults in Canadian LTC facilities?
3. Is sleep disturbance associated with an increased risk of antipsychotic initiation among older adults in Canadian LTC facilities?

Chapter 3: Examining Antipsychotic Use as a Risk Factor for New-Onset Sleep Disturbance among Residents (≥ 65 years) in Canadian LTC Facilities

3.1 Introduction

Sleep is an important part of healthy aging that plays a major role in cognition, neural development, and emotional regulation, as well as physical recovery, metabolic regulation, and immune functioning.[18] Total sleep time decreases with age and the risk of sleep disorders increase, leaving older adults with a high risk of insufficient sleep and the resulting adverse effects.[19,74] Most sleep issues in older adults are attributed to environmental and age-related health changes, rather than physiological factors.[21]

Sleep disturbances in older adults are primarily caused by behavioural, environmental, and individual factors, all of which are amplified for those living in LTC settings.[74] Residents in LTC experience more acute and complex health challenges. These result in a higher prevalence of medical and psychiatric conditions, an increase of medication use, pain, incontinence, and frequent nighttime disruptions such as light and noise, which all contribute to disturbances in sleep.[6,34,35,75,76] Sleep disruption in older adults has serious functional, social, and psychological consequences, leading to adverse health outcomes and a reduced quality of life.[24,77] Sleep disturbance is associated with depression, cognitive decline and neurodegeneration, loss of independence in ADLs, falls and fractures due to reduced mobility and balance, as well as an increased risk of cardiovascular disease, metabolic health outcomes, and death.[19,24,44,53,77]

Dementia is also strongly associated with sleep disturbance, and nearly two-thirds of residents in LTC have a diagnosis of Alzheimer's disease or other dementias.[9,52,53,77] Individuals with dementia in LTC settings often have severely fragmented sleep, experiencing patterns of constant dozing and waking within a 24 hour period, contributing to a further increase in cognitive impairment and behavioural symptoms.[20,47]

Many residents in LTC are prescribed antipsychotics to treat the behavioural and psychological symptoms of dementia (BPSD), such as agitation and aggression, delusions, and hallucinations.[12,51,59] Despite numerous guidelines in favour of non-pharmacological interventions for BPSD due to the adverse side effects, the use of antipsychotics is still prevalent, raising concerns for safety and quality of care.[12] As of 2024, one in four residents in Canadian LTC facilities take antipsychotics without indicators of psychosis, demonstrating that the amount of antipsychotics used without a clinical indication remains high for this population.[9]

Recent evidence demonstrates that 1 in 5 LTC residents experience sleep disturbance in Canada.[46] With the high use of antipsychotics in LTC, it is critical to understand the effect of antipsychotics on sleep quality. Despite some research suggesting an association between antipsychotic use and sleep disturbance for LTC residents, this issue has not been explored comprehensively, particularly in the Canadian context.[46]

To reduce sleep issues in LTC facilities, the relationship between sleep disturbance and antipsychotic use should be examined in greater depth. This study intends to fill this critical gap in the literature for older adults in Canadian LTC facilities. Sleep disturbance is an underrepresented issue for this population, and there is minimal research on the role of antipsychotics in the development of sleep disturbance, especially for older adults in LTC. Using standardized data captured using the interRAI Resident Assessment Instrument–Minimum Data Set 2.0, this study aims to (1) estimate the prevalence of sleep disturbance and (2) determine whether antipsychotic use is associated with an increased risk of new-onset sleep disturbance for older adults in Canadian LTC.

3.2 Methods

3.2.1 Study design

A longitudinal cohort study was conducted using clinical assessment data from LTC facilities across Canada to estimate rates of sleep disturbance and examine the relationship between baseline antipsychotic use and new-onset sleep disturbance. The assessment records were derived from 1,389 LTC facilities across seven provinces and territories (AB, BC, MB, NL, ON, SK, YT) with data from January 1st, 2014, to July 17th, 2025. This project involved secondary data analysis of information collected using the interRAI RAI-MDS 2.0.

3.2.2 Data source and instrument

The interRAI Resident Assessment Instrument–Minimum Data Set 2.0 (RAI-MDS 2.0) are managed in the Canadian Institute for Health Information's (CIHI) Continuing Care Reporting System (CCRS). For the prevalence estimates, each resident contributed a single baseline observation for sleep disturbance, measured at the time of the initial assessment. The longitudinal comparisons were made between the initial assessment from the first LTC episode for each individual (T1) with the follow-up based on the subsequent assessment completed three months later (T2).

The RAI-MDS 2.0 is a comprehensive health assessment used in LTC facilities to systematically collect clinical and sociodemographic information from residents to evaluate their strengths, preferences, and needs.[17] This instrument provides standardized data for functional scales that aim to support care planning and improve quality of life.[17] interRAI scales are embedded clinical measurement tools that provide reliable scores to help monitor an individual's condition over time, by assessing the severity of various relevant domains, including cognitive status, physical functioning, and mood and behaviour.[13,17] The RAI 2.0 has been shown to be a

valid and reliable instrument used to assess the function and health of residents in LTC over time.[13–16]

3.2.3 Study population

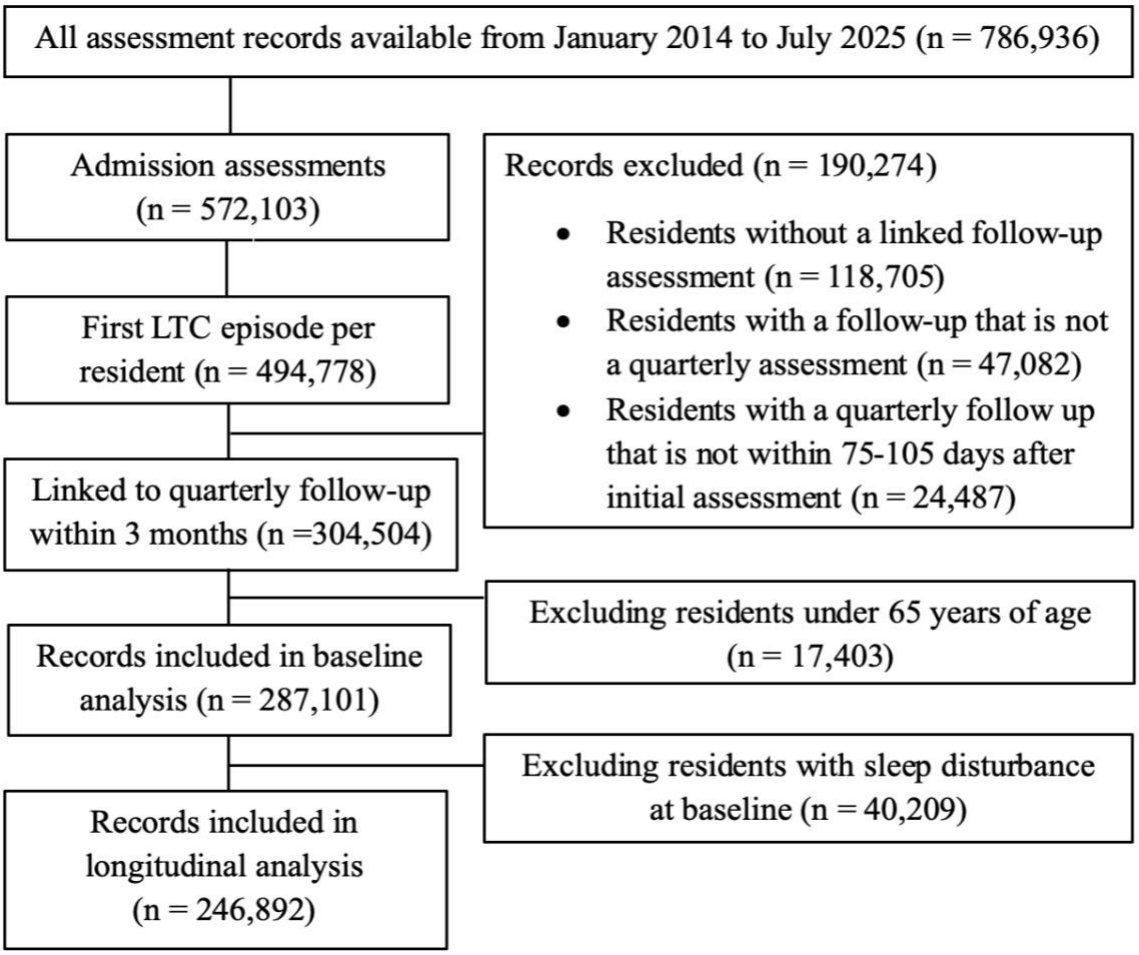
Figure 1 illustrates the flowchart for the study sample selection. The study sample consisted of older adults aged 65 and above residing in Canadian LTC facilities. Residents in LTC from participating provinces were included if they had an RAI-MDS 2.0 assessment from at least two time points, including the initial assessment, completed within 14 days of entry, and a quarterly follow-up assessment conducted three months later. Those with only one data point were excluded from the analysis, due to the study's focus of investigating outcomes at T2 based on independent variables at baseline. To allow for the identification of new sleep disturbance over time, the longitudinal analysis excluded residents with sleep disturbance at T1.

3.2.4 Measures

3.2.4.1 Main outcome

The main outcome for this study was the onset of new sleep disturbance. To determine whether a resident had sleep disturbance, the RAI 2.0 item regarding insomnia or change in usual sleep pattern was used. Residents were considered to have sleep disturbance if they received a score of 1 or higher which includes the options: Present but not exhibited in the last 30 days; Exhibited up to 5 days a week; Exhibited daily or almost daily (6, 7 days a week). Based on clinical judgement, this item is clinician rated using all sources of information available including resident self-reports, reports by family or staff, and chart information. For the longitudinal analysis, residents were classified as having new sleep disturbance if it was present at T2 without being present at baseline.

Figure 1. Sample selection flow chart for new-onset sleep disturbance



3.2.4.2 Main exposure

The main exposure variable for this study was antipsychotic use at T1. This was measured by the RAI-MDS 2.0 item that records whether the resident had taken an antipsychotic in the last 7 days. The details provided in this section of the assessment are supported by information including physician order sheets and drug administration records.[60]

3.2.4.3 Covariates

The covariates used in the analyses were chosen based on existing literature and expert knowledge.[22,26,28,30,31,34] These variables included age (65-74, 75-84, and 85+), gender

(female/male), dementia (both Alzheimer's and non-Alzheimer's dementia), Parkinson's disease, renal disease, heart failure, cancer, asthma, anxiety, depression, schizophrenia, and bipolar disorder. Diagnostic data in these assessments has been validated against hospital records.[78] Other variables included bowel and bladder incontinence (none, moderate, or high), hallucinations, delusions, and conflict with staff or family/friends. A number of validated clinical scales were also used in the analyses, including the Cognitive Performance Scale (CPS), Activities of Daily Living Hierarchy Scale (ADL-H), Changes in Health, End-stage Disease and Signs and Symptoms scale (CHESS), Pain Scale, Depression Rating Scale (DRS), and the Index of Social Engagement (ISE).[79–86] Description and scoring of scales are provided in Appendix A.

3.2.5 Statistical analysis

Descriptive statistics were used to describe sample characteristics of individuals in the study, indicated by frequencies and percentages. The proportion of residents identified as having sleep disturbance was calculated at the national level and stratified by province. Bivariate analyses using chi-square tests were conducted to compare the distribution of baseline characteristics between residents with and without sleep disturbance at baseline. To understand the associations and the statistical significance between the independent variables and new sleep disturbance at T2, crude odds ratios (OR), and their respective p-values, were produced.

Logistic regression was used to analyze the association between antipsychotic use at T1 and new sleep disturbance at T2, adjusting for covariates. The covariates in the multivariate model included independent variables that were deemed significant through bivariate analysis, or variables with solid theoretic backing to be included in the binary model for new sleep disturbance at T2. Prior to model fitting, independent variables were assessed for pairwise multicollinearity using Pearson's correlation coefficient, with a cut-off of 0.70. Following this, the Variance

Inflation Factor (VIF) was calculated to further rule out multicollinearity when considering all independent variables. A best-subset approach was used to select the final model.[87] These associations were expressed as odds ratios with 95% confidence intervals (CIs). All statistical analyses were conducted using SAS 9.4 within the University of Waterloo, with statistical significance defined as $p < 0.05$.

3.2.6 Ethical considerations

Ethical approval for this study was obtained through an existing agreement between interRAI, CIHI, and the University of Waterloo's Research Ethics Boards (ORE #30173).

3.3 Results

3.3.1 Sample characteristics

A total of 287,101 resident admission assessments from 1,389 LTC facilities across Canada were included in the baseline analysis. Table 1 provides a summary of the demographic and clinical characteristics stratified by sleep disturbance status at baseline. Within the sample, 63.2% were female, half of the residents were aged 85 and older, almost two thirds had a diagnosis of dementia, and 28.7% were on an antipsychotic at baseline. All included variables were significantly different between the two groups, with the exception of a cancer diagnosis.

Both groups were predominately female (63.2%). Though, there was a higher proportion of males with sleep disturbance than those without. Residents with sleep disturbance were generally younger than residents without, with a higher proportion of residents aged 65-74 and 75-84 in the sleep disturbance group. Compared to residents without sleep disturbance, those with sleep disturbance had higher rates of dementia, delusions, pain, and dependency in ADLs. Residents with sleep disturbance at baseline had more severe depressive symptoms than those without (DRS > 3+ was 42.1% and 15.5%, respectively) and were more cognitively impaired (CPS > 3+ was 74.4% and 56.0 %, respectively) (Table 1).

Table 1. Demographic and clinical characteristics of residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

Characteristic % (*n*)	Total sample	Sleep disturbance	
		No	Yes
	(*n*=287,101)	(*n*=246,892 [86.0%])	(*n*=40,209 [14.0%])
Gender			
Female	63.2 (181,586)	63.5 (156,856)	61.5 (45,730)
Male/Other	36.8 (105,428)	36.5 (89,959)	38.5 (15,469)
Age			
65-74	13.0 (37,410)	13.0 (32,111)	13.2 (53,299)
75-84	33.1 (95,165)	32.8 (80.975)	35.3 (14,190)
85+	53.9 (154,526)	54.2 (133,806)	51.5 (20,720)
Marital Status			
Never married	5.3 (15,312)	5.5 (13,620)	4.2 (1,692)
Married	26.7 (76,633)	26.1 (64,599)	29.9 (12,043)
Widowed	42.8 (122,834)	43.6 (107,593)	37.9 (15,421)
Separated/divorced	8.9 (25,556)	9.0 (22,319)	8.1 (3,237)
Other	16.3 (46,766)	15.7 (38,761)	19.9 (8,005)
Disease Diagnoses			
Dementia	63.4 (181,921)	61.6 (152,142)	74.1 (29,779)
Cancer	10.6 (30,349)	10.6 (26,066)*	10.7 (4,238)*
Clinical Symptoms			
Delusions	7.5 (21,966)	6.5 (15,931)	14.2 (5,707)
Anxiety	13.0 (37,175)	12.5 (30,780)	15.9 (6,395)
Functional Scales			
Pain Scale	35.9 (102,949)	34.9 (86,034)	42.1 (16,915)
CHESS Scale			
0	51.8 (148,839)	53.5 (132,107)	41.6 (16,732)
1-2	44.1 (126,637)	43.0 (106,236)	50.7 (20,401)
3+	4.1 (11,625)	3.5 (8,549)	7.7 (3,076)
ADL Hierarchy Scale			
0	3.4 (9,702)	3.7 (9,024)	1.7 (678)
1-2	22.1 (63,355)	22.5 (55,647)	19.1 (7,681)
3+	74.6 (214,044)	73.8 (182,194)	79.2 (31,850)
Cognitive Performance Scale			
0	8.1 (23,225)	8.8 (21,791)	3.6 (1,434)
1-2	33.3 (95,483)	35.1 (86,661)	21.9 (8,822)
3+	58.7 (168,393)	56.1 (138,440)	74.5 (29,953)

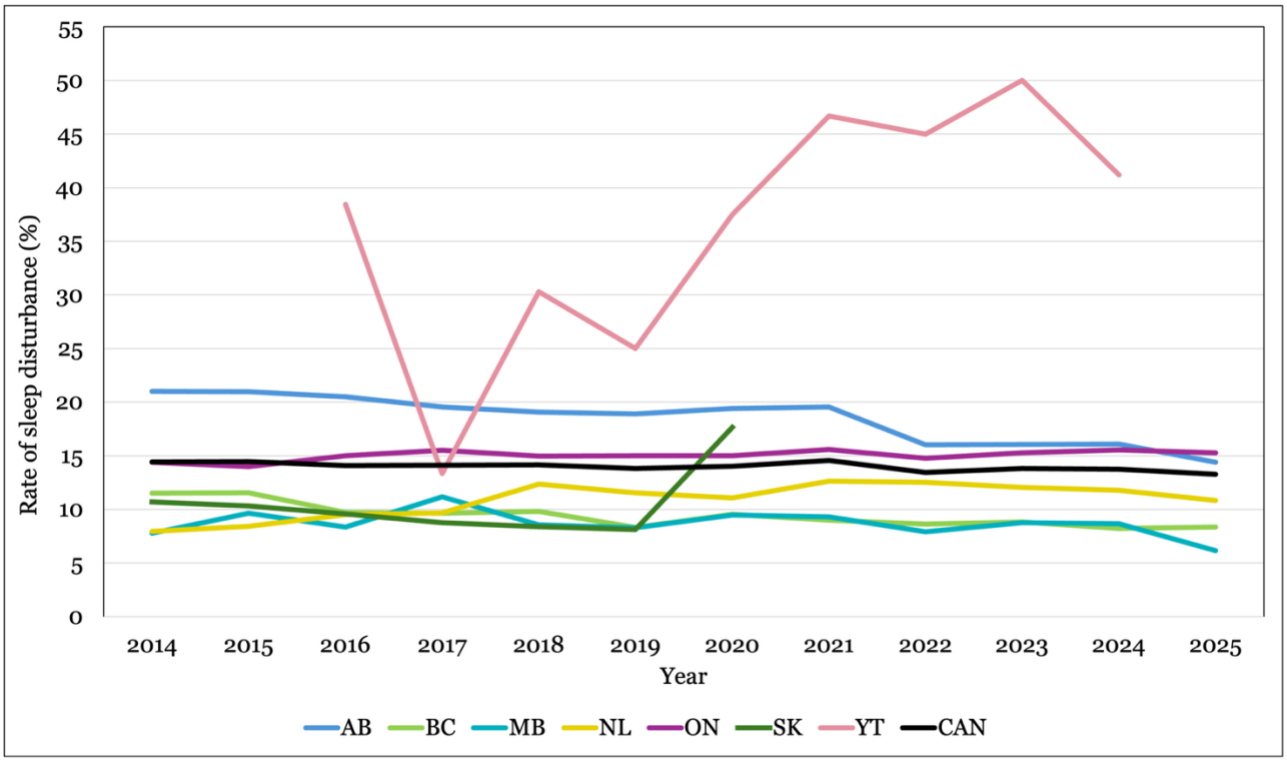
Depression Rating Scale			
0	52.8 (151,514)	58.0 (143,304)	20.4 (8,210)
1-2	28.1 (80,543)	26.5 (65,451)	37.5 (15,092)
3+	19.1 (55,044)	15.5 (38,137)	42.1 (16,907)
Medication use			
Antipsychotic	28.7 (82,348)	26.8 (66,244)	40.1 (16,104)

*p >0.05

3.3.2 Prevalence of sleep disturbance

Overall, 14% (n=40,209) of residents in this study had sleep disturbance at baseline. This estimate varied between provinces, ranging from 7.8% in Manitoba to 50% in the Yukon. Figure 2 shows the annual unadjusted rates of sleep disturbance by province. Some provinces showed considerable changes in the annual rate of sleep disturbance over time, but the pan-Canadian prevalence remained relatively consistent, lowering slightly from 14.4% in 2014 to 13.3% in 2025.

Figure 2. Pan-Canadian annual unadjusted rates of sleep disturbance among residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025



3.3.3. Antipsychotics as a predictor for sleep disturbance

A logistic regression model was used to explore the association between baseline antipsychotic use and new onset sleep disturbance among LTC residents in the sample. A total of 246,892 records were included in the longitudinal analysis. Among residents without sleep disturbance at baseline, 11.1% had developed sleep disturbance at T2. Both unadjusted (Table 2) and adjusted (Table 3) logistic regression models are reported.

Table 2 shows the crude odds ratios for new onset sleep disturbance. Before adjustment, residents with antipsychotic use at T1 had a 48% increase in the odds of developing sleep disturbance at T2 (OR 1.48, 95% CI 1.44-1.52, P = <.0001), compared to those without antipsychotic use at T1. Females had lower odds of having new sleep disturbance compared to males (OR 0.92, 95% CI 0.90-0.94, P = <.0001), and residents with dementia had over a 50% increase in the odds of new sleep disturbance compared to those without a diagnosis of dementia (OR 1.53, 95% CI 1.49-1.57, P = <.0001) (Table 2).

Table 2. Unadjusted odds ratios for new sleep disturbance among residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

Variable	Crude OR	95% CI		p
		Lower	Upper	
Gender (Ref = male)	0.92	0.90	0.94	<.0001
Age (Ref = 65-74)				
75-84	1.02	0.98	1.06	0.48
85+	1.00	0.96	1.04	0.98
Dementia (Ref = Not present)	1.53	1.49	1.57	<.0001
Cancer (Ref = Not present)	0.97	0.93	1.01	0.13
Shortness of breath (Ref = Not present)	1.10	1.04	1.17	0.0005
Arthritis (Ref = Not present)	1.06	1.03	1.08	<.0001
Parkinson's (Ref = Not present)	1.03	0.98	1.08	0.34
Heart failure (Ref = Not present)	0.97	0.93	1.00	0.07
Asthma (Ref = Not present)	1.01	0.96	1.08	0.67
Renal failure (Ref = Not present)	0.99	0.95	1.03	0.57
Anxiety (Ref = Not present)	1.24	1.19	1.28	<.0001
Depression (Ref = Not present)	1.11	1.08	1.14	<.0001
Schizophrenia (Ref = Not present)	0.96	0.87	1.06	0.435
Bipolar disorder (Ref = Not present)	0.96	0.87	1.06	0.43
Hallucinations (Ref = Not present)	1.54	1.45	1.64	<.0001
Delusions (Ref = Not present)	1.57	1.50	1.64	<.0001
Conflict (Ref = Not present)	1.58	1.50	1.66	<.0001
Bowel incontinence (Ref = None)				
Moderate	1.23	1.20	1.27	<.0001
High	0.96	0.93	0.99	0.04
Bladder incontinence (Ref = None)				
Moderate	1.40	1.35	1.44	<.0001
High	1.18	1.13	1.22	<.0001
Pain Scale (Ref = 0)	1.18	1.15	1.21	<.0001
CHESS (Ref = 0)				
1-2	1.28	1.24	1.31	<.0001
3+	1.58	1.48	1.68	<.0001
Index of Social Engagement (Ref = 6)				
≤ 5	1.37	1.30	1.44	<.0001
ADL Hierarchy Scale (Ref = 0)				
1-2	1.39	1.28	1.51	<.0001
3+	1.69	1.59	1.84	<.0001

Cognitive Performance Scale (Ref = 0)				
1-2	1.41	1.33	1.50	<.0001
3+	2.21	2.09	2.33	<.0001
Depression Rating Scale (Ref = 0)				
1-2	1.83	1.77	1.88	<.0001
3+	2.54	2.46	2.63	<.0001
Antipsychotic (Ref = Not present)	1.48	1.44	1.52	<.0001

The final multivariate model to identify whether antipsychotic use at T1 is a predictor of new onset sleep disturbance was established using a best-subsets approach.[87] Only statistically significant variables were kept in the final model, with the exception of age. Table 3 shows the adjusted odds ratios for new onset sleep disturbance. This model showed modest discrimination, with a c-statistic of 0.64 (95% CI 0.63-0.64). After adjusting for all covariates in the final model, antipsychotic use was associated with a 21% increase in the odds of new sleep disturbance compared to non-use (OR 1.21, 95% CI 1.18-1.24).

Additional variables with higher odds of new sleep disturbance in the final model included a dementia diagnosis (OR 1.24, 95% CI 1.20-1.28), arthritis (OR 1.04, 95% CI 1.01-1.06), anxiety (OR 1.11, 95% CI 1.07-1.16), hallucinations (OR 1.15, 95% CI 1.05-1.19), conflict (OR 1.12, 95% CI 1.06-1.18), moderate and high bladder incontinence (OR 1.21, 95% CI 1.16-1.26; OR 1.13, 95% CI 1.09-1.18), pain (OR 1.14, 95% CI 1.10-1.17), and reduced social engagement (OR 1.13, 95% CI 1.07-1.19). Only high bowel incontinence (OR 0.87, 95% CI 0.84-0.91) and female gender (OR 0.87, 95% CI 0.81-0.85) were associated with reduced odds of new sleep disturbance (Table 3). Health instability (CHESS), ADL-Hierarchy, cognitive performance (CPS), and depression symptoms (DRS) also showed increasing odds of new sleep disturbance with higher categories. For example, the odds of developing new sleep disturbance were 17% greater among residents with a CPS of 1-2 (OR 1.17 95% CI 1.11-1.25), and 52% greater among residents with a CPS of 3+ (OR 1.52 95% CI 1.43-1.61), compared to residents with a CPS of 0.

Table 3. Adjusted odds ratios (final model) for new sleep disturbance among residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

Variable	Adjusted OR	95% CI		p
		Lower	Upper	
Gender (Ref = male)	0.83	0.81	0.85	<.0001
Age (Ref = 65-74)				
75-84	0.96	0.92	1.00	0.06
85+	0.99	0.95	1.03	0.70
Dementia (Ref = Not present)	1.24	1.20	1.28	<.0001
Arthritis (Ref = Not present)	1.04	1.01	1.06	0.01
Anxiety (Ref = Not present)	1.11	1.07	1.16	<.0001
Hallucinations (Ref = Not present)	1.11	1.05	1.19	0.001
Conflict (Ref = Not present)	1.12	1.06	1.18	<.0001
Bowel incontinence (Ref = None)				
Moderate	1.01	0.98	1.05	0.54
High	0.87	0.84	0.91	<.0001
Bladder incontinence (Ref = None)				
Moderate	1.21	1.16	1.26	<.0001
High	1.13	1.09	1.18	<.0001
Pain Scale (Ref = 0)	1.14	1.10	1.17	<.0001
CHESS Scale (Ref = 0)				
1-2	1.17	1.14	1.20	<.0001
3+	1.26	1.19	1.35	<.0001
Index of Social Engagement (Ref = 6)				
≤ 5	1.13	1.07	1.19	<.0001
ADL Hierarchy Scale (Ref = 0)				
1-2	1.14	1.05	1.24	0.003
3+	1.29	1.18	1.41	<.0001
Cognitive Performance Scale (Ref = 0)				
1-2	1.17	1.11	1.25	<.0001
3+	1.52	1.43	1.61	<.0001
Depression Rating Scale (Ref = 0)				
1-2	1.63	1.58	1.68	<.0001
3+	2.12	2.05	2.20	<.0001
Antipsychotic (Ref = Not present)	1.21	1.18	1.25	<.0001

C-statistic for the final model = 0.64

3.4 Discussion

This study established a national prevalence rate of 14.0% of sleep disturbance for older adults residing in Canadian LTC. Using comprehensive interRAI assessment data, the findings indicate that baseline antipsychotic use was associated with increased odds of new onset sleep disturbance at follow-up (OR 1.21, 95% CI 1.17-1.24). These results confirm that sleep disturbance continues to be a prevalent issue for LTC residents across the country. This study also demonstrates the role of antipsychotics and other significant predictors in the development of sleep disturbance, providing justification for tailored intervention strategies aimed at reducing sleep disturbance for this population.

3.4.1 Prevalence of sleep disturbance

With an overall prevalence of 14.0%, the rate of sleep disturbance in the study is within the range of previously reported estimates from LTC settings but remains on the lower end. Wabe et al. examined sleep in LTC using a newer version of the interRAI assessment with more granular sleep measures.[46] Their study showed an overall prevalence of 21.7% from two Canadian provinces, with estimates ranging from 3-56% between facilities.[46] A recent systematic review and meta-analysis documented a pooled prevalence of 20% of clinically significant sleep disturbance among people with dementia living in care homes, with individual studies ranging from 5-53%.[47] This variation in estimates may be due to the type of measurement used to detect sleep disturbance.[88] When these analyses included only studies that used actigraphy to report prevalence for people with dementia living in care home settings, rather than validated questionnaires, the estimates of sleep disturbance had a higher range of 32-84%.[47]

Webster et al. also found that the method of measurement was statistically significant moderator of prevalence.[47] This suggests that more standardized measurements should be applied

for research on sleep disturbance to ensure comparable results. Moving forward, Canada has transitioned to the interRAI LTCF and it will be used as an assessment instead of the RAI 2.0. The LTCF has a more granular and precise measure of sleep disturbance, so although prevalence rates in this study vary from previous interRAI prevalence results, the associations found should hold.

3.4.2 Antipsychotic use as a predictor of sleep disturbance

Our study found that antipsychotic use was associated with new sleep disturbance for older adults in LTC. The current findings are generally consistent with prior studies on antipsychotics and sleep; however, much of the existing research focuses on populations that are different from the current sample, including only individuals with dementia or schizophrenia.[47,89]

As currently understood, only one other study has previously associated antipsychotic use as a predictor for sleep disturbance for residents in LTC. Wabe et al. conducted a retrospective longitudinal cohort study (n=21,394) using interRAI LTCF assessment records for LTC residents in New Brunswick and Saskatchewan.[46] They found antipsychotic use to be a predictor of worsened sleep in older adults in LTC.[46] The current study is the first to focus on antipsychotic use as a predictor of sleep disturbance in LTC at the pan-Canadian level, highlighting the need for more research for a more representative and diverse LTC population.

There are several possible underlying mechanisms that could explain this association between antipsychotic use and sleep disturbance. The use of antipsychotics can lead to excessive daytime sleepiness, resulting in more fragmented sleep and disrupted circadian rhythms.[90,91] Antipsychotic use can also increase the risk of movement and sleep-related breathing disorders that make sleep more difficult, such as akathisia, restless leg syndrome (RLS), periodic limb movement disorder (PLMD), and sleep disordered breathing (SDB).[90,92]

3.4.3. Clinical implications

This research has implications for practice and education in LTC, related to changes in prescribing practices. The current findings could help develop training curriculum or guidance for clinicians on the appropriate prescribing on antipsychotics, along with other effective intervention strategies that target relevant significant risk factors for sleep disturbance. This reinforces the importance of non-pharmacological interventions to improve sleep in LTC, and highlights the need for evidence-based prescribing practices.[93]

The focus of existing interventions for sleep disturbance in LTC broadly align with several key domains also identified in this study. Environmental and behavioural treatments, such as Cognitive Behavioural Therapy for Insomnia (CBT-I) and sleep hygiene education, aim to address modifiable psychological and physical elements such as behavioural and depressive symptoms, anxiety, and pain to improve sleep outcomes, which reflect the present findings.[23,36,94,95] Similarly, interventions that target social engagement, using an approach like recreational therapy, are effective, which is consistent with the results that show that more social isolation is associated with sleep disturbance.[54] Existing literature also emphasizes the importance of tailoring sleep interventions to the unique needs and clinical complexities of older adults with dementia, agreeing with the strong association between cognitive impairment and sleep disturbance established in the current study.[95,96] These interventions reflect the use of non-pharmacological approaches and should continue to be incorporated to improve sleep outcomes in LTC.

3.4.4 Strengths and limitations

This study is not without limitations. First, due to the observational nature of this study, causation cannot be implied and the potential for residual confounding from unmeasured factors remains despite adjustment. Secondly, the c-statistic for the final model shows modest

discrimination (0.64), demonstrating limited accuracy for prediction at the individual level. Although the associations in the current findings are still statistically meaningful and clinically relevant, future work could use alternative modelling approaches to improve the prediction of sleep disturbance in LTC settings. Lastly, the logistic regression model did not account for resident- or facility-level clustering. Future research should incorporate multilevel modelling to explore the effects of resident-level determinants and broader contextual factors on sleep disturbance. In addition, a treatment effects analysis could provide stronger evidence of causality to rule out confounding by indication. That said, none of the study participants had a pre-existing sleep disturbance that was detected in the baseline assessment.

This study also has several strengths. This analysis used a large representative sample of comprehensive assessment data across multiple Canadian provinces, enhancing generalizability of the findings at a national level. In addition, it examined a broad range of clinically important covariates to control for potential confounding factors.

3.4.5 Conclusion

This study demonstrated the substantial prevalence of sleep disturbance in LTC at the pan-Canadian level and the need for more consistent measurement instruments, while identifying a number of contributing determinants for new-onset sleep disturbance, including antipsychotic use. The association between antipsychotics and sleep disturbance emphasizes the need for more appropriate prescribing practices. It is also clear that non-pharmacological interventions that target other modifiable risk factors to improve sleep should be prioritized over further medication use. Future research should consider the dynamics of individual attributes and broader system-level factors while examining the effects of antipsychotic use on sleep disturbance in LTC, helping to

strengthen the evidence base and inform future quality improvement, benchmarking, and policy initiatives.

Chapter 4: Examining Sleep Disturbance as a Risk Factor for Antipsychotic Initiation among Residents (≥ 65 years) in Canadian LTC Facilities

4.1 Introduction

The potentially inappropriate use of antipsychotic medication in LTC is a growing area of interest across Canada. Antipsychotics are typically prescribed for managing psychiatric conditions, such as schizophrenia and bipolar disorder, yet their use in the absence of these conditions raises concern due to the adverse side effects, particularly for older adults.[51] Antipsychotic use in LTC is associated with higher rates of mortality,[66,97] stroke,[97] falls,[51,67] cognitive decline, cardiovascular events, and hospitalization.[55,97,98]

The use of antipsychotics without clinical indication in LTC remains high, bringing into question the safety and quality of care for older adults in Canadian facilities. While there was a notable period of decline in potentially inappropriate antipsychotic use in Canada prior to the COVID-19 pandemic, this trend reversed after that time.[72,99] Recent evidence shows that 1 in 4 residents take antipsychotics without indicators of psychosis.[9,62] The potentially inappropriate use of these medications is an important quality indicator in LTC settings, providing insight into the quality of care in facilities, supporting new initiatives, and advising program evaluation.[100]

Nearly two-thirds of residents in LTC have a diagnosis of dementia, often experiencing agitation, depression, aggression, and other behavioural and psychological symptoms of dementia (BPSD).[9,12,93] Although antipsychotics are frequently used off-label in LTC for BPSD, there is limited evidence of their long-term effectiveness.[12,101,102] Hence, there are preponderant recommendations that use should be discontinued for residents with these symptoms and behaviours in favour of other non-pharmacological interventions as first-line treatments.[51,93,97]

Country-wide deprescribing initiatives have aimed to reduce the use of antipsychotics by targeting factors known to be associated with antipsychotic use in LTC.[101,103] Relevant attributes

associated with antipsychotic use include age, gender, cognitive status, depressive symptoms, use of other medications, and social engagement.[60] Structural factors are also important including facility size and management style, staff attitude and availability, and training and education.[60–62]

Considering the rebound in the rate of potentially inappropriate use of antipsychotics in LTC despite continued efforts towards reduction, it is reasonable to consider further evaluation of other underlying drivers of antipsychotic use that are insufficiently understood. One possible understudied factor is sleep disturbance. Sleep disturbance in LTC has been associated with increased agitation, disruptive behaviours, and psychological distress for both residents and staff,[31,104] which all contribute to the use of psychoactive medications.[60,72] Presentation of these behaviours associated with insufficient sleep can increase the need for intervention from clinicians and staff, highlighting an important pathway in which sleep disturbance increases the risk of initiating antipsychotic medications for LTC residents.

With recent evidence showing that 1 in 5 LTC residents experience sleep disturbance in Canada[46] and the current national focus on reducing antipsychotic use, there is a critical gap in the literature examining the association between sleep disturbance and antipsychotics. This study intends to address this gap for older adults in Canadian LTC facilities. Identifying sleep disturbance as a risk factor of antipsychotic use could highlight an area of focus for further efforts to reduce potentially inappropriate antipsychotic use, leading to improved health outcomes and quality of care for older adults in Canadian LTC. Using standardized data captured using the interRAI Resident Assessment Instrument–Minimum Data Set 2.0, this study aims to (1) estimate the current pan-Canadian rates of antipsychotic use and (2) determine whether sleep disturbance is a risk factor for initiating antipsychotic use for older adults in Canadian LTC.

4.2 Methods

4.2.1 Study design

A longitudinal cohort study was conducted using clinical assessment data from LTC facilities across Canada to estimate rates of antipsychotic use and examine the relationship between baseline sleep disturbance and the follow-up initiation of antipsychotic use. The assessment records were produced from 1,389 LTC facilities across seven provinces and territories (AB, BC, MB, NL, ON, SK, YT) with data from January 1st, 2014, to July 17th, 2025. This project involved a secondary data analysis of information collected using the interRAI RAI-MDS 2.0.

4.2.2 Data source and instrument

This project used interRAI Resident Assessment Instrument–Minimum Data Set 2.0 (RAI-MDS 2.0) records from the Canadian Institute for Health Information's (CIHI) Continuing Care Reporting System (CCRS). For the prevalence estimates, each resident contributed a single baseline observation for antipsychotic use, measured at the time of the initial assessment. The longitudinal comparisons were made between the initial assessment from the first LTC episode for each individual (T1) with the follow-up based on the subsequent assessment completed three months later (T2).

The RAI-MDS 2.0 is a comprehensive health assessment used in LTC facilities to systematically collect clinical and sociodemographic information from residents to evaluate their strengths, preferences, and needs.[17] This instrument provides standardized data for functional scales that aim to support care planning and improve quality of life.[17] interRAI scales are embedded clinical measures that help monitor an individual's condition over time, by assessing the severity of various relevant domains, including cognitive status, physical functioning, mood,

and behaviour.[13] The RAI 2.0 has been shown to be a valid and reliable instrument used to assess the function and health of residents in LTC over time.[13–16]

4.2.3 Study population

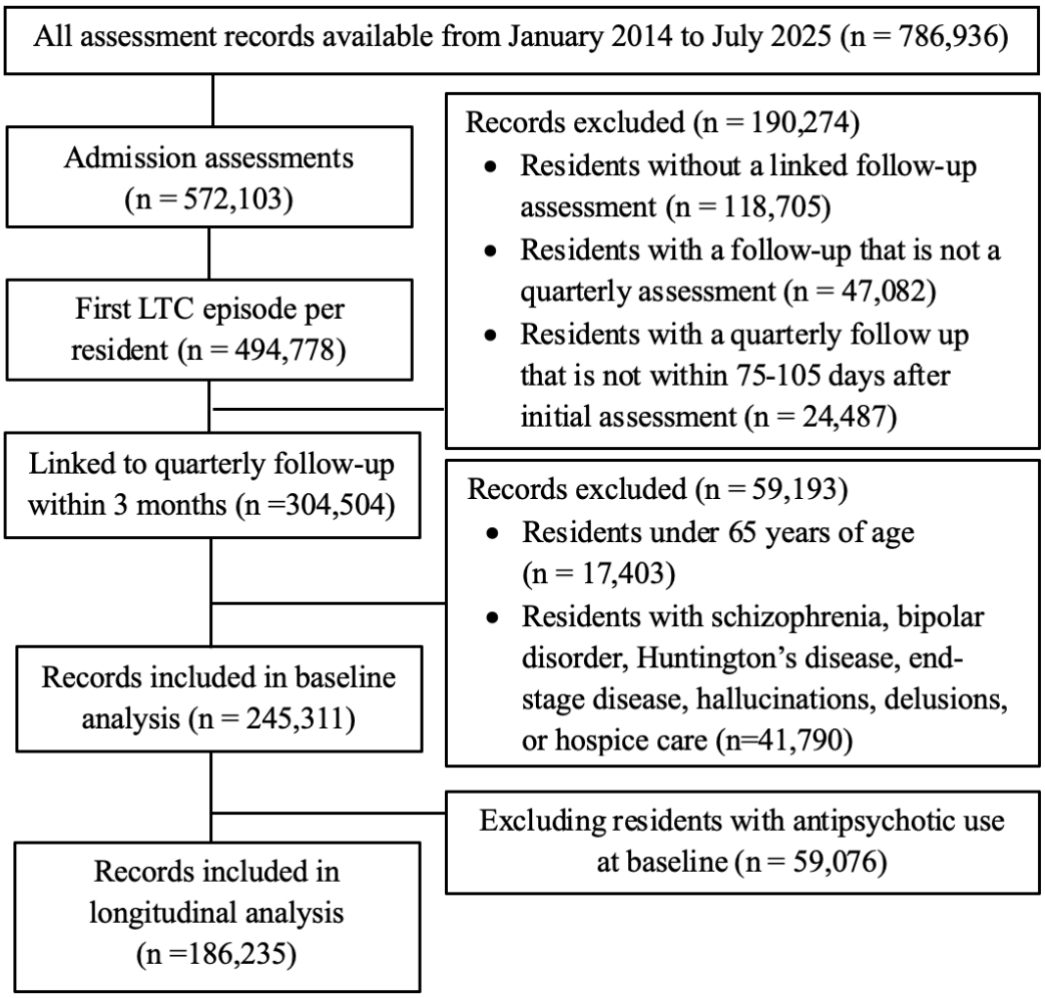
Figure 3 illustrates the flowchart for the study's sample selection. The study population consisted of older adults aged 65 and above residing in Canadian LTC facilities and employed the same inclusion/exclusion criteria as the interRAI quality indicator for potentially inappropriate antipsychotic use (Figure 3).[11] Namely, it excluded residents with schizophrenia, bipolar disorder, Huntington's disease, end-stage disease, hallucinations, or delusions as baseline, and those receiving palliative care at the time of assessment.[105] Residents in LTC from participating provinces were included if they had an RAI-MDS 2.0 assessment from at least two time points, including the initial assessment, completed within 14 days of entry, and a quarterly follow-up assessment conducted three months later. Those with only one data point were excluded from the analysis, due to the study's focus on investigating outcomes at T2 based on independent variables at baseline. To allow for the identification of the initiation of antipsychotics over time, the longitudinal analysis excluded residents with antipsychotic use at T1.

4.2.4 Measures

4.2.4.1 Main outcome

The main outcome for this study was the initiation of antipsychotic use. This was measured by the RAI 2.0 item that records the number of days in the last 7 days that the resident had taken an antipsychotic, with a score of 1 or more indicating antipsychotic use for this study. The details provided in this section of the assessment are supported by information including physician order sheets and drug administration records.[60] For the longitudinal analysis, residents were classified as having initiated antipsychotics if it was not present at T1 and present at T2.

Figure 3. Sample selection flow chart for initiation of antipsychotic use



4.2.4.2 Main exposure

The main exposure variable for this study was sleep disturbance at T1. To determine whether a resident had sleep disturbance, the RAI 2.0 item regarding insomnia or change in usual sleep pattern was used. Residents were considered to have sleep disturbance if they received a score of 1 or higher which includes the options: Present but not exhibited in the last 30 days; Exhibited up to 5 days a week; Exhibited daily or almost daily (6 or 7 days a week). Based on clinical judgement, this item is clinician rated using all sources of information available including resident self-reports, reports by family or staff, and chart information.

4.2.4.3 Covariates

The covariates used in the analyses were selected based on existing literature and expert knowledge.[27,59,60] These variables included age (65-74, 75-84, and 85+), gender (female/male), dementia (both Alzheimer's and non-Alzheimer's dementia), Parkinson's disease, renal disease, heart failure, cancer, asthma, anxiety, and depression. Diagnostic data in these assessments have been validated against hospital records.[78] Other variables included bowel and bladder incontinence (none, moderate, or high), and conflict with staff or family/friends. A number of validated interRAI clinical scales were also used in the analyses, including the Cognitive Performance Scale (CPS), Activities of Daily Living Hierarchy Scale (ADL-H), Changes in Health, End-stage Disease and Signs and Symptoms scale (CHESS), Pain Scale, Depression Rating Scale (DRS), the Aggressive Behaviour Scale (ABS), and the Index of Social Engagement (ISE).[79–84,86,106] Description and scoring of scales are provided in Appendix A.

4.2.5 Statistical analysis

Descriptive statistics were used to describe sample characteristics of individuals in the study, indicated by frequencies and percentages. The proportion of residents with antipsychotic use was calculated at the national level. While the primary analyses included only residents without the clinical indication for appropriate antipsychotic use, rates of overall antipsychotic use were also examined descriptively for the population without these exclusions to provide context for potentially inappropriate use. Bivariate analyses using chi-square tests were conducted to compare the distribution of baseline characteristics between residents with and without antipsychotic use at T1. To understand the associations and the statistical significance between the independent variables and the initiation of antipsychotic use at T2, crude odds ratios (OR), and their respective p-values, were produced.

Logistic regression was used to analyze the association between sleep disturbance at T1 and initiated antipsychotics at T2, adjusting for covariates. The covariates in the multivariate model included independent variables that were deemed significant through bivariate analysis, or variables with a solid theoretical backing to be included in the binary model for initiation of antipsychotic use at T2. Prior to model fitting, independent variables were assessed for pairwise multicollinearity using Pearson's correlation coefficient, with a cut-off of 0.70. Following this, the Variance Inflation Factor (VIF) was calculated to further rule out multicollinearity when considering all independent variables. A best-subset approach was used to select the final model.[87] These associations were expressed as odds ratios with 95% confidence intervals (CIs). All statistical analyses were conducted using SAS 9.4 within the University of Waterloo, with statistical significance defined as $p < 0.05$.

4.2.6 Ethical considerations

Access to the data was obtained through an existing agreement between interRAI and CIHI with ethics clearance provided through the University of Waterloo's Research Ethics Board (ORE #30173).

4.3 Results

4.3.1 Sample characteristics

A total of 245,311 resident admission assessments from 1,389 LTC facilities across Canada met the inclusion criteria for the baseline analyses. Table 4 provides a summary of the demographic and clinical characteristics of the study population stratified by antipsychotic use at baseline. All independent variables included in the analysis were significantly different between the two groups.

The group with antipsychotic use at baseline had a higher proportion of males compared to the non-user group, with most of the sample at baseline comprised of females overall (63.3%). Residents with antipsychotic use were generally younger than non-users, with a higher proportion of residents aged 65-74 and 75-84 in the user group. Compared to non-users, residents with antipsychotic use had higher rates of dementia, depression, anxiety, and antidepressant use, but lower rates of pain (Table 4). Residents had higher rates of sleep disturbance in the user group (18.2%) than in the non-user group (11.0%). Cognitive impairment and aggressive behaviour were also more severe among residents with antipsychotic use at baseline, compared to those without.

Table 4. Demographic and clinical characteristics of residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

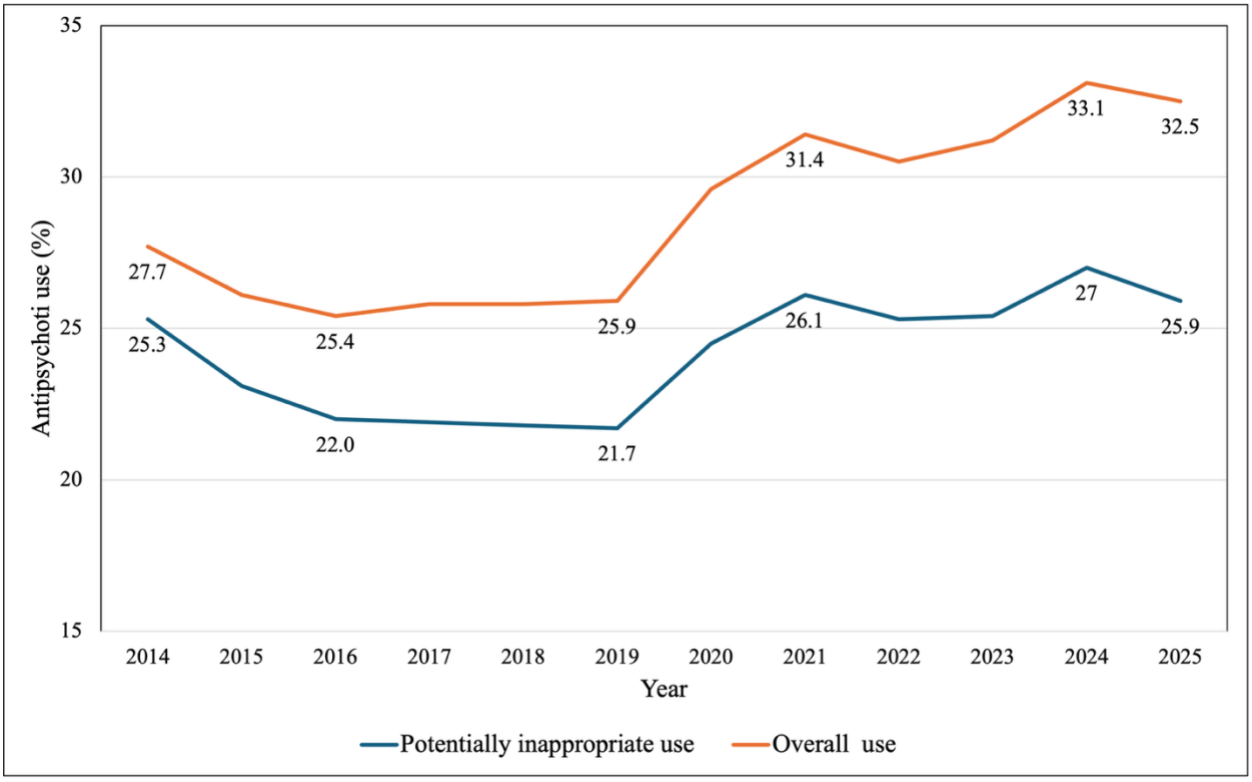
Characteristic % (*n*)	Total Sample	Antipsychotic Use	
		No	Yes
	(*n*=245,311)	(*n*=186,235 [75.9%])	(*n*=59,076 [24.1%])
Gender			
Female	63.3 (155,236)	64.6 (120,202)	59.3 (35,034)
Male/Other	36.7 (89,996)	35.4 (65,974)	40.7 (24,022)
Age			
65-74	11.9 (29,097)	11.0 (20,409)	14.7 (8,688)
75-84	32.5 (79,841)	30.7 (57,186)	38.4 (22,655)
85+	55.6 (136,373)	58.3 (108,640)	46.9 (27,733)
Marital Status			
Never married	4.9 (12,123)	5.0 (9,332)	4.7 (2,791)
Married	26.3 (64,488)	24.5 (45,635)	31.9 (18,853)
Widowed	43.6 (106,900)	45.3(84,356)	38.2 (22,544)
Separated/divorced	8.4 (20,604)	8.1 (15,121)	9.3 (5,483)
Other	16.8 (41,196)	17.1 (31,791)	15.9 (9,405)
Disease Diagnoses			
Dementia	62.0 (52,183)	56.4 (104,992)	79.9 (47,191)
Cancer	10.2 (25,083)	10.6 (19,684)	9.1 (5,399)
Depression	23.0(56,481)	21.7 (40,457)	27.1 (16,024)
Clinical Symptoms			
Sleep disturbance	12.8 (31,299)	11.0 (20,533)	18.2 (10,766)
Anxiety	12.2 (29,877)	10.8 (20,116)	16.5 (9,761)
Functional Scales			
Pain Scale	35.7 (87,478)	36.7 (68,400)	32.3 (19,078)
CHESS Scale			
0	53.7 (131,654)	53.1 (98,796)	55.6 (32,858)
1-2	43.2 (106,086)	43.8 (81,639)	41.4 (24,447)
3+	3.1 (7,571)	3.1 (5,800)	3.0 (1,771)
ADL Hierarchy Scale			
0	3.5 (8,585)	3.6 (6,655)	3.3 (1,930)
1-2	22.4 (54,881)	22.5 (41,860)	22.0 (13,021)
3+	74.1 (181,845)	73.9 (137,720)	74.7 (44,125)
Cognitive Performance Scale			
0	8.8 (21.584)	10.6 (19,690)	3.2 (1,894)
1-2	35.0 (85,780)	38.7 (72,122)	23.1 (13,658)
3+	56.2 (137,947)	50.7 (94,423)	73.7 (43,524)

Depression Rating Scale			
0	55.4 (135,885)	59.1 (110,149)	43.6 (25,736)
1-2	27.6 (67,778)	26.3 (48,915)	31.9 (18,863)
3+	17.0 (41,648)	14.6 (27,171)	24.5 (14,477)
Aggressive Behavioural Scale			
0	65.2 (160,039)	71.0 (132,220)	47.1 (27,819)
1-2	20.2 (51,200)	19.2 (35,909)	25.9 (15,291)
3-4	8.7 (21,244)	6.6 (12,336)	15.1 (8,908)
5+	5.2 (12,828)	3.1 (5,770)	12.0 (7,058)
Medication use			
Antidepressants	46.3 (113,687)	42.4 (79,024)	58.7 (34,663)

4.3.2 Prevalence of antipsychotic use

At admission, 59,076 (24.1%) residents experienced antipsychotic use, and 186,235 (75.9%) did not. Figure 4 shows the pan-Canadian unadjusted rates of baseline antipsychotic use from 2014-2025. The potentially inappropriate use of antipsychotics reflects the rates within the study sample, consistent with the exclusion criteria of clinical indication for use, while the overall use indicates the rates of antipsychotic use for the same population without the exclusion criteria. The overall use ranges from 27.7% in 2014 to 32.5% in 2025. The potentially inappropriate use also increases over time, starting at 25.3% in 2014, with a low of 21.7% in 2019 and a high of 27% in 2024, with a current rate of 25.9% across the country.

Figure 4. Pan-Canadian annual unadjusted rates of antipsychotic use among residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025



4.3.3 Sleep disturbance as a predictor of antipsychotic use

A logistic regression model was used to explore the association between baseline sleep disturbance and the initiation of antipsychotic use among LTC residents in the sample. A total of 186,235 records were included in the longitudinal analysis. Among residents without antipsychotic use at baseline, 9,978 (5.4%) of residents had antipsychotics initiated at follow-up. Both unadjusted (Table 5) and adjusted (Table 6) logistic regression models are reported.

Table 5 shows the crude odds ratios for initiation of antipsychotics at T2. Before adjustment, residents with sleep disturbance at T1 had 2.18 times higher odds of initiating antipsychotics (OR 2.18, 95% CI 2.07-2.29, *P* = <.0001), compared to those without sleep disturbance at T1. There was a 30% decrease in odds of initiating antipsychotics among females compared to males (OR 0.70, 95% CI 0.76-0.83, *P* = <.0001), and residents with a dementia

diagnosis had a 2.54 times increase in the odds of initiating antipsychotics compared to those without dementia (OR 2.54, 95% CI 2.41-2.66, $P = <.0001$) (Table 5). Additionally, residents with the lowest score for social engagement had 3 times higher odds of initiating antipsychotics, compared to the reference group of high social engagement (OR 3.01, 95% CI 2.71-3.35, $P = <.0001$).

Table 5. Unadjusted odds ratios for initiation of antipsychotic use among residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

Variable	Crude OR	95% CI		P
		Lower	Upper	
Sleep disturbance (Ref = Not present)	2.18	2.07	2.29	<.0001
Gender (Ref = male)	0.70	0.76	0.83	<.0001
Age (Ref = 65-74)				
75-84	1.02	0.95	1.08	0.66
85+	0.73	0.69	0.79	<.0001
Dementia (Ref = Not present)	2.54	2.41	2.66	<.0001
Depression (Ref = Not present)	1.17	1.11	1.22	<.0001
Anxiety (Ref = Not present)	1.40	1.32	1.48	<.0001
Shortness of breath (Ref = Not present)	0.59	0.53	0.66	<.0001
Arthritis (Ref = Not present)	0.77	0.74	0.80	<.0001
Asthma (Ref = Not present)	0.84	0.76	0.93	0.001
Cancer (Ref = Not present)	0.91	0.85	0.97	0.006
Parkinson's (Ref = Not present)	0.93	0.85	1.01	0.07
Heart failure (Ref = Not present)	0.67	0.63	0.71	<.0001
Renal failure (Ref = Not present)	0.81	0.76	0.87	<.0001
Bowel incontinence (Ref = None)				
Moderate	1.11	1.06	1.16	0.32
High	1.03	0.97	1.09	<.0001
Bladder incontinence (Ref = None)				
Moderate	0.99	0.94	1.04	0.77
High	0.99	0.94	1.05	0.81
Conflict (Ref = Not present)	2.35	2.18	2.53	<.0001
Pain Scale (Ref = 0)	0.86	0.82	0.89	<.0001
CHESS Scale (Ref = 0)				
1-2	0.94	0.90	0.98	0.003
3+	1.10	0.98	1.23	0.10
Index of Social Engagement (Ref = 6)				
0	3.01	2.71	3.35	<.0001
1	2.09	1.90	2.29	<.0001
2	1.84	1.68	2.02	<.0001
3	1.51	1.37	1.65	<.0001
4	1.23	1.11	1.35	<.0001
5	1.14	1.03	1.28	0.015
ADL Hierarchy Scale (Ref = 0)				
1-2	1.14	1.02	1.29	0.021

3+	0.99	0.89	1.11	0.87
Cognitive Performance Scale (Ref = 0)				
1-2	1.93	1.72	2.15	<.0001
3+	4.36	3.92	4.85	<.0001
Depression Rating Scale (Ref = 0)				
1-2	1.83	1.77	1.88	<.0001
3+	2.54	2.46	2.63	<.0001
Aggressive Behaviour Scale (Ref = 0)				
1-2	2.21	2.10	2.32	<.0001
3-4	4.09	3.85	4.35	<.0001
5+	7.02	6.54	7.54	<.0001
Antidepressant	1.67	1.61	1.74	<.0001

The final multivariate model to identify whether sleep disturbance at T1 is a predictor of antipsychotic initiation was established using a best-subsets approach.[87] Only statistically significant variables were kept in the final model. Table 6 shows the adjusted odds ratios for initiation of antipsychotics. With a c-statistic of 0.73 (95% CI 0.72-0.73), this model showed acceptable discrimination. After adjusting for all covariates in the final model, sleep disturbance was associated with a 32% increase in the odds of initiating antipsychotics compared to no sleep disturbance (OR 1.32, 95% CI 1.23-1.40).

Table 6. Adjusted odds ratios (final model) for initiation of antipsychotic use among Residents (≥ 65 years) in Canadian long-term care (LTC) facilities, 2014-2025

Variable	OR	95% CI		p
		Lower	Upper	
Sleep disturbance (Ref = Not present)	1.32	1.25	1.40	<.0001
Gender (Ref = male)	0.81	0.78	0.85	<.0001
Age (Ref = 65-74)				
75-84	0.93	0.87	0.99	0.03
85+	0.75	0.70	0.81	<.0001
Dementia (Ref = Not present)	1.61	1.53	1.69	<.0001
Depression (Ref = Not present)	0.92	0.87	0.97	0.002
Anxiety (Ref = Not present)	1.25	1.18	1.33	<.0001
Heart failure (Ref = Not present)	0.86	0.80	0.92	<.0001
Arthritis (Ref = Not present)	0.83	0.80	0.87	<.0001
Bowel incontinence (Ref = None)				
Moderate	0.99	0.94	1.04	0.56
High	0.83	0.77	0.88	<.0001
Conflict (Ref=Not present)	1.27	1.17	1.38	<.0001
CHESS Scale (Ref = 0)				
1-2	0.86	0.82	0.89	<.0001
3+	0.80	0.71	0.90	0.0002
Index of Social Engagement (Ref = 6)				
0	1.75	1.56	1.96	<.0001
1	1.45	1.31	1.60	<.0001
2	1.34	1.22	1.48	<.0001
3	1.21	1.10	1.33	<.0001
4	1.08	0.98	1.19	0.117
5	1.06	0.95	1.18	0.307
ADL Hierarchy Scale (Ref = 0)				
1-2	0.89	0.79	0.99	0.044
3+	0.69	0.61	0.77	<.0001
Cognitive Performance Scale (Ref = 0)				
1-2	1.43	1.28	1.60	<.0001
3+	2.16	1.93	2.43	<.0001
Depression Rating Scale (Ref = 0)				
1-2	1.23	1.17	1.88	<.0001
3+	1.49	1.40	1.59	<.0001
Aggressive Behaviour Scale (Ref = 0)				
1-2	1.54	1.456	1.620	<.0001
3-4	2.39	2.231	2.553	<.0001

5+	3.44	3.172	3.737	<.0001
Antidepressant	1.43	1.37	1.50	<.0001

C-statistic for the final model = 0.73

Additional variables with higher odds of antipsychotic initiation in the final model included a dementia diagnosis (OR 1.61, 95% CI 1.53-1.69), anxiety (OR 1.25, 95% CI 1.18-1.33), conflict (OR 1.27, 95% CI 1.17-1.38), and antidepressant use (OR 1.43, 95% CI 1.37-1.50). Compared to residents aged 65-74, those aged 75-84 had lower odds of initiating antipsychotics (OR 0.93, 95% CI 0.87-0.99), with even lower odds among those aged 85+ (OR 0.75, 95% CI 0.70-0.81). Also significantly associated with decreased odds of antipsychotic initiation was female gender (OR 0.81, 95% CI 0.78-0.85), a depression diagnosis (OR 0.92, 95% CI 0.87-1.97), heart failure (OR 0.86, 95% CI 0.80-0.92), arthritis (OR 0.83, 95% CI 0.80-0.87), and high bowel incontinence (OR 0.83, 95% CI 0.77-0.88). Cognitive performance (CPS), depression symptoms (DRS), and aggressive behaviour (ABS) also showed increasing odds of initiating antipsychotics with higher categories. Health instability (CHESS) and ADL-Hierarchy showed decreasing odds of initiating antipsychotics with higher categories. The odds of antipsychotic initiation were 11% lower among residents with an ADL-H score of 1-2 (OR 0.89, 95% CI 0.79-0.99), and 31% lower among residents with an ADL-H score of 3+ (OR 0.69, 95% CI 0.61-0.77), compared to residents with a score of 0 on the ADL-Hierarchy scale.

4.4 Discussion

This study identified a national rate of 24.1% of antipsychotic use for older adults residing in Canadian LTC facilities, confirming that high use of potentially inappropriate antipsychotics continues to be evident across the country. Using comprehensive interRAI assessment data, the results show that baseline sleep disturbance was associated with increased odds of the initiation of antipsychotic use at follow-up (OR 1.32, 95% CI 1.25-1.40) after adjusting for numerous other covariates. By demonstrating the role of sleep disturbance and other key risk factors in the initiation of antipsychotics, this work emphasizes the importance of non-pharmacological treatments for sleep and provides actionable insights for intervention strategies regarding efforts to reduce antipsychotic use.

4.4.1 Rates of antipsychotic use

The total rate of antipsychotic use in this study was 24.1%, which does not include residents with psychiatric conditions that indicate appropriate use. These results were generally consistent with previous research conducted among LTC residents in Canada.[9,59,60] A study using the RAI 2.0 in Ontario discovered an overall estimate of 26.1% of antipsychotic use from admission assessment records, and 7% of new drug users at follow-up, relatively congruent with the current findings of 5.4% of new antipsychotic users.[60] Another Canadian study estimated that 26.8% of residents in LTC had potentially inappropriate use of antipsychotics.[59] With the lowest rates of antipsychotic use in 2019, these results show an increase over the last 6 years in Canadian LTC. This is consistent with results from Turcotte et al., with findings indicating an increase of antipsychotic use during the COVID-19 pandemic.[72] A new national benchmark of 15% for antipsychotic use was introduced by the Appropriate Use Coalition in 2025.[107] Despite a minimal decrease from the peak rate of 27%, this study observed a rate of 25.9% in 2025, remaining well

above the benchmark and emphasizing continued need for coordinated efforts to reduce antipsychotic use.

This increase in antipsychotic use observed during the COVID-19 pandemic could be due to a number of reasons, including changes to the underlying resident population, changes in mental health symptoms, and a reduction in regular care practices and quality improvement protocols.[72,108] Research has shown a decrease in social engagement and the use of non-pharmacological therapies and care programs in Canadian LTC during this time, such as occupational therapy and respite care.[99] Reduced care practices, less social opportunities, and disturbances in routine could all contribute to changes in resident mood and health status. However, these factors are accounted for with the use of the quality indicator for potentially inappropriate antipsychotic use, so these changes may not reflect in the current estimate.

4.4.2 Sleep disturbance as a risk factor for antipsychotic use

Our study demonstrated that sleep disturbance was associated with initiation of antipsychotics for older adults in LTC. While some research in community-based populations found that older adults with sleep disorders in Ontario were being prescribed antipsychotics,[57] there is limited prior evidence for this association in LTC. Considering the extensive literature on antipsychotic use in LTC, there is limited mention of any associations with sleep disturbance, with the majority of studies focusing mainly on the prescribing practices and effectiveness for residents with dementia and the management of BPSD.[93,109] Despite a substantial evidence base of existing studies on the predictors of antipsychotic use in Canadian facilities, these have not investigated sleep disturbance as a risk factor.[59,60,109]

4.4.3 Clinical implications

This research has implications for practice and policy in LTC. Current efforts in Canada to reduce the inappropriate use of antipsychotics primarily focus on staff education, training, and support to implement evidence-informed strategies.[62,109] These interventions utilize methods to improve resident behaviours associated with dementia,[62] aligning with the findings that show that conflict, a dementia diagnosis, and higher cognitive impairment are associated with increased initiation of antipsychotics. The observation that sleep disturbance is associated with antipsychotic use among older adults in LTC could be used to inform further development of interventions to reduce antipsychotic use. These results highlight the role of sleep disturbance in the initiation of antipsychotics, allowing future strategies to focus on sleep disturbance as an important determinant, along with other significant factors. This research could help promote non-pharmacological interventions for sleep and contribute to improved education approaches and prescribing practices.

Many additional significant risk factors were discovered in the current study that have their own clinical implications for LTC. Notably, the association between the use of antidepressants and the initiation of antipsychotics. The high prevalence of antidepressants in LTC is most likely driven by the use of Trazodone, an antidepressant that is predominantly used off-label for insomnia, anxiety, and agitation, despite it not having any indication for use in LTC.[56,110,111] These medications carry similar concerns for older adults living in LTC as antipsychotics, in terms of adverse effects.[112] With recent evidence showing increasing rates of antidepressant use in Canadian LTC facilities,[56] there is concern due to their association with increased use of antipsychotics. It is also important to consider the potential for antidepressants to become a replacement for antipsychotics in these settings.[111,113] Given the widespread focus on the reduction

of antipsychotics, clinicians must remain vigilant in their prescribing practices of psychotropic medications, ensuring that antidepressants do not emerge as a substitution in response to reducing rates of antipsychotics.

4.4.4 Strengths and limitations

This study is not without limitations. First, due to the observational nature of this study, causation cannot be implied and the potential for residual confounding from unmeasured factors remains despite adjustment. Secondly, data regarding medication use is limited for the Canadian RAI 2.0 instrument. Antipsychotic information is captured only by its use in the last 7 days and details about dose and type of the drug are not documented. In addition, the sleep disturbance variable in the RAI 2.0 has been replaced in the newer interRAI LTCF by a more direct measure of specific types of sleep problems. Lastly, the logistic regression model did not account for resident- or facility-level clustering due to challenges with multi-level modelling with large samples sizes and numerous clusters. Future research should further examine structural variables to explore the effects of broader contextual factors on sleep disturbance. In addition, a treatment effects analysis could provide stronger evidence of causality to rule out confounding by indication. That said, none of the study participants had prior antipsychotic use that was detected in the baseline assessment.

This study also has several strengths. This analysis used a large representative sample of comprehensive assessment data across multiple Canadian provinces, enhancing generalizability of the findings at a national level. In addition, it examined a broad range of clinically important covariates to control for potential confounding factors. This study also employed the CIHI-defined quality indicator that excluded residents for whom antipsychotics may be clinically justified,

allowing for the analysis to exclusively focus on the use of potentially inappropriate antipsychotics for older adults in LTC.

4.4.5 Conclusion

This study demonstrated the high pan-Canadian rates of potentially inappropriate antipsychotic use in LTC, while identifying several contributing risk factors for the initiation of antipsychotics, including sleep disturbance. The association between sleep disturbance and antipsychotic use emphasizes the importance of prioritizing non-pharmacological interventions for sleep that target other modifiable risk factors rather than using medication. The need for more appropriate prescribing practices is also evident. Future research should consider the dynamics of individual attributes and broader system-level factors while examining the effects of sleep disturbance on antipsychotic use in LTC, helping to strengthen the evidence base and inform future quality improvement and policy initiatives.

Chapter 5: Discussion

5.1 Summary of findings

This thesis sought to gain further understanding into the current prevalence and implications of sleep disturbance and antipsychotic use among older adults in Canadian LTC using comprehensive interRAI assessment data. Study 1 established a 14.0% pan-Canadian prevalence of sleep disturbance, confirming that sleep disturbance continues to be evident for one in seven LTC residents across the country. Logistic models were used to identify risk factors for new-onset sleep disturbance, including antipsychotic use. The research findings indicate that baseline antipsychotic use was associated with increased odds of new-onset sleep disturbance at follow-up (OR 1.21, 95% CI 1.17-1.24), after adjusting for numerous other covariates. Study 2 found antipsychotic use in 24.1% of residents, emphasizing the persistence of potentially inappropriate antipsychotic use among older adults in Canadian LTC facilities. To identify risk factors for antipsychotic initiation, including sleep disturbance, logistic models were used. Findings show that baseline sleep disturbance was associated with increased odds of the initiation of antipsychotic use at follow-up (OR 1.32, 95% CI 1.25-1.40) after adjusting for other covariates in the model.

This work demonstrates the dynamic relationship of antipsychotics, sleep disturbance, and other key demographic and clinical characteristics for older adults in LTC. Several shared risk factors were identified across both studies, underscoring the critical contribution of cognition, mood, and behaviour in the interplay between sleep disturbance and antipsychotic use. This research emphasizes the importance of non-pharmacological treatments for sleep and provides actionable insights for interventions strategies regarding efforts to reduce antipsychotic use in Canadian LTC facilities.

5.2 Clinical implications

This research has important implications for practice in Canadian LTC. These findings could help provide clinicians with insight and guidance for implementing optimal sleep-based strategies and appropriate prescribing practices. Current non-pharmacological strategies to improve sleep in LTC utilize therapeutic and environmental techniques to address modifiable behavioural, physical, and social factors.[23,36,94,95] A recent review on non-pharmacological approaches for sleep in older adults pointed to interventions that implemented CBT-I, mindfulness, physical exercise, and music and manual therapies as ways of reducing sleep disturbance.[114] Further, a systematic review by Capezuti et al. found that sleep outcomes were improved when strategies focused on increasing daytime activity and exposure to light, as well as reducing nighttime staff disruptions for LTC residents.[75]

While targeting sleep disturbance through non-pharmacological interventions provides a promising path to reducing antipsychotic use, the broader context of resident attributes and care needs should also be considered. Accumulating evidence points to the link between sleep disturbance, cognitive impairment, and BPSD, highlighting their possible interconnected associations with increased antipsychotic use.[12,20,51,77,115] Therefore, the non-pharmacological management of BPSD in LTC facilities should be considered as well. Promising results emerged from a recent study from Quebec, demonstrating that providing education for nurses on sensory strategies and behavioural interventions for BPSD lead to improvements in BPSD and a reduction of antipsychotic use for LTC residents.[116] Additional research from Morris et al. on implementing non-pharmacological interventions for dementia in LTC shows that these strategies can aide in reducing resident agitation, anxiety, and mood disturbances.[117]

Collectively, this research highlights the need for clinicians to focus efforts on non-pharmacological strategies for residents with sleep disturbance and BPSD in LTC facilities. The current findings provide evidence to support that antipsychotics are not associated with improving sleep outcomes. In fact, the off-label use of antipsychotics can potentially worsen sleep disturbance for residents in LTC. Prior research indicates that these drugs are not effective when used for insomnia and related symptoms.[64,93] To improve health outcomes, reduce inappropriate antipsychotic use, and limit unnecessary drug substitutions, non-pharmacological interventions should be prioritized in LTC.

5.3 Policy implications

The findings from this research also have relevance at the policy level. Performance monitoring across facilities and public reporting of health outcomes are certain aspects that help reflect system-level quality of care in LTC.[11] The use of a publicly reported quality indicator (QI) can facilitate these efforts. However, a QI has not yet been developed for sleep disturbance in LTC.

The current findings and previous evidence collectively demonstrate that sleep disturbance is a significant issue across the country, varying within provinces and facilities and warranting attention at the policy level.[46] The current research could support the development of an interRAI risk-adjusted QI for sleep disturbance in LTC with a potential for use as a national benchmark. A QI and national benchmark for sleep disturbance could help to further inform policy development in LTC. By identifying gaps in care practices and guiding resource allocation, these metrics provide justification for funding and implementation of non-pharmacological interventions for sleep in LTC facilities. In addition, given that one in seven LTC residents are affected by sleep disturbance, it is important to allocate resources to support use of non-pharmacological interventions to reduce these rates in all provinces/territories.

The existence of these indicators could work to support the national benchmark of 15% for the potentially inappropriate use of antipsychotics, recently introduced by the Appropriate Use Coalition.[107,118] With current findings indicating that nearly 1 in 4 residents are receiving antipsychotics without proper clinical indication, this research highlights the need for continued efforts to reinforce this pan-Canadian target, in line with recommendations from Choosing Wisely Canada.[107,118]

5.4 Research implications and future directions

This thesis provides important insights into the previously underexplored associations between sleep disturbance and antipsychotic use in LTC; however, considerable opportunities remain for further investigation in this area.

Future research should incorporate mixed-effects or generalized estimating equation (GEE) modeling to account for clustering at the facility- and resident- level, addressing resident-level determinants and broader contextual factors. In addition, treatment effects analysis (TEA) could be used to rule out confounding by indication and provide stronger evidence of causality between sleep disturbance and antipsychotic use. Further, the need for more sleep-based interventions in LTC without the use of antipsychotics is clear. Future studies should consider evaluating the effects of pragmatic trials of non-pharmacological interventions on sleep outcomes in LTC, thus identifying the optimal strategies to reduce sleep disturbance and the use of potentially inappropriate antipsychotics.

Importantly, this work could support the development of a sleep-related interRAI Collaborative Action Plan (CAP). This CAP would be incorporated into interRAI assessments to help guide care planning for individuals with sleep disturbance. This would fill an important gap

by addressing clinical decision making regarding sleep in LTC and contribute to improved resident outcomes, as demonstrated by the use of other interRAI CAPs.[119]

5.5 Strengths and limitations

This thesis has several limitations. First, these studies are observational and cannot indicate causation, only associations, due to the potential for residual confounding from unmeasured factors. Next, data regarding medication use is limited for the Canadian RAI 2.0 instrument. Antipsychotic information is restricted to the class-level, captured only by its use in the last seven days, while details about dose and type of the drug are not documented. Similarly, the RAI 2.0 item for sleep disturbance is a single observational reported measure. This item has not been validated against gold standard measures of sleep health or quality, such as polysomnography or the Pittsburgh Sleep Quality Index (PSQI).[120,121] However, practical limitations also constrain the use of the body-worn sensors associated with polysomnography or actigraphy for sleep patterns for residents in LTC. While not at the level of laboratory based objective measures, the RAI 2.0 sleep item is justified given that it is completed by trained health professionals, has proven reliable and valid[13–16], and is used nationally and internationally.[46,122,123] Given this limitation with the RAI 2.0 assessment, the prevalence of sleep disturbance observed in Study 1 likely represents an under-estimate of the true prevalence, rather than an over-estimate.

The transition to the interRAI LTCF in Canadian LTC facilities will allow for a more granular and precise measure of sleep disturbance. While the RAI 2.0 assesses for insomnia and changes in usual sleep pattern, this assessment has an extended reference period of up to 30 days. The LTCF item for sleep disturbance has measures that are more clearly defined and comprehensive, with a standard 3 day observation period. This item captures the frequency in

which a resident experiences various issues related to sleep, including difficulty falling or staying asleep, waking up too early, and restlessness.

This study also has several strengths. This analysis used a large representative sample of comprehensive assessment data across multiple Canadian provinces, enhancing generalizability of these findings at a pan-Canadian level. Further, it examined a broad range of clinically important covariates to control for potential confounding factors. In addition, Study 2 employed the CIHI-defined quality indicator that excluded residents for whom antipsychotics may be clinically justified, allowing for the analysis to exclusively focus on the use of potentially inappropriate antipsychotics for older adults in LTC.

5.6 Conclusion

This thesis explored the bidirectional longitudinal associations between sleep disturbance and antipsychotic use among older adults in Canadian LTC. By identifying key shared risk factors and establishing high rates of antipsychotics and sleep disturbance, this work illustrates the scope of this challenge and provides meaningful insights for practice, policy, and future research in LTC. This work emphasises the need to prioritize non-pharmacological interventions for sleep and BPSD in order to improve health outcomes and reduce antipsychotic use, ultimately improving quality of care in LTC facilities across the country.

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Appendix A

Table A 1. Description and scoring of interRAI scales

Outcome Scale	Description	RAI-MDS 2.0 Assessment Items	Score Range
Activities of Daily Living Hierarchy Scale (ADL-H)	Measures the resident's level of functional status impairment	• Personal Hygiene (G1jA) • Toilet Use (G1iA) • Locomotion (G1eA) • Eating (G1hA)	**0–6** Higher scores indicate greater decline (progressive loss) in ADL performance.
Aggressive Behaviour Scale (ABS)	Provides a measure of aggressive behaviour	• Verbally Abusive (E4b) • Physically Abusive (E4c) • Socially Inappropriate/Disruptive Behaviour (E4d) • Resists Care (E4e)	**0–12** Higher scores indicate higher levels of aggressive behaviour.
Cognitive Performance Scale (CPS)	Describes the cognitive status of the resident	• Comatose (B1) • Short-Term Memory (B2a) • Cognition Skills for Daily Decision-Making (B4) • Expressive Communication (C4) • Eating (G1hA)	**0–6** Higher scores indicate more severe cognitive impairment.
Changes in Health, End-Stage Disease and Signs and Symptoms (CHESS)	Detects frailty and health instability and can identify residents at risk of serious decline	• Decline in Cognition (B6) • Decline in ADL (G9) • Dehydration (J1c) • Edema (J1g) • Shortness of Breath (J1l) • Vomiting (J1o) • End-Stage Disease (J5c) • Weight Loss (K3a) • Leaving Food Uneaten (K4c)	**0–5** Higher scores indicate higher levels of medical complexity and are associated with adverse outcomes, such as mortality, hospitalization, pain, caregiver stress and poor self-rated health
Depression Rating Scale (DRS)	Detects presence and severity of depressive symptoms	• Negative Statements (E1a) • Persistent Anger (E1d) • Expression of Unrealistic Fears (E1f) • Repetitive Health Complaints (E1h) • Repetitive Anxious Complaints (E1i) • Sad, Pained, Worried Facial Expression (E1l) • Crying, Tearfulness (E1m)	**0–14** A score of 3 or more may indicate a potential or actual problem with depression.

Pain Scale	Measures the frequency and intensity of pain	• Frequency of Pain (J2a) • Intensity of Pain (J2b)	**0–3** Higher scores indicate a more severe pain experience.
Index of Social Engagement (ISE)	Measures a resident's initiative and social involvement, with higher scores indicating greater social interaction and involvement	• At Ease Interacting With Others (F1a) • At Ease Doing Planned or Structured Activities (F1b) • At Ease Doing Self-Initiated Activities (F1c) • Establishes Own Goals (F1d) • Pursues Involvement in the Life of the Facility (F1e) • Accepts Invitations Into Most Group Activities (F1f)	**0–6** Higher scores indicate a higher level of social engagement.