Older Stroke Survivors in Home Care: Factors Associated with the use of CCAC Rehabilitation Services

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

Purpose: Despite improvements in the prevention and management of stroke, it continues to have a significant impact on the Canadian population. For individuals who have suffered a stroke, rehabilitation is an important part of post stroke care that can maximize quality of life by reducing the impact of stroke-related impairments and disability. The purpose of this thesis was to describe the profile of older adults with stroke receiving home care services and to examine relationship between characteristics of these individuals and their use of home care rehabilitation services (PT and OT). Information from interRAI home care assessments (RAI-HC and interRAI CA) was used and the Andersen Newman Behavioural model was employed as a conceptual framework.

Methods: Two retrospective cohort studies of older stroke survivors receiving services from the Hamilton Niagara Haldimand Brant Community Care Access Centre were conducted. Individuals with acute stroke were identified from hospital discharge records (Discharge Abstract Database) that were linked to interRAI assessments (RAI-HC N=1,181 and interRAI CA N=573), and CCAC service utilization data to identify the use of PT and OT services. Both samples were compared with a non-stroke population in order to describe the characteristics of those with stroke. Logistic regression was used to examine associations between independent variables and the use of services for PT and OT and ordinal logistic regression was used to assess relationships between characteristics and the number of PT/OT visits (0, 1-4, 5+) in both samples.

Results: Comparison with the general older population revealed that older stroke survivors had greater difficulty with communication, swallowing, IADLs, ADLs, and a greater prevalence of cognitive impairment. Following RAI-HC assessment those with unsteady gait and difficulty with stairs were more likely to receive PT and OT services. Impairment in ADLs and triggering the Home Environment Optimization CAP were significantly associated with receiving OT. Being married and receiving a greater amount of informal care increased the odds of receiving PT services, while cognitive impairment and having Alzheimer's disease or dementia decreased the odds of receiving PT. Significant variation by CCAC branch was also found. Male sex, language other than English, location of intake, cognitive decline, and unstable health were significantly associated with the use of OT services among those assessed with the interRAI CA. Referral for rehabilitation, cognitive decline, co-residing caregiver, and difficulty with locomotion were significantly associated with the use of PT services after assessment with the interRAI CA. Comparison of predisposing, enabling, and

need factors revealed that need factors were the primary determinant of service use in this population, although enabling factors also played an important role.

Conclusions: Older stroke survivors receiving home care services are a complex population with a high need for rehabilitation services. A better understanding of the characteristics of older stroke survivors and their use of home care services can help to inform the provision of services to this population to facilitate community reintegration and enhance quality of life.

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Dedication

This thesis is dedicated to the memory of my grandfather, Joseph Bucek.

Table of Contents

AUTHOR'S DECLARATION ..... **ii**
Abstract ..... **iii**
Acknowledgements ..... **v**
Dedication ..... **vi**
List of Figures ..... **xi**
List of Tables ..... **xii**
Chapter 1 Introduction **1**
Chapter 2 Background **4**
2.1 Stroke 4
2.2 Transient Ischemic Attack 5
2.3 Epidemiology 5
2.4 Effects of Stroke 8
2.5 Aging and Stroke 10
2.6 Recovery 12
2.7 Rehabilitation 14
2.7.1 Effectiveness of Post-Stroke Rehabilitation 15
2.8 Organization of Post-Stroke Health Care Services in Ontario 16
2.8.1 Ontario Stroke System 16
2.8.2 Post-Stroke Rehabilitation 17
2.9 Home Care 18
2.9.1 Rehabilitation in Home Care 19
2.10 Conceptual Framework 20
2.11 interRAI 23
Chapter 3 Literature Review: **25**
3.1 Purpose 25
3.2 Methodological Issues 25
3.3 Findings 28
3.4 Strengths and Limitations 31
3.4.1 Internal Validity 31
3.4.2 External Validity 34
3.5 Conclusion 34

Chapter 4 Rationale **36**
4.1 Research Questions 37
4.2 Relevance of Research 37
Chapter 5 Methods **39**
5.1 Ethics Approval 39
5.2 Study Design and Setting 39
5.3 Comparison of HNHB with Other Regions 39
5.3.1 Comparison of HNHB CCAC with Other CCACs 39
5.3.2 Comparison of HNHB with the Ontario and Canadian Populations 42
5.4 Data Sources 45
5.4.1 Discharge Abstract Database (DAD) 45
5.4.2 Resident Assessment Instrument Home Care (RAI-HC) 45
5.4.3 interRAI Contact Assessment (CA) 49
5.4.4 Client Health Related Information System (CHRIS) 50
5.5 Case Definition of Stroke 50
5.6 Study Samples 51
5.6.1 RAI-HC Sample 51
5.6.2 interRAI CA Sample 53
5.7 Comparison Groups 57
5.8 Study Variables 57
5.8.1 Independent Variables 57
5.8.2 Dependent Variables 62
5.9 Missing Values 63
5.10 Statistical Analysis 64
5.11 Model Diagnostics 65
Chapter 6 Results **67**
6.1 Sample Description 67
6.1.1 RAI-HC Sample Description 67
6.1.2 interRAI CA Sample Description 67
6.2 Profile of Older Stroke Survivors 68
6.2.1 RAI-HC Stroke Profile 68
6.2.2 interRAI CA Stroke Profile 69

6.3 Bivariate Analysis 70
6.3.1 RAI-HC Bivariate Analysis 70
6.3.2 interRAI CA Bivariate Analysis 74
6.4 Binary Logistic Regression Results 76
6.4.1 RAI-HC Logistic Regression 76
6.4.2 interRAI CA Logistic Regression 78
6.4.3 Stratified interRAI CA Logistic Regression Models by Referral for Rehabilitation 81
6.5 Ordinal Logistic Regression 84
6.5.1 RAI-HC Ordinal Logistic Regression for PT/OT Visits 84
6.5.2 interRAI CA Ordinal Logistic Regression for PT/OT Visits 85
6.5.3 Stratified interRAI CA Ordinal Logistic Regression for the Number of PT/OT Visits 85
6.6 Summary Tables 86
Chapter 7 Discussion 114
7.1 Profile of Older Stroke Survivors 114
7.2 Use of Rehabilitation Services 118
7.2.1 Predisposing Variables 118
7.2.2 Enabling Variables 119
7.2.3 Need Variables 123
7.3 Models Stratified by Referral for Rehabilitation 127
7.4 Relative Contribution of Predisposing, Enabling, and Need Variables 128
7.5 Strengths of the Study 129
7.6 Limitations of the Study 131
7.7 Implications of the Findings 131
7.8 Future Directions 133
7.9 Conclusion 134
Appendix A Literature Review Search Strategy 136
Appendix B Summary of Articles Included in the Literature Review 137
Appendix C Ethics Clearance 142
Appendix D Map of Ontario LHIN Boundaries 143
Appendix E Case Definition of Stroke 144
Appendix F Parameter Estimates and Standard Errors from Multivariate Models 145
Appendix G Interactions from Contact Assessment Models 152

References 155

List of Figures

Figure 1 Main components of the Andersen-Newman Behavioural Model of Health Services Utilization 21
Figure 2 Individual Determinants of Health Service Utilization 22
Figure 3 Overview of RAI-HC Sample Creation 52
Figure 4 Overview of Contact Assessment Sample Creation 55
Figure 5 Interaction between Cognitive Decline and Unstable Health 79
Figure 6 Interaction between Co-residing Caregiver and Dependent in Locomotion 81
Figure 7 Interaction between Co-residing Caregiver and Dependent in Locomotion Among Those Referred for Rehabilitation 83

List of Tables

Table 1 Proportion of Individuals[1] age 65+, with a Stroke Diagnosis on First RAI-HC Assessment, Receiving Physiotherapy and Occupational Therapy Services within 91 days of Assessment, by CCAC/LHIN, 2008-2013 (N=39,900) 41
Table 2 Statistics Canada: Population Comparison 43
Table 3 RAI-HC Sample Description (N=1,181) 87
Table 4 InterRAI CA Sample Description (N=573) 88
Table 5 Comparison of RAI-HC Study Sample with an Older Non-Stroke Population Assessed with the RAI-HC 89
Table 6 Comparison of interRAI CA Study Sample with an Older Non-Stroke Population assessed with the InterRAI CA 91
Table 7 RAI-HC OT and PT Bivariate Comparisons 93
Table 8 RAI-HC PT/OT Bivariate Comparison 96
Table 9 interRAI CA OT and PT Bivariate Comparison 99
Table 10 Number of PT/OT Visits after interRAI CA Assessment 101
Table 11. Predisposing, Enabling and Need Models for use of OT after RAI-HC Assessment 103
Table 12. Predisposing, Enabling, and Need Models for use of PT after RAI-HC Assessment 104
Table 13 Predisposing, Enabling and Need Models for use of OT after interRAI CA Assessment 105
Table 14. Enabling and Need Models for use of PT after interRAI CA Assessment 106
Table 15 Models Stratified by Referral for Rehabilitation, use of OT after interRAI CA Assessment 107
Table 16 Models Stratified by Referral for Rehabilitation, use of PT after interRAI CA Assessment 108
Table 17 Predisposing, Enabling and Need Model amount of PT/OT after RAI-HC 109
Table 18 Models Stratified by Referral for Rehabilitation, use of PT/OT after interRAI CA Assessment 110
Table 19 Summary RAI-HC Models 111
Table 20 Summary interRAI CA Models 113

Chapter 1
Introduction

A stroke is an acute event of vascular origin, which causes damage to the brain as a result of either the interruption of the blood supply to the brain or the rupture of blood vessels in the brain (Hwang, Glass, & Molter, 1998). Stroke is a life-altering event, with profound consequences for individuals, their families, the health care system, and society as a whole (Teasell, Hussein, McClure, & Meyer, 2014). Many stroke survivors are left with substantial physical, cognitive, communication and psychological difficulties, which can negatively affect quality of life. As a leading cause of mortality and adult neurologic disability, stroke has a significant impact on Canadians (Canadian Institute for Health Information, 2007; Statistics Canada, 2014b). An estimated 319,000 individuals in Canada are currently living with the effects of stroke (Statistics Canada, 2012a). Changes in risk factors, such as increased prevalence of diabetes and obesity, and the aging of the population, are expected to result in a greater number of individuals suffering a stroke in the coming years (Public Health Agency of Canada, 2009). Mortality after stroke is also decreasing, meaning a greater number of Canadians will be living with stroke-related disability. Additionally, a policy shift towards providing a greater amount of care in community settings as opposed to acute care implies that the demand on community service providers, such as home care agencies for stroke rehabilitation services, will continue to increase.

For stroke survivors, rehabilitation plays an important role in enhancing quality of life, reducing the effects of stroke, and facilitating community reintegration (Markle-Reid et al., 2011). Although rehabilitation is provided in hospital settings in Canada, many stroke survivors returning home from hospital will still require some outpatient services to live independently in the community (Canadian Stroke Network, 2011). The relative effectiveness of rehabilitation provided in hospital as compared to community settings has been compared in previous literature, with a reviews reporting

that rehabilitation provided in the home is equally as effective as rehabilitation provided in hospital settings in terms of function, cognition, quality of life, and satisfaction (Stolee, Lim, Wilson, & Glenny, 2012) and was preferred by patients and caregivers (Barnes & Radermacher, 2001). For stroke specifically, previous research suggests that a select group of stroke patients (with mild to moderate strokes) may benefit from early hospital discharge when it is combined with enhanced services in the home (Fearon & Langhorne, 2012). Others reviews of studies examining the effectiveness of single or multi-discipline rehabilitation interventions in community settings after stroke have reported benefits for ADLs and leisure activities, and reductions in functional decline (Legg et al., 2004; Walker et al., 2004). Despite the potential benefits of rehabilitation services provided in the home after stroke, home care agencies often struggle to provide a level of service consistent with guideline recommendations (Hall et al., 2013). Similarly, some have argued that the funding of stroke care in Ontario has focused too heavily on acute care, and have suggested a shift towards a more balanced approach that better supports the long-term needs of stroke survivors through a greater focus on rehabilitation and recovery (Teasell et al., 2014).

Due to the anticipated increase in the burden of stroke and changing patterns of care resulting in more care being provided in the home, it is important to understand the needs of stroke survivors and their use of health care services in order to better plan for the future. Although several studies have examined the use of services after stroke, their generalizability to Canadian home care settings is somewhat limited. Most were conducted in the United States and examined a broader range of services, with few focusing on home care or rehabilitation specifically. Another key limitation is the lack of direct measures of stroke-related impairment in many of the studies reviewed. As a result of the limitations identified in the existing literature and the potential for rehabilitation services to improve the health and well being of stroke survivors, there is a need to better understand factors associated with the use of rehabilitation services among this population. By using administrative

hospital discharge data linked to interRAI home care assessments to identify older adults receiving home care services from the Hamilton Niagara Haldimand Brant CCAC following stroke, the objective of this thesis was to examine the profile of these individuals and to identify factors associated with their use of home care rehabilitation services. The Andersen Newman Behavioural model was used as a conceptual framework to identify predictors or service utilization and guide the analysis.

Chapter 2
Background

2.1 Stroke

Stroke is defined by the World Health Organization as “rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin” (Aho et al., 1980, p.114). Ischemic strokes represent approximately 80% of all strokes and occur when blood flow to the brain is interrupted as a result of a blood clot (Heart and Stroke Foundation, 2014). Ischemic stroke can be further subdivided into lacunar infarction (small artery disease), large artery disease and cardioembolic stroke, based on the area where the stroke occurs (de Freitas, Bezerra, Maulaz, & Bogousslavsky, 2005). Atherosclerosis, which leads to thromboembolism (a blood clot that travels to another part of the body) or local occlusion, and cardioembolism (a blood clot that originates in the heart) are the major causes of ischemic stroke (van der Worp, H Bart & van Gijn, 2007). Hemorrhagic strokes represent the remaining 20% of stroke cases and are caused by uncontrolled bleeding in the brain (Heart and Stroke Foundation, 2014). Intracerebral hemorrhage (ICH) is the most common type, accounting for 10-15% of cases of stroke and occurs when a blood vessel in the brain ruptures, causing bleeding directly into the brain tissue. Structural damage to blood vessels from chronic hypertension and amyloid angiopathy are responsible for the majority of strokes due to ICH, with vascular abnormalities (such as arteriovenous malformations, aneurysms, tumours or impaired coagulation) contributing to the remaining cases (Qureshi et al., 2001). Subarachnoid hemorrhage (SAH) is a rarer type of hemorrhagic stroke (about 5% of all stroke cases) that results from bleeding in the subarachnoid space (an area between the brain and the skull), which is typically caused by the rupture of an aneurysm (Donnan, Fisher, Macleod, & Davis, 2008).

2.2 Transient Ischemic Attack

Transient ischemic attack (TIA) is a condition that occurs on the same disease spectrum as ischemic stroke, but differs with respect to the duration of symptoms and the degree to which they resolve (Albers et al., 2002). TIA is defined as "a neurologic deficit lasting less than 24 hours that is attributed to focal cerebral or retinal ischemia" (Johnston, 2002, p.1987). This definition is based on the assumption that rapid resolution of neurological symptoms caused by focal brain ischemia does not result in any permanent brain injury (Johnston, 2002). However, the 24-hour criterion that is used to distinguish between ischemic events of a transient nature (TIA) and those of a longer duration (ischemic stroke) is an arbitrary one (Donnan et al., 2008). Some have called for a revision to the definition of TIA to include the absence of infarction (Albers et al., 2002) based on findings from studies that have found evidence of infarction indicative of ischemic stroke among those previously thought to have suffered a TIA (Kidwell et al., 1999; Rovira et al., 2002). Regardless of definition, having a TIA increases the risk for experiencing a subsequent stroke (Furie et al., 2011). The risk of stroke ranges from 3-17% for the period 2-90 days after the TIA, respectively (Giles & Rothwell, 2007; Wu et al., 2007), with 23% of ischemic stroke patients being found to have had a history of TIA (Rothwell & Warlow, 2005).

2.3 Epidemiology

Information on the epidemiology of stroke, including prevalence, incidence, mortality and cost can provide insight into the current and projected future burden of stroke in the Canadian population. According to the Canadian Community Health Survey, there are an estimated 319,354 individuals living with the effects of stroke in Canada, representing 1% of the total population (Statistics Canada, 2012b). Estimates of the incidence of stroke and TIA in Canada come from hospital records, an approach that tends to substantially underestimate the true incidence rate due to the exclusion of individuals treated only in emergency departments (e.g., those with minor stroke or

TIA) and those who died before reaching hospital (Public Health Agency of Canada, 2009). In 2005/06 the age-standardized hospitalization rate for acute stroke was 94.9/100,000 population and the rate for TIA was 22.6/100,000 population. This rate has declined steadily since 1970 in Canada, a trend that may be due to changing patterns of stroke care and/or improved prevention and management of stroke risk factors resulting in fewer strokes (Public Health Agency of Canada, 2009). Other Canadian studies have attempted to determine the incidence of first-ever stroke in Canada using hospital records, and have reported age-standardized incidence rates between 13.2 and 14.4/10,000 population (Johansen, Wielgosz, Nguyen, & Fry, 2006; Yiannakoulias et al., 2004).

For those who suffer a stroke, approximately 30% will die within a year (Warlow, Sudlow, Dennis, Wardlaw, & Sandercock, 2003). The case fatality for stroke varies according to the type of stroke, with a 30-day case fatality rate of 42% for ICH, 32% for SAH and 16% for ischemic stroke (Feigin, Lawes, Bennett, & Anderson, 2003). Early death is typically related to the stroke itself, while death in the weeks following a stroke tends to result from medical complications (e.g., pulmonary embolism, infections) (Warlow et al., 2003). After the first year, non-stroke cardiovascular disease is responsible for the majority of deaths among survivors (Dennis et al., 1993; Hankey et al., 2000). Among survivors, recurrence is another important concern. Approximately 1 in 6 individuals who survive will have a second stroke within 5 years (Hankey et al., 1998).

Mortality is another indicator that provides important information about the impact of stroke. As the third leading cause of death in Canada, cerebrovascular disease (including stroke) is responsible for 6% of deaths annually (Statistics Canada, 2014b). Declines in mortality rates for stroke over the past several decades have been observed (Public Health Agency of Canada, 2009); however, understanding the underlying causes of trends in stroke mortality requires a consideration of changes in both incidence and case fatality (de Freitas et al., 2005; World Health Organization, 2006). Potential reasons for changes in case fatality include improvements in acute stroke care (e.g.,

management of medical complications), declines in stroke severity, and changes in diagnostic technology allowing for the identification of more individuals with milder strokes (de Freitas et al., 2005). Improvements in population-level risk factor control, such as management of blood pressure are potential contributors to declines in stroke incidence (Lackland et al., 2014). Findings from studies examining changes in stroke mortality over time suggest that the majority of the decline in stroke mortality can be attributed to changes in case fatality, rather than incidence (Sarti et al., 2003; Vaartjes, O'flaherty, Capewell, Kappelle, & Bots, 2013). As a result of decreasing case facility a greater number of individuals are living with the effects of stroke. Although age-adjusted mortality and hospitalization rates for stroke have been declining over the past several decades, increases in the prevalence of underlying stroke risk factors (such as diabetes and obesity) are expected to result in increases in stroke incidence in future decades. This, in conjunction with the aging of the population is expected to result in an increased total number of individuals suffering a stroke in the future (Public Health Agency of Canada, 2009).

As a leading cause of mortality and long-term disability, stroke also has a high economic cost (de Freitas et al., 2005; World Health Organization, 2006). A report by the Canadian Institute for Health Information estimated the total cost for stroke based on direct (hospital, physician, and drugs) and indirect (mortality and morbidity) costs to be $2.8 billion (Canadian Institute for Health Information, 2007). A more recent study involving prospective measurement of resource utilization after stroke and including a more comprehensive measurement of costs yielded an estimate of $2.8 billion for ischemic stroke alone (Mittmann et al., 2012). Overall, consideration of the incidence, prevalence, mortality and cost of stroke provides an understanding of the impact of stroke on the Canadian population.

2.4 Effects of Stroke

The effects of stroke vary between individuals according to the area of the brain affected and the extent of the damage (Langhorne, Bernhardt, & Kwakkel, 2011). Stroke can affect individuals in many areas, including physical functioning, cognition, communication, and psychological functioning (Mukherjee, Levin, & Heller, 2006; Walker, Sunnerhagen, & Fisher, 2013).

Motor impairment is the most widely recognized consequence of stroke, and it includes loss of muscle control or movement or limitations in mobility (Langhorne, Coupar, & Pollock, 2009). Motor impairments typically affect the control of movement of the face, arm, and leg on one side of the body with hemiplegia (paralysis on one side of the body) and hemiparesis (weakness on one side of the body) both common among stroke patients (Ropper & Samuels, 2009; Teasell & Hussein, 2013). Post-stroke motor issues may affect the ability of stroke survivors to carry out activities in daily living as a result of difficulties with gait, balance, postural control, and neuromuscular coordination of upper and lower extremities (Miller et al., 2010). Bowel and bladder incontinence affects an estimated 25-50% of stroke survivors (Miller et al., 2010). Incontinence may be related to the location of the brain lesion, or may occur as a result of difficulties with mobility or communication (Brittain, Peet, & Castleden, 1998; Teasell & Hussein, 2013). Dysphagia, a motor issue that affects swallowing, occurs amongst 37-78% of stroke patients (Martino et al., 2005), and has been has been associated with an increased risk of pneumonia and malnutrition after stroke (Foley, Martin, Salter, & Teasell, 2009; Martino et al., 2005).

In addition to physical function, cognitive abilities are also commonly affected by stroke. The effects of stroke on cognitive function are more pronounced in terms of deficits of attention or executive function, rather than memory or orientation. In terms of attention, unilateral spatial neglect is a visual spatial perceptual disorder that can affect individuals after stroke. It is defined as a failure to report, respond or orient to stimuli on one side of the body, typically the side opposite to the stroke

(Teasell & Hussein, 2013). Individuals with neglect may also exhibit anosognosia, an issue that results in a lack of awareness or knowledge of one's deficits (Miller et al., 2010; Teasell & Hussein, 2013). Although memory deficits are less common than impairments in other cognitive domains, they do still occur (Cumming et al., 2013). Subcortical infarcts have been associated with deficits in episodic, semantic, and working memory (Schneider, Boyle, Arvanitakis, Bienias, & Bennett, 2007).

Difficulties with communication following stroke may result from impaired motor skills, difficulties with language, or impaired cognitive processes (Miller et al., 2010). Dysarthria, a motor disorder affecting the muscles required for the articulation of speech, is one condition affecting communication ability (Ropper & Samuels, 2009). Apraxia of speech is an impairment of the planning of movements required to produce speech sounds resulting in difficulties with articulation and prosody of speech (Jordan & Hillis, 2006). In contrast, aphasia is a set of cognitive disorders that impairs the production and comprehension of written or spoken language (Ropper & Samuels, 2009). In a study of stroke patients in Ontario, 35% exhibited symptoms of aphasia (Dickey et al., 2010). In addition to these conditions, underlying attention and executive function deficits may also affect social aspects of communication (Miller et al., 2010).

Following stroke, individuals may also experience psychological and social issues including depression, anxiety, and social isolation. Depression after stroke is common, affecting 31% of survivors (Hackett & Pickles, 2014). The elevated risk of depression has been attributed to both the location of the brain lesion and the loss of psychological and physical abilities that accompany stroke (Mukherjee et al., 2006). Anxiety, characterized by worry or apprehension that is typically future-oriented, such as fear of having another stroke, can occur, negatively affecting individuals (Mukherjee et al., 2006). Stroke survivors may also suffer from emotional lability, an inability to control emotional expression, which can lead to involuntary outbursts of laughing or crying inappropriate to the situation (Ropper & Samuels, 2009). Assessment of psychological issues after

stroke can be further complicated by difficulties in expressive capabilities, for example, as a result of facial paralysis or speech impairments (Mukherjee et al., 2006). Social isolation is another important issue affecting individuals after stroke, which can result from changes in social roles, communication difficulties, or the impact of cognitive and emotional issues on interpersonal relationships (Mukherjee et al., 2006).

Overall, the extent to which stroke-related impairments and the resulting disabilities affect the well-being of stroke survivors is partly dependent on contextual factors, including those that are internal (e.g., comorbidities, coping style) and external (e.g., family support, healthcare resources) to the individual (Clarke, 2003; Langhorne et al., 2011; Miller et al., 2010).

2.5 Aging and Stroke

As a group, older adults (65+) have a heightened risk of stroke, greater pre-stroke disability, more severe strokes, and a greater likelihood of experiencing poor outcomes after stroke as compared to younger individuals. Age is considered to be the most important non-modifiable risk factor for stroke (Sacco et al., 1997), with more than half of all strokes occurring in those over 75 years of age (Feigin et al., 2003). The higher risk of stroke with advancing age is due, in part, to accumulated vascular risk factors (Heitsch & Panagos, 2013). Age-associated cardiovascular changes, such as increased large artery thickening, increased arterial stiffness, and endothelial dysfunction, can contribute to the increased the risk of stroke through the development of hypertension and atherosclerosis (Lakatta & Levy, 2003a; Lakatta & Levy, 2003b). However, the extent to which age-associated changes in the cardiovascular system, such as increased pulse pressure, result in clinically manifest disease, such as hypertension, is affected by interaction of these changes with genetic and lifestyle factors (Lakatta & Levy, 2003b).

Several studies examining age-related differences in acute stroke presentation have reported greater pre-stroke disability and more severe strokes among older patients (Denti et al., 2010; Di

Carlo et al., 1999; Kammersgaard et al., 2004). Older stroke patients also had a higher prevalence of cardiac comorbidities such as hypertension, atrial fibrillation, and coronary heart disease (Denti et al., 2010; Fonarow et al., 2010), and higher rates of pre-stroke dementia (Saposnik et al., 2011). Greater stroke severity among older stroke populations has also been reported in several studies (Denti et al., 2010; Fonarow et al., 2010; Kammersgaard et al., 2004), with many finding that neurological deficits, including dysphagia, aphasia, paralysis, weakness, and neglect were more prevalent among older patients (Di Carlo et al., 1999; Saposnik et al., 2009). Changes in the nervous system's capacity to handle pathological insults with increasing age, such as decreased cerebral blood flow, and diminished metabolic reserve can increase the vulnerability of the aged brain to stroke (Choi, Morris, & Hsu, 1998; Popa-Wagner, Buga, Turner, Rosen, & Toescu, 2012) and may be a contributing factor to the increased severity observed among older patients. Atrial fibrillation, which is more common among older adults, is also associated with greater stroke severity (Lin et al., 1996; Steger et al., 2004) and may be another possible explanation for the greater stroke severity seen in older populations.

Associations between age and health outcomes are complex and likely due to interactions between multiple factors including sociodemographic attributes, preexisting frailty and stroke severity (Di Carlo et al., 1999). Advanced age has been associated with increased mortality after stroke, longer length of stay in hospital, higher levels of post-stroke disability, and greater likelihood of institutionalization after adjusting for relevant confounders (Di Carlo et al., 1999; Fonarow et al., 2010; Kammersgaard et al., 2004; Saposnik et al., 2008; Saposnik et al., 2009; Saposnik, Black, & Stroke Outcome Research Canada (SORCan) Working Group, 2009). Pneumonia and dementia, are potential moderators of the relationship between age and outcome after stroke, and are of interest because they are more common among older stroke patients. A study by Saposnik and colleagues (2011) found that the presence of pre-stroke dementia was an independent predictor of disability and

institutionalization after stroke. Another study found that the development of pneumonia after stroke was associated with age, and was an independent predictor of mortality, length of stay and dependency after stroke (Finlayson et al., 2011). Thus, studies that do not control for the effect of potential confounders that may affect the relationship between age and stroke outcome, may overestimate the effect of age.

2.6 Recovery

Recovery from stroke can be understood by examining by mechanisms that underlie it and the trajectory of recovery. A combination of spontaneous and learning-dependent processes, including restitution, substitution and compensation, are responsible for stroke recovery (Langhorne et al., 2011). Restitution involves the restoration of function to neural tissue damaged as a result of stroke (Langhorne et al., 2011). Resolution of edema in the brain, restoration of blood flow to the ischemic penumbra (the region of reduced blood flow surrounding the damaged tissue), and resolution of diaschisis (loss of function in an area connected to damaged tissue) are processes by which function may spontaneously improve early after stroke (Kwakkel, Kollen, & Lindeman, 2004; Teasell & Hussein, 2013). In contrast, substitution involves the reorganization of neural pathways partly affected by the stroke to relearn previously lost functions, and can occur long after processes involved in restitution have ended (Langhorne et al., 2011; Teasell & Hussein, 2013). Anatomic and functional reorganization of the central nervous system, including synaptic sprouting, functional enforcement in existing neural circuits and the development of new connections between synapses may play an important role in restoring function after stroke (Kwakkel, Kollen, & Lindeman, 2004). Changes that occur during neurological reorganization in stroke recovery are similar to those that occur in regular motor learning, and as a result are thought to be amenable to rehabilitation training (Teasell & Hussein, 2013). Compensation is another key process in the recovery of function after stroke. It refers to behaviors that individuals use to compensate for stroke-related deficits, which serve to improve the

disparity between impairments and demands of the environment (Kwakkel et al., 2004; Langhorne et al., 2011).

Both the trajectory and extent of recovery from stroke are highly variable across individuals, partly as a result of differences in stroke severity (Dobkin, 2005; Teasell & Hussein, 2013). The majority of stroke patients will experience some degree of recovery within the first six months after stroke, with the most rapid rate of recovery occurring during the first 3 months (Kwakkel et al., 2004; Teasell & Hussein, 2013). Additional functional recovery, defined as the ability to carry out activities despite limitations, can occur beyond 6 months and up to 3 years post-stroke and is influenced by factors such as motivation, ability to learn, and the availability of family support (Teasell & Hussein, 2013).

The term recovery plateau is used to describe the stage in stroke recovery after which recovery is no longer seen. However, issues with the measurement of recovery after stroke, the confounding role of rehabilitation, and a lack of understanding of the mechanism underlying a recovery plateau have led some to question how best to determine when stroke recovery ends. In a review of the stroke recovery plateau, Demain and colleagues (2006) argued that measurement issues might be partially responsible for the plateau observed in studies of stroke recovery. The use of ordinal scales to measure changes over time (which mistakenly assumes that intervals between scores are the same) and the presence of ceiling effects (where greater improvements are required to see a change in score) in scales used to measure recovery are two issues with measurement that may give the appearance of a plateau (Demain, Wiles, Roberts, & McPherson, 2006). The frequency, duration, type and intensity of rehabilitation provided after stroke also influence the extent of recovery (Teasell et al., 2012). Finally, Page and colleagues have argued that a plateau might be temporary, and result from neuromuscular adaptation. This suggests that changes in the intensity and duration of therapy,

rather than cessation, may be a better approach to address plateaus in recovery (Page, Gater, & Bach-Y-Rita, 2004).

2.7 Rehabilitation

For stroke survivors with residual functional impairment, rehabilitation plays an important role by improving quality of life, reducing the effects of stroke, and facilitating reintegration into the community (Markle-Reid et al., 2011). Young (1996) defined rehabilitation as "a complex set of processes usually involving several disciplines and aimed at improving quality of life for people facing daily living difficulties caused by chronic disease" (Young, 1996, p.677). For individuals with stroke, rehabilitation interventions use a combination of problem-solving and therapeutic approaches to limit the impact of stroke-related deficits (Young & Forster, 2007). Rehabilitation involves assessment, goal setting, intervention, and reassessment (Langhorne et al., 2011).

Several disciplines are involved in the rehabilitation of individuals with stroke, including: physicians, nurses, recreational therapists, speech language pathologists, social workers, physiotherapists, and occupational therapists (Miller et al., 2010). Occupational therapy (OT) and physiotherapy[1] (PT) rehabilitation services are the focus of this thesis, so they will be discussed in more detail. OT is defined as "the art and science of enabling engagement in everyday living, through occupation; of enabling people to perform the occupations that foster health and well-being; and of enabling a just and inclusive society so that all people may participate in the daily occupations of life" (Townsend & Polatajko, 2007, p.327). Occupational therapists focus on the "skills of living" necessary for individual to live independently, and help individuals to participate in activities of daily living either through modifying the activity or the environment (Miller et al., 2010; World Federation of Occupational Therapists, Unknown). The Canadian Physiotherapy Association defines PT as a "profession dedicated to improving quality of life by: promoting optimal mobility, physical activity

[1] The terms physiotherapy and physical therapy are used interchangeably in this thesis

and overall health and wellness; preventing disease, injury and disability; managing acute and chronic conditions, activity limitation, and participation restrictions; improving and maintaining optimal functional independence and physical performance; rehabilitation of injury and the effects of disease or disability with therapeutic exercise programs and other interventions; and educating and planning maintenance and support programs to prevent re-occurrence, re-injury or functional decline" (Canadian Physiotherapy Association, 2012, p.2).

2.7.1 Effectiveness of Post-Stroke Rehabilitation

Individual trials examining the effectiveness of stroke rehabilitation are typically conducted with small numbers of stroke patients making these studies relatively underpowered (Walker et al., 2004). Additionally, trials often take place in a single center, which limits their generalizability (Langhorne & Legg, 2003). As a result of these limitations, systematic reviews and meta-analyses of stroke rehabilitation trials provide the best evidence of the effectiveness of interventions across acute, post-acute, and community settings (Langhorne & Legg, 2003). Reviews in the area of stroke rehabilitation effectiveness have focused on comparing the setting in which rehabilitation is provided (hospital, home), comparing the effectiveness of specific rehabilitation disciplines (OT and PT) and assessing the effect of rehabilitation delivered at different time points after stroke.

Reviews have compared the relative effectiveness of rehabilitation provided in different settings, comparing rehabilitation provided in the home to that provided in a hospital. Early Supported Discharge services, which aim to accelerate discharge from hospital by providing an equivalent level of rehabilitation in the home, have been found to reduce the length of hospital stay, improve activities of daily living and patient satisfaction, and decrease the odds of death and institutionalization for a selected group of stroke patients with mild to moderate stroke severity (Fearon & Langhorne, 2012). For older adults with musculoskeletal disorders, home-based rehabilitation is associated with equal or greater gains in function, cognition, quality of life, and

satisfaction as compared to inpatient rehabilitation (Stolee et al., 2012). For neurological conditions, rehabilitation in community settings is equally as effective as rehabilitation provided in hospital settings and is preferred by patients and caregivers (Barnes & Radermacher, 2001).

Other reviews have focused on specific disciplines, or interventions delivered at different time points after stroke. A meta-analysis of OT interventions for stroke patients delivered in the community (including home and outpatient settings) reported improvements in ADLs and leisure activity (Walker et al., 2004). Legg and colleagues found that multidisciplinary therapy services delivered in the community could reduce the odds of deterioration in ADLs after stroke (Legg et al., 2004). However, for therapy services initiated more than one-year post stroke, no benefit was found, although the authors noted the lack of studies in this area (Aziz et al., 2008). A more recent research synthesis conducted by Teasell et al. (2012), examined interventions initiated more than a year post-stroke and found evidence of effectiveness, although they included interventions provided across a variety of inpatient and outpatient settings making it difficult to generalize findings to home-based rehabilitation.

2.8 Organization of Post-Stroke Health Care Services in Ontario

Post-stroke care in Ontario is provided in many different settings, with multiple transitions between settings. A report on the evaluation of stroke care in Ontario reported that of stroke and TIA patients discharged from acute care in 2011/12: 54.8% were discharged home, 24.4% were discharged to rehabilitation, 6.6% were discharged to complex continuing care, and 6.4% were discharged to long-term care (Hall et al., 2013).

2.8.1 Ontario Stroke System

The Ontario Stroke System (OSS) is a provincial system of provider organizations and partners that was developed to coordinate and improve stroke prevention and care across the Ontario

health care system. The OSS aims to decrease the incidence of stroke and improve care and outcomes for persons experiencing a stroke by providing care that is comprehensive, integrated, evidence-based, and province-wide (Ontario Stroke Network, 2014). Stroke services are organized into three tiers including regional stroke centers, district stroke centers and community hospitals (Ontario Stroke Network, 2014). The early stages of development of the OSS involved pilots starting in four areas starting in 1998: Hamilton Health Sciences, London Health Sciences Center, the Care Delivery Network at Queens University in Kingston, and several hospitals in the west greater Toronto area (Black, Lewis, Monaghan, & Trypuc, 2003). An evaluation of the OSS reported an 11% decrease in the number of acute inpatient hospitalizations between 1997/98 and 2002/03, which is thought to result from the development of secondary stroke prevention clinics. Other improvements in acute care, including reductions in the length of stay for acute stroke hospitalizations and reductions in 30-day in-hospital mortality have also been observed (Lewis, Trypuc, Lindsay, O'Callaghan, & Dishaw, 2006).

2.8.2 Post-Stroke Rehabilitation

Following the acute phase of stroke, the focus of care shifts from medical stabilization to rehabilitation (Duncan et al., 2005). For those requiring rehabilitation, stroke severity is the main determinant of the setting in which services are received (Canadian Stroke Network, 2011). Rehabilitation services are provided through multiple organizations with different types of accountability, funding, and oversight (Hirdes & Kehyayan, 2014). Programs differ with respect to the complexity and intensity of services provided based on the needs of the patient and the goals of the program (Ontario Hospital Association, 2006). Inpatient rehabilitation is provided in specialized rehabilitation facilities, or in general hospitals through rehabilitation units, programs or designated beds (Canadian Institute for Health Information, n.d.). Complex continuing care (CCC) is another setting where stroke patients who are not able to tolerate intensive rehabilitation may receive services

after stroke (Canadian Institute for Health Information, 2012a). As a population, CCC patients have greater medical complexity than that seen in other sectors (e.g. Long-term care) (Ontario Hospital Association, 2006). Stroke patients who have appropriate support at home and lesser impairment may receive rehabilitation on an outpatient basis (Canadian Institute for Health Information, 2012a). The Canadian Stroke Network estimates that more than half of patients with stroke who return home will require some form of ongoing care or in home services (Canadian Stroke Network, 2011). For individuals residing in the community, publicly funded rehabilitation is available from hospital-based outpatient clinics, stand-alone clinics, or home care agencies (Office of the Auditor General of Ontario, 2013).

2.9 Home Care

The Canadian Home Care Association defines home care as "an array of services for people of all ages provided in the home and community setting, that encompasses health promotion and teaching, curative intervention, end-of-life care, rehabilitation, support and maintenance, social adaptation and integration and support for the family caregiver" (Canadian Home Care Association, 2013). In his 2002 report, Romanow acknowledged the growing importance of home care to the Canadian health care sector when he referred to home care as "the next essential service" (Romanow, 2002, p.177). Several factors have led to this increased the focus on care in home and community settings in Canada. First, demographic shifts in the population have resulted in an increased number of people living into old age, many of whom will require a greater variety and intensity of health care (Abelson, Gold, Woodward, O'Connor, & Hutchison, 2004). Second, assumptions that some services previously provided in institutional settings can be provided at a lower cost in the community have increased interest in community care. Finally, individual preferences towards services delivered in the home are another factor that is perceived to have contributed to the shift towards home care (Baranek, Deber, & Williams, 2004; MacAdam, 2004). Home care programs typically serve three main

functions: a maintenance and preventive function, where they allow those with health and/or functional deficits to live independently and prevent further deterioration; a long term care (LTC) substitution function, where the needs of those who would otherwise be institutionalized are met in the community; and an acute care substitution function, where stays in acute care are shortened or prevented (Hollander & Walker, 1998; MacAdam, 2004).

Home care is considered to be an "extended health service" under the Canada Health Act. As a result, the delivery of home care services is the responsibility of the provincial and territorial governments, leading to differences in the administration of home care programs across the country (Canadian Home Care Association, 2013). In Ontario the Ministry of Health and Long-Term Care (MOHLTC) is responsible for the health care system. The MOHLTC provides funding to the 14 Local Health Integration Networks who are responsible for planning, funding and integrating health care services, including home care, at the local level (Canadian Home Care Association, 2013). The delivery of home care services of coordinated by 14 Community Care Access Centers (CCACs), whose geographic boundaries correspond to the Local Health Integration Networks, to which they are accountable (Canadian Home Care Association, 2013). CCACs contract with a mix of for-profit and not-for-profit provider agencies to deliver home care services (Abelson et al., 2004; MacAdam, 2004). Services provided by CCACs include nursing, personal support/homemaker, therapy services (physiotherapy, occupational therapy, speech language pathology, social work, nutrition/dietetics), medical supplies and equipment, and case management (Ontario Home Care Association, 2008).

2.9.1 Rehabilitation in Home Care

The use of physiotherapy and occupational therapy by home care clients is associated with improvements in functional status and decreased odds of mortality and institutionalization (Cook et al., 2013). Due to the potential benefits, provision of rehabilitation services for those with identified rehabilitation potential is an indicator of quality of care (Hirdes et al., 2004). In Ontario, individuals

are eligible for CCAC rehabilitation if they require services to return home from hospital or remain in their home, if their needs cannot be met by outpatient services, and if services are expected to result in progress towards rehabilitation goals (Ministry of Health and Long Term Care, 2006). Mohammed et al. (2013) reported that home care case managers used a variety of factors to determine the need for rehabilitation services, with mobility being important for physiotherapy, and equipment needs and cognitive issues typically prompting referral to occupational therapy. In Ontario, 21% of patients discharged from hospital to home after stroke received physiotherapy and 36% received occupational therapy from CCACs (Hall et al., 2013). However, the intensity of therapy among those who received CCAC services was not sufficient to obtain optimal functional outcomes (Hall et al., 2013).

2.10 Conceptual Framework: The Andersen-Newman Behavioural Model of Health Services Use

The Andersen-Newman Behavioural Model of Health Services use is a theoretical framework for examining the utilization of healthcare services that views the use of healthcare services as a type of individual behaviour (Andersen & Newman, 1973; Andersen & Newman, 2005). It was first developed by Ronald Andersen in 1968 to explain the use of healthcare services by families, define and measure equitable access to healthcare, and assist in the development of policies to promote equitable access to services (Andersen, 1995). Since its initial development, the model has undergone several revisions. In the version introduced by Andersen and Newman in 1973, the influence of 1) characteristics of the healthcare system, 2) changes in medical technology and social norms relating to the definition and treatment of illness, and 3) individual determinants on healthcare utilization are emphasized (Andersen & Newman, 1973; Andersen & Newman, 2005). This model is depicted in Figure 1:

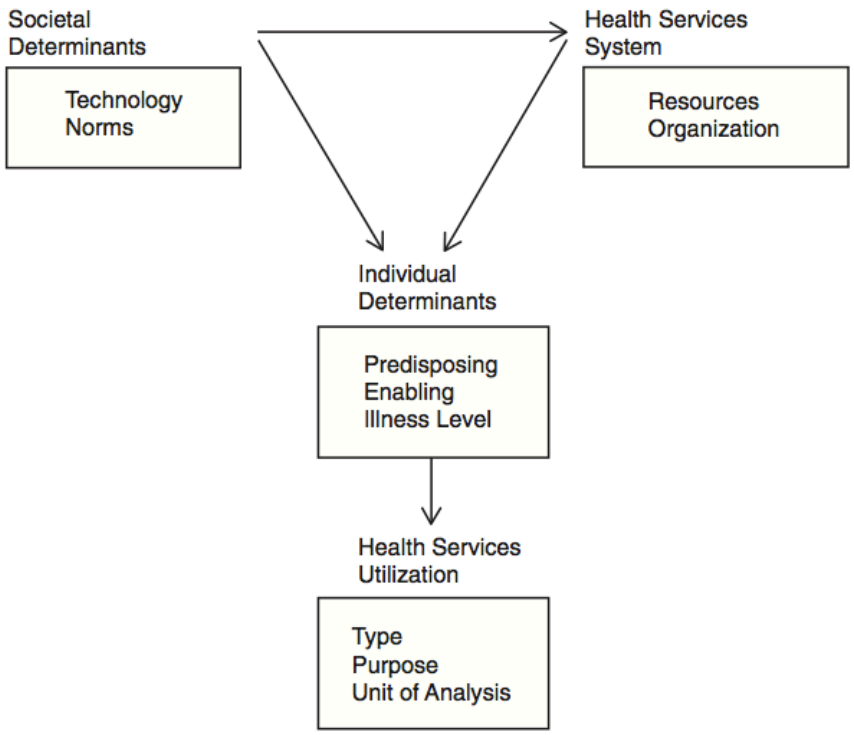


Figure 1 Main components of the Andersen-Newman Behavioural Model of Health Services Utilization

From "Societal and Individual Determinants of Medical Care Utilization in the United States." By R. Andersen & J.F. Newman, 2005, *Milbank Quarterly, 83(4),* Online-only. Copyright © 2005 Milbank Memorial Fund. Reprinted by permission of John Wiley & Sons, Inc.

Societal determinants of utilization, such as changes in technology or social norms affect the individual determinants both directly and indirectly through their effect on the health services system. The individual characteristics included in the model hypothesize that the use of services is related to three types of characteristics: 1) the predisposition of an individual to use services (predisposing variables); 2) the ability of an individual to access services (enabling variables); 3) his/her illness level (need variables) (Andersen & Newman, 1973; Andersen & Newman, 2005). The three types of individual determinants are depicted in Figure 2:

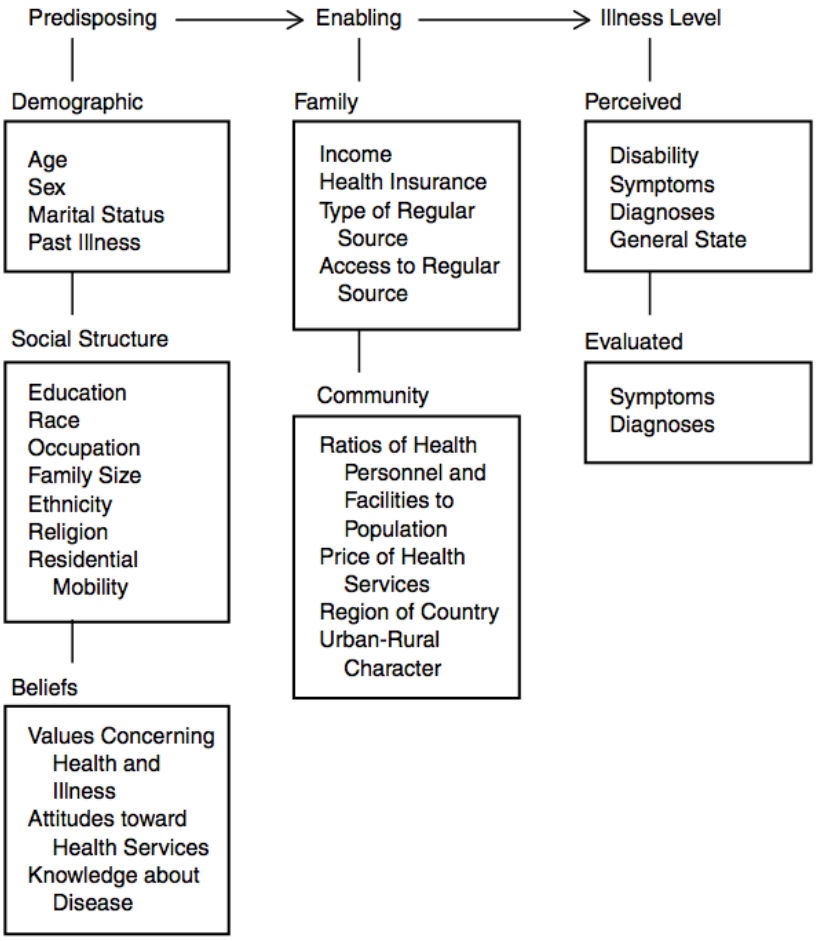


Figure 2 Individual Determinants of Health Service Utilization

From "Societal and Individual Determinants of Medical Care Utilization in the United States." By R. Andersen & J.F. Newman, 2005, *Milbank Quarterly, 83(4),* Online-only. Copyright © 2005 Milbank Memorial Fund. Reprinted by permission of John Wiley & Sons, Inc.

According to the model, individuals who possess certain characteristics have greater predisposition to use healthcare services, although these characteristics themselves are not directly related to service use, and exist prior to the onset of illness. These include demographic factors, biological imperatives that affect the likelihood of needing healthcare services; factors related to social structure, which can affect the health of the individual's environment and ability to cope with illness; and health belief variables, which may affect perceptions of need (Andersen & Newman,

1973; Andersen & Newman, 2005; Andersen, 1995). Predisposing factors are seen as the most distal class of individual determinants, whereas enabling factors are resources that are necessary but not sufficient conditions for the use of health services (Andersen, 1995). Family resources, such as income and insurance status, and community resources, such as the supply of healthcare professionals, are examples of enabling factors that can affect healthcare use. According to Andersen (1995), in order for health service use to take place some need must be present. Thus, need or illness level factors represent the most immediate causes of health services use, with the level of evaluated need affecting the amount of health services received, once an individual seeks care (Andersen & Newman, 1973; Andersen & Newman, 2005).

Further revisions of the model beyond the version introduced in 1973, have expanded it to include other behaviors in addition to health service use, such as the process of care and personal health practices. The revised model also includes health status, consumer satisfaction and quality of life as outcomes of health service use (Andersen, Davidson, & Baumeister, 2014). The Andersen-Newman model has been used extensively in health services research (Babitsch, Gohl, & von Lengerke, 2012). Additionally, several studies examining the use of health services among older adults have adopted the model as a conceptual framework (Cook & Thomas, 1994; Penning, 1995; Strain, 1991; Strain, 1990).

2.11 interRAI

interRAI is a non-profit organization, with collaboration between clinicians, researchers and health administrators from over 30 countries (Hirdes & Carpenter, 2013). By providing accurate information in a format that is common to a variety of service sectors and countries, standardized assessment tools developed by interRAI enhance the well-being of frail persons and facilitate efficient and equitable distribution of public resources (Fries et al., 2003). interRAI assessments are used across Canada in a variety of healthcare settings. As of 2006 in Ontario, interRAI assessments are

used in home care settings, nursing homes, complex continuing care hospitals, psychiatric hospitals, deaf, blind intervener services and community-based palliative care (Hirdes, 2006).

Individual items contained within interRAI assessments cover a variety of domains including issues such as cognition, communication and hearing, physical functioning, health conditions and preventive health measures, with items characterizing each issue in a variety of ways (e.g. frequency, severity, presence/absence) (Hirdes & Carpenter, 2013). Individual items contained in interRAI assessments are used to generate summary scales, which can be used to measure outcomes, and Clinical Assessment Protocols (CAPs); clinical algorithms that aid in care planning. In addition to care planning, interRAI assessments can also be used to measure quality and inform resource allocation within care settings (Hirdes & Carpenter, 2013).

Chapter 3
Literature Review: Determinants of Outpatient Rehabilitation Utilization Post-Stroke

3.1 Purpose

A literature review was conducted to identify potential predictors of the use of rehabilitation services post stroke, Using the terms described in Appendix A, and excluding articles not published in English, those with non-human subjects, and those without the full text and abstract available 2,807 articles were identified. Following manual review of the title and abstract of these articles, 35 were selected for review of the full text, and 16 were included in the final review. A review of the references of the included articles yielded one additional study. In total, 17 articles from 16 different studies met the inclusion criteria and were included in the final literature review. Studies examining the use of outpatient rehabilitation in a clinic-based setting or those examining the use of rehabilitation in conjunction with other types of health services (e.g., all home care services or all outpatient services) were included due to a limited number of studies examining the use of in-home rehabilitation after stroke in isolation. The studies identified in the literature review varied in their design, study population, method of identifying individuals with stroke, measurement of service utilization, methodology and inclusion of predictor variables, making it difficult to synthesize findings. The details of these studies are summarized in Appendix B. An overview of the characteristics, main findings, strengths, and limitations of the studies are summarized below.

3.2 Methodological Issues

There were substantial methodological differences in the studies identified in the literature review. Three different types of study design were used in studies included in the review, including retrospective cohort studies (Chan et al., 2009; Ghose, Williams, & Swindle, 2005; Hinojosa,

Rittman, & Hinojosa, 2009; Huang et al., 2013; Jia, Ried, Feng, Cameon, & Wang, 2011; Jia, Cowper, Tang, Litt, & Wilson, 2012; Jia et al., 2006), prospective cohort studies (Bhalla et al., 2004; Clark et al., 2010; Ostwald, Godwin, Cheong, & Cron, 2009; van den Bos, Smits, Westert, & van Straten, 2002), and cross-sectional studies (Cook, Stickley, Ramey, & Knotts, 2005; de Haan, Limburg, van der Meulen, & van den Bos, 1993; Fan, Strine, Jiles, Berry, & Mokdad, 2009; Freburger et al., 2011; Xie et al., 2007).

Most studies used hospital-based cohorts (Bhalla et al., 2004; Chan et al., 2009; Clark et al., 2010; de Haan et al., 1993; Freburger et al., 2011; Ghose et al., 2005; Hinojosa et al., 2009; Huang et al., 2013; Jia et al., 2011; Jia et al., 2012; Jia et al., 2006; Ostwald et al., 2009; van den Bos et al., 2002), with others using community samples (Cook et al., 2005; Fan et al., 2009; Xie et al., 2007). The sample size of the included studies ranged from N=61 to N=187,188, and different age cut-offs such as 18+ (Xie et al., 2007), 35+ (Fan et al., 2009), 45+ (Freburger et al., 2011), 50+ (Ostwald et al., 2009) and 65+ (Cook et al., 2005) were used. Studies were conducted in a variety of countries, with the most taking place in the United States (Chan et al., 2009; Clark et al., 2010; Cook et al., 2005; Fan et al., 2009; Freburger et al., 2011; Ghose et al., 2005; Hinojosa et al., 2009; Jia et al., 2011; Jia et al., 2012; Jia et al., 2006; Ostwald et al., 2009; Winkler, Wu, Ripley, Groer, & Hoenig, 2011; Xie et al., 2007), two occurring the Netherlands (de Haan et al., 1993; van den Bos et al., 2002), one in Canada (Huang et al., 2013), and one in several European countries (Bhalla et al., 2004). Many of the studies conducted in the United States focused on patients receiving services from the United States department of Veterans Affairs (Ghose et al., 2005; Hinojosa et al., 2009; Jia et al., 2011; Jia et al., 2012; Jia et al., 2006; Winkler et al., 2011), a predominately male population.

The identification of stroke patients is another important factor that were differed across the studies identified. Case ascertainment using ICD codes from administrative medical records was the most common method employed to identify those who suffered a stroke (Chan et al., 2009; Freburger

et al., 2011; Ghose et al., 2005; Hinojosa et al., 2009; Jia et al., 2011; Jia et al., 2012; Jia et al., 2006; Winkler et al., 2011), but the specific ICD codes used were often not reported, making it difficult to determine whether a consistent definition was used across studies. Other methods of identifying individuals with stroke included review of medical records by researchers (Clark et al., 2010; de Haan et al., 1993; Huang et al., 2013; Ostwald et al., 2009; van den Bos et al., 2002; Winkler et al., 2011), the WHO definition to prospectively enroll patients (Bhalla et al., 2004), or self-report for studies using survey methods (Cook et al., 2005; Fan et al., 2009; Xie et al., 2007).

Another consideration for the literature review is differences in how service use was conceptualized across studies, including the types of services examined, the way they were measured, and the length of follow-up after stroke. Services examined included general outpatient health service use, outpatient rehabilitation in a variety of settings, any rehabilitation services (including inpatient and outpatient settings), in home physiotherapy and occupational therapy, and home health care enrolment after hospital discharge. Service use was conceptualized in a variety of ways including as any vs. none (Bhalla et al., 2004; Chan et al., 2009; Cook et al., 2005; de Haan et al., 1993; Fan et al., 2009; Freburger et al., 2011; Ostwald et al., 2009; van den Bos et al., 2002; Xie et al., 2007), the number of visits (Chan et al., 2009; Ghose et al., 2005; Hinojosa et al., 2009; Huang et al., 2013; Jia et al., 2011; Jia et al., 2006; Winkler et al., 2011) and the proportion of individuals who complied with scheduled rehabilitation therapy visits (Clark et al., 2010). The length of follow-up ranged from 4 weeks after discharge from inpatient rehabilitation in one study (Ostwald et al., 2009), to 5 years after discharge from hospital in another (van den Bos et al., 2002). Three studies did not measure or restrict self-report of outpatient rehabilitation use based on the amount of time since the individual had a stroke (Cook et al., 2005; Fan et al., 2009; Xie et al., 2007).

Due to differences in how service use was measured across studies, multiple statistical techniques were used to examine relationships between independent variables and the use of services.

Most studies used multivariate regression, including logistic, poisson and linear regression. The study by Bhalla et al (2004) only examined the association between age and service use at a bivariate level. In contrast to the majority of studies, which only examined individual factors, Freburger and colleagues used multilevel modeling as they included both individual-level and system-level variables in models explaining the use of services after stroke.

3.3 Findings

Although the overall objective of the identified studies was to examine the relationship between various determinants and the use of services among stroke survivors, the specific research questions varied. Several studies investigated hypothesized relationships between specific determinants and the use of services, while others were more exploratory in nature, and examined associations between a wider range of variables and the use of services. Two studies adopted the Andersen Newman model as a conceptual framework to guide the selection of variables (de Haan et al., 1993; Hinojosa et al., 2009), while Freburger et al. (2011), created their own conceptual framework. The main findings of these studies are summarized below.

Several of the reviewed studies examined the relationship between specific sociodemographic characteristics and the use of services. A multi-country European study reported that older patients (75+) had lower utilization of outpatient rehabilitation in the 3 months following stroke, but they did not examine the role of any potential confounding factors in this relationship (Bhalla et al., 2004). In a study in Ontario, Canada, Huang et al. (2013), investigated the relationship between socioeconomic status (SES) and the receipt of CCAC physiotherapy and occupational therapy services after stroke, and found no association. Another study examined the relationship between socioeconomic status (measured by educational attainment), health outcomes, and service use at various time points after stroke in the Netherlands. They found that those with a lower socioeconomic status had greater

disability and handicap at six months after stroke, but that SES did not have an independent effect on the use of rehabilitation therapy services, after adjusting for other characteristics (van den Bos et al., 2002). A retrospective cohort study by Chan and colleagues (2009) in the United States examined sociodemographic disparities in the use of services after stroke. They found that older age, female gender, and higher neighbourhood SES were negatively associated with the number of outpatient visits. In contrast, female gender and older age were positively associated with home health care enrolment, while Caucasian race and rural location were negatively associated with both outcomes (Chan et al., 2009). Jia and colleagues (2012) examined the association between various urban/rural taxonomies and the use of services among Veteran's Affairs (VA) stroke patients in the United States and found that those living in rural or highly isolated areas were less likely to use rehabilitation services, as compared to those living in urban centers.

Caregiver characteristics and the amount of informal support provided after stroke were examined in a few studies. Clark and colleagues investigated the contribution of caregiver characteristics to health service utilization in a population of minorities who had a stroke. Caregivers who believed that health was due to chance, a belief that was particularly common among Hispanic subjects, were less likely to attend scheduled rehabilitation appointments. Perceived social support, overall health status, and the adequacy of family resources (e.g., food, shelter) were also examined, and these characteristics were not associated with the use of rehabilitation services (Clark et al., 2010). Hinojosa and colleagues also focused on caregiver characteristics, but included other variables as part of their adoption of the Andersen Newman model. They found that stroke survivors who had a co-residing caregiver, who received a greater number of hours of informal care, and whose caregiver received outside assistance were more likely to use outpatient health services after adjusting for demographic and clinical characteristics (Hinojosa et al., 2009).

In addition to sociodemographic factors and caregiver characteristics, some studies focused on specific conditions. Post-stroke depression, and its relation to service utilization was the focus of several studies included in the review. Jia et al. (2006) found that veterans who had a diagnosis of depression, or who were prescribed antidepressant medication in the year post-stroke used a higher volume of outpatient services than those who did not, after controlling for indicators of disease severity. Ghose et al. (2005) found that veterans with stroke who had a diagnosis of depression, or other mental health conditions (anxiety disorder, schizophrenia, personality disorder, and substance abuse/dependence disorders) during their initial inpatient hospitalization had higher utilization of outpatient services after stroke. A 2011 study by Jia and colleagues attempted to distinguish between depression diagnosis and active treatment for depression. Veterans who were prescribed antidepressants within a year of stroke used a greater amount of outpatient services, but a depression diagnosis alone was not a significant predictor of service use (Jia et al., 2011). Finally, the relationship between serious psychological distress and rehabilitation was examined by Fan et al. (2009), who did not find a relationship between serious psychological distress and the use of outpatient rehabilitation, despite a higher level of disability within this sub-population of stroke survivors.

Fewer studies examined the relationship between functional status and the use of rehabilitation services. Although not their primary objective, Hinojosa et al. (2009) found that greater difficulty with ADLs (as measured by the Functional Independence Measure) was associated with increased utilization, while greater dependence in IADLs (as measured by the Frenchday Activities Index) was associated with decreased utilization of outpatient services. The Stroke Impact Scale physical subscale measures the extent of physical limitations from the individual's perspective. Ostwald et al. (2009) found that stroke survivors with higher scores (indicating fewer negative impacts from stroke) were less likely to resume PT and OT after discharge from inpatient

rehabilitation. Ostwald and colleagues examined several other measures of stroke severity in relation to the use of PT and OT including: aphasia, apraxia, ataxia, cognitive impairment, dysarthria, dysphagia, facial paralysis, hemiparesis/hemiplegia, sensory changes, spasticity, visual neglect, pain, vision difficulty, and emotional lability, and found that only the presence of visual neglect was associated with an increased likelihood of resuming PT and OT after discharge. In a community-based survey of stroke survivors, Cook et al. (2005) found that self-report of stroke-related weakness was associated with the use of rehabilitation services. Severe handicap (as measured by the Rankin Scale) was associated with increased use of rehabilitation services after stroke, while severe disability (as measured by the Barthel Index) was not in another study (de Haan et al., 1993). Finally, Winkler et al. (2011) found that the use of assistive devices was associated with increased use of outpatient services among veterans post-stroke.

In addition to individual characteristics, one study examined the relationship between system level factors and health service use. Freburger et al. (2011) found that stroke volume (the number of stroke cases in a hospital), the number of physiotherapists and occupational therapists in the community per 1,000 population and the number of skilled nursing facility beds per 1,000 population were positively associated with the receipt of home care services after stroke.

3.4 Strengths and Limitations

Several strengths and limitations with respect to the internal and external validity of the studies included in the literature review are important to discuss.

3.4.1 Internal Validity

Elements of the study design, including the study type, data sources used, and the degree of control for confounding are important to consider as they can affect the internal validity, or ability to draw conclusions about relationships between predictors and the use of services. Prospective cohort

studies were less common than retrospective cohort studies or cross-sectional study designs across the studies reviewed. Prospective studies typically included a greater range of variables (allowing for greater control of confounding), and investigators had greater control over how stroke patients were identified. However, due to the more intensive nature of these studies, they typically had a much smaller sample size than other studies reviewed, which may have limited their power and increased the probability of type 2 errors. Retrospective cohort study design was the most common across the studies reviewed. These studies are typically less costly to conduct, but are limited by the availability of historical information. Among the retrospective cohort studies included in the review, most used administrative data to identify predictors of service use. Although not originally designed for research, administrative data offer several advantages to researchers including a lower cost and a greater number of study subjects (Iezzoni, 2002). For studies conducted in stroke populations, use of administrative data may allow investigators to include persons that would be difficult to include in prospective studies or surveys, such as those with significant cognitive or communication difficulties. However, these data offer several limitations as noted by Statistics Canada, including: 1) a lack of quality control over the data; 2) the potential for missing data; 3) differences in concepts leading to bias; 4) the timeliness of the data; 5) cost associated with processing the data such as data cleaning (Statistics Canada, 2014d). The extent to which these limitations may have affected some of the studies reviewed is difficult to ascertain, as these issues were not commonly discussed. In addition to cohort studies, cross-sectional studies were also used. Cross-sectional studies are limited in that they are not able to establish a temporal order, as the exposures and outcome are measured simultaneously (Gordis, 2009). Several cross-sectional studies used surveys, which may be affected by non-response and recall biases, which may have affected findings if the factors associated with non-response and recall were also associated with the outcome (Gordis, 2009).

The timing of measurement is another important issue that affected some studies. The length of follow-up varied across the studies, and a longer follow-up may have led to weakened associations between independent variables and service use in addition to increasing attrition. Further, several cross-sectional surveys reported associations between independent variables measured in the present and rehabilitation use at any point in the past (Cook et al., 2005; Fan et al., 2009; Xie et al., 2007). Associations between variables subject to change over time (e.g., psychological distress, employment status, stroke-related weakness) and prior rehabilitation use are questionable because these variables may not reflect the individual's characteristics at the time they accessed rehabilitation services.

Adjustment for potential confounding factors is another important factor in ensuring adequate internal validity in epidemiological studies. One potential limitation in studies using administrative databases is a lack of availability of covariates of interest (Gavrielov-Yusim & Friger, 2014). Administrative data often lack information on functional status, such as performance of ADLs, which is important for studies involving persons with disabilities, including those with stroke (Iezzoni, 2002). To compensate for a lack of direct measures of stroke severity in administrative databases, several studies used proxies for stroke severity including: length of stay in acute care, comorbid conditions identified through diagnostic codes in health records, and use of intubation or mechanical ventilation during the initial hospitalization (Chan et al., 2009; Ghose et al., 2005; Jia et al., 2011; Jia et al., 2012; Winkler et al., 2011). This may reduce residual confounding that could have resulted from a lack of direct measures of stroke severity available in databases used in these studies. Among other studies reviewed, differences in control for confounding may result in varying amounts of residual confounding across studies, negatively affecting the internal validity of the findings. Differences in functional status or stroke severity were controlled for directly in some of the studies reviewed using valid measures of functional status among stroke survivors including the FIM, Barthel Index, Rankin Scale, and Stroke Impact Scale (de Haan et al., 1993; Hinojosa et al., 2009; Ostwald et

al., 2009; van den Bos et al., 2002). Other studies did not attempt to adjust for stroke severity as a potential confounding factor when examining relationships of various factors with service utilization (Bhalla et al., 2004; Clark et al., 2010; Cook et al., 2005; Fan et al., 2009; Freburger et al., 2011; Xie et al., 2007). As a result the internal validity of their findings may be subject to residual confounding.

3.4.2 External Validity

Among the studies reviewed, several used specific stroke populations or exclusion criteria that resulted in samples that are unlikely to be representative of the general stroke population, thus reducing the external validity of their findings. Several studies examined factors associated with outpatient service utilization among stroke-affected individuals in the United States receiving care through the Veteran's Health Administration (Ghose et al., 2005; Hinojosa et al., 2009; Jia et al., 2011; Jia et al., 2012; Jia et al., 2006; Winkler et al., 2011), a population that is mostly male, older, poorer, and has a greater number of comorbidities as compared to other stroke populations (Ghose et al., 2005). Another study focused specifically on African American and Hispanic stroke survivors treated at a specific inpatient rehabilitation facility, limiting the generalizability of their findings (Clark et al., 2010). The exclusion of individuals with dementia, communication issues, or those who did not have a primary caregiver, from several other studies further limits their external validity. The lack of studies conducted in Canada is another limitation, since the differences in the organization of services and eligibility criteria for accessing rehabilitation services across countries may affect the generalizability of findings to Canada.

3.5 Conclusion

Overall, substantial heterogeneity was observed among the studies reviewed, including with respect to the internal and external validity of the reported findings. Issues related to study design, data sources used, and degree of control for confounding affected the internal validity of several of

the studies; however, this was not the case for all studies included in the literature review. Although there were well-designed studies examining the predictors of service utilization after stroke, differences in the delivery of services or the stroke population examined (e.g., U.S. Veterans) may limit the applicability of their findings to Canadian home care settings.

Chapter 4
Rationale

As described in previous sections, stroke results in significant impairments in multiple domains, such as physical, cognitive and psychological functioning that can negatively affect the health and well being of survivors. For community dwelling older adults, stroke-related impairments may negatively affect the ability to live independently. Rehabilitation services, including physiotherapy and occupational therapy, can help to mitigate the effects of stroke by reducing stroke-related disability or teaching strategies to compensate for functional limitations. As such, rehabilitation services play an important role in helping to improve quality of life after stroke.

Identifying individuals who are most likely to benefit from rehabilitation following stroke is one aspect of ensuring that services are provided in a cost-effective manner (Gresham et al., 1997). Understanding the relationship between individual attributes and the use of rehabilitation may help to ensure services are being delivered appropriately to maximize the health and well being after stroke. Although this has been the focus of previous research, several limitations in the current literature exist, including a lack of studies measuring the severity of stroke-related impairments, exclusion of those with cognitive or communication impairments, and a limited number of studies conducted in Canadian settings. To address these limitations studies examining the use of rehabilitation services among stroke survivors in Canadian home care settings using a comprehensive set of need-related variables are needed.

The objective of this Master's thesis is to examine factors associated with the use of CCAC rehabilitation services among older stroke survivors in the Hamilton Niagara Haldimand Brant region. Information from two different interRAI home care assessments (Resident Assessment Instrument – Home Care [RAI-HC] and interRAI Contact Assessment [CA]) are used in analyses that employ the Andersen Newman Behavioral Model as a conceptual framework.

4.1 Research Questions

The following research questions were addressed by this thesis:

1. What is the profile of older stroke survivors using physiotherapy and/or occupational therapy home care services?

2. What factors are associated with the use of physiotherapy and/or occupational therapy home care services among older stroke survivors?

3. What is the relative contribution of predisposing, need, and enabling factors to the use of services among older stroke survivors?

4.2 Relevance of Research

A better understanding of the needs of stroke survivors in home care may have important implications for policy and practice. At an individual level, identifying characteristics of this population may highlight unique needs after stroke that can be the focus of intervention for home care providers. At a policy level, understanding the needs of stroke survivors in relation to the general population of home care recipients can help policy makers determine whether specialized stroke services (such as inter-professional stroke rehabilitation teams) are needed in community settings. The use of interRAI assessments will also facilitate comparison with stroke survivors in other health care settings, such as Long-Term Care and Complex Continuing Care.

Knowledge of factors associated with the use of home care rehabilitation services after stroke can help to inform clinical decision-making regarding the allocation of services, an important issue to ensure that services are provided in a cost effective manner, to those most likely to benefit. Comparing the relative contributions of individual determinants of service use will allow for determination of whether services are provided according to need, or whether disparities in the use of services (e.g., by age or gender) exist. Identification of disparities in service provision can help to identify areas for quality improvement within home care agencies. Finally, the use of comprehensive

measures of individual need may contribute knowledge regarding novel predictors of service use for stroke survivors receiving home care services.

Chapter 5
Methods

5.1 Ethics Approval

The University of Waterloo Office of Research Ethics granted full ethics clearance for this project (ORE #20070) on August 22, 2014 (see Appendix C).

5.2 Study Design and Setting

This project involved two retrospective cohort studies. Both studies included individuals aged 65 years and older who were discharged from hospitals in the Hamilton Niagara Haldimand Brant (HNHB) region with a diagnosis of stroke and were admitted to the HNHB CCAC following hospital discharge. The HNHB LHIN covers a wide geographical area, with a mix of urban and rural areas containing 1.4 million people (HNHB LHIN, 2014). The first study involved a sample of individuals admitted to the HNHB CCAC and assessed with the RAI-HC following a stroke. The second study involved individuals admitted to the HNHB CCAC and assessed with the interRAI CA after a stroke. For a map of Ontario LHINs including the HNHB region see Appendix D.

5.3 Comparison of HNHB with Other Regions

5.3.1 Comparison of HNHB CCAC with Other CCACs

To determine whether HNHB CCAC provided a similar level of rehabilitation services to stroke patients, HNHB was compared to other Ontario CCACs. Using provincial CCAC data, unique individuals 65+ admitted to home care agencies between 2008 and 2013 were identified by selecting the first admission for each person during this time period. The sample was further restricted to home care admissions by selecting those with service recipient codes at admission of 91 (acute), 92 (rehabilitation), 93 (maintenance), 94 (long-term supportive), or 95 (end of life) who had a RAI-HC

assessment with completed within 91 days of referral and a diagnosis of stroke. Service utilization data from the Client Health Related Information System (CHRIS) were used to identify the receipt of physiotherapy or occupational therapy services within 91 days of assessment. The proportion of individuals receiving physiotherapy, occupational therapy and a combination of these services was compared across the 14 CCACs in Table 1 on the following page.

Compared to the overall provincial rate, HNHB CCAC provided a greater proportion of physiotherapy (36.5% vs. 30.7%), occupational therapy (51.6% vs. 44.2%), and both services combined (67.5% vs. 58.3%) to individuals. However, when comparing HNHB to other individual CCACs, HNHB does not appear to be an outlier with respect to the provision of rehabilitation services after stroke. Central West (39.6%), Waterloo Wellington (34.8%), North West (34.3%), and South East (33.9%) CCACs provided physiotherapy to a similar proportion of individuals with stroke. For Occupational Therapy, Mississauga Halton (56.3%), Central West (52.1%), and Waterloo Wellington (52.3%) provided similar, but higher proportions of stroke patients with services. In terms of overall rehabilitation provision (physiotherapy or occupational therapy), Mississauga Halton (66.1%), Central West (67.1%) and Waterloo Wellington (66.2%) provide services to a similar proportion of individuals.

Table 1 Proportion of Individuals[1] age 65+, with a Stroke Diagnosis on First RAI-HC Assessment, Receiving Physiotherapy and Occupational Therapy Services within 91 days of Assessment, by CCAC/LHIN, 2008-2013 (N=39,900)

CCAC/LHIN Name	Number of Individuals	Received PT Services % (n)	Received OT Services % (n)	Received any Rehabilitation[2] Services % (n)
Ontario	39,900	30.7 (12,248)	44.2 (17,665)	58.3 (23,283)
Central East	4,271	28.0 (1,197)	42.3 (1,809)	58.0 (2,479)
Central	4,243	28.1 (1,195)	46.9 (1,990)	62.1 (2,638)
Champlain	3,265	28.5 (932)	34.4 (1,126)	49.4 (1,613)
Central West	1,472	39.6 (583)	52.1 (767)	67.1 (988)
Erie St. Clair	2,047	29.3 (601)	32.3 (663)	47.0 (962)
Hamilton Niagara Haldimand Brant	6,267	36.5 (2,291)	51.6 (3,235)	67.5 (4,233)
Mississauga Halton	2,494	31.0 (774)	56.3 (1,404)	66.1 (1,649)
North East	2,385	29.4 (702)	34.5 (823)	49.6 (1,184)
North Simcoe Muskoka	2,002	18.9 (380)	26.6 (533)	34.5 (692)
North West	830	34.3 (285)	43.8 (364)	56.5 (469)
South East	1,790	33.9 (607)	48.2 (863)	62.1 (1,112)
South West	3,542	32.5 (1,152)	42.8 (1,517)	55.7 (1,974)
Toronto Central	2,774	24.2 (672)	45.2 (1,254)	58.4 (1,621)
Waterloo Wellington	2,518	34.8 (877)	52.3 (1,317)	66.2 (1,669)

[1] Includes the first admission for each individual between April 1, 2008 and March 31, 2013, limited to those with an admission SRC of: 91,92,93,94, or 95 who were assessed with a RAI-HC within 91 days of referral

[2] Refers to those who received any OT or PT services

[3] chi square test: PT $p<0.0001$, OT $p<0.0001$, any rehabilitation $p<0.0001$

5.3.2 Comparison of HNHB with the Ontario and Canadian Populations

To determine the extent to which the general HNHB population was similar to the Ontario and Canadian populations, data from Statistics Canada were used. Data from the 2011 Canadian Census and National Household Survey (NHS) were used to compare the sociodemographic characteristics of the three populations. Note that in 2011 the NHS, which is voluntary, replaced the long-form census, which was previously mandatory. In addition to the sociodemographic comparison, data contained in the Statistics Canada health profile (from the Canadian Institute for Health Information) were used to compare hospitalization, mortality and hospital-based mortality rates for stroke across the three populations. This comparison is shown in Table 2 on the following page.

Overall, the HNHB population is similar to the population of Ontario and Canada with the exception of a few differences. HNHB has a greater proportion of individuals whose mother tongue is English (81.2%) as compared to Ontario (69.8%) and Canada as a whole (58.1%). There are also a lower proportion of visible minorities in HNHB (10.3%) as compared to the Ontario (25.9%) and Canadian (19.1%) populations.

Table 2 Statistics Canada: Population Comparison

Population Characteristics	HNHB % (n)	Ontario % (n)	Canada % (n)
Age	N=1,358,810	N=12,851,820	N=33,476,685
0-19	23.1 (314,150)	23.7 (3,044,405)	23.3 (7,785,480)
20-64	60.0 (814,645)	61.7 (7,929,100)	62.0 (20,746,150)
65+	16.9 (230,015)	16.9 (1,878,325)	14.8 (4,945,065)
Gender	N=1,358,810	N=12,851,820	N=33,476,685
Male	48.6 (660,575)	48.7 (6,263,140)	49.0 (16,414,225)
Female	51.4 (698,230)	51.3 (6,588,685)	51.0 (17,062,460)
Legal Marital Status (15 years and over)	N=1,136,735	N=10,671,050	N=27,869,340
Currently Married	57.4 (652,330)	57.7 (6,158,605)	57.7 (16,414,225)
Not Currently Married	42.6 (484,410)	42.3 (4,512,440)	42.3 (11,784,855)
Mother Tongue	N=1,322,660	N=12,434,770	N=32,481,635
English	81.2 (1,073,350)	69.8 (8,677,040)	58.1 (18,858,980)
French	1.9 (25,455)	4.0 (493,300)	21.7 (7,054,975)
Other	16.9 (223,855)	26.3 (3,264,435)	20.2 (6,567,680)
Visible Minority	N=1,332,960	N=12,651,795	N=35,852,320
Yes	10.3 (137,960)	25.9 (3,279,565)	19.1 (6,264,750)
Educational Attainment (15 years and over)	N=1,111,320	N=10,473,670	N=27,259,525
No certificate, diploma or degree	20.5 (227,300)	18.7 (1,954,520)	20.1 (5,485,400)
High school diploma or equivalent	28.3 (314,950)	26.8 (2,801,805)	25.6 (6,968,935)
Postsecondary certificate, diploma or degree	51.2 (569,070)	54.6 (5,717,340)	54.3 (14,805,190)
Labour force activity (15 years and over)	N=1,111,320	N=10,473,670	N=27,259,525
Employment rate	58.5	60.1	60.9
Unemployment rate	8.1	8.3	7.8
Income in 2010 (15 years and over)	N=1,111,325	N=10,473,670	N=27,259,520
Median Income	$30,091.00	$30,526.00	$29,878.00
After-tax Income in 2010 (15 years and over)	N=1,111,320	N=10,473,665	N=27,259,525
Median Income After-tax	$27,782.00	$28,118.00	$27,334.00

Stroke Statistics[3]			
Hospitalized stroke event rate (per 100,000 population)	115	119	121
30-Day stroke in-hospital mortality rate	15.0	14.8	15.0
Cerebrovascular disease, deaths (per 100,000 population)	32.9	30.7	30.8

[1] Visible minority status, educational attainment, labour force activity and income are from the National Household Survey. As of 2011, this information (previously part of the mandatory long-form census) was voluntary. (Statistics Canada, 2014c)

[2] Frequencies do not add up to totals due to random rounding of individuals by Statistics Canada for confidentiality purposes (Statistics Canada, 2014a)

[3] Stroke statistics reported by Statistics Canada are from the Canadian Institute for Health Information's Discharge Abstract Database (2011-2012)

[4] Source: Statistics Canada. 2013. Hamilton Niagara Haldimand Brant (Health Region), Ontario and Canada (table). *Health Profile*. Statistics Canada Catalogue no. 82-228-XWE. Ottawa. Released December 12, 2013. http://www12.statcan.gc.ca/health-sante/82-228/index.cfm?Lang=E (accessed December 18, 2014)

5.4 Data Sources

Information from three different data sources including hospital discharge records from the Discharge Abstract Database (DAD), interRAI assessment records, and CCAC referral and service utilization data from CHRIS were linked.

5.4.1 Discharge Abstract Database (DAD)

The DAD is a national administrative hospital database that captures information about all separations (discharges, deaths, sign-outs, and transfers) from acute care and day surgery institutions in Canada. Demographic, administrative, and clinical data (such as diagnostic information) are abstracted from patient charts and reported in a standardized format in the DAD (Canadian Institute for Health Information, 2011). For this project DAD data from the HNHB LHIN Integrated Decision Support Database, a business intelligence system, were used.

5.4.2 Resident Assessment Instrument Home Care (RAI-HC)

The RAI-HC is a comprehensive, standardized clinical assessment that is used to assess the needs, strengths, and preferences of home care clients (Landi et al., 2000). It was developed by interRAI, a collaborative network of researchers and clinicians from over 30 countries (Hirdes & Carpenter, 2013). It contains over 300 items that provide information regarding: cognition, communication, vision and hearing, mood and behaviour, informal support, physical functioning, continence, disease diagnoses, nutritional status, skin conditions, preventative health measures, medications, service utilization, and environmental assessment (Morris et al., 2002). Individual items contained in the RAI-HC are used to trigger Clinical Assessment Protocols, which identify issues to guide care planning, and summary scales. Case managers complete the RAI-HC through a face-to-face interview typically conducted in the client's home using all possible sources of information (Morris et al., 2002). In 2002, the RAI-HC was mandated in Ontario for all long-stay home care clients, defined as those expected to be on service for 60 days or more (Hirdes, 2006). High inter-rater reliability of the RAI-HC as a whole has been empirically demonstrated (Morris et al., 1997).

5.4.2.1 Scales

The RAI-HC contains several summary scales, six of which were used for this thesis: the Changes in Health and End-Stage Disease and Signs and Symptoms (CHESS) scale, Pain Scale, Cognitive Performance Scale (CPS), Depression Rating Scale (DRS), ADL Hierarchy Scale, and IADL Capacity Scale.

The CHESS scale is a measure of health instability, designed to predict mortality and other adverse outcomes associated with frailty (Hirdes, Frijters, & Teare, 2003). The CHESS score is calculated by creating a symptom count up to a maximum of 2 from 6 items in the RAI-HC: vomiting (k2e), dehydration (l2c), leaving food uneaten (l2b), weight loss (l1a), shortness of breath (k3e) and edema (k3d). One additional point is added for the presence of each end-stage disease (k8e), cognitive decline (b2b), and ADL decline (h3) resulting in a 6-point scale, with values ranging from 0 (no health instability) to 5 (very high health instability) (interRAI, n.d. a). It has been shown to be an independent predictor of mortality in CCC hospital patients (Hirdes et al., 2003). Armstrong and colleagues (2010) found that ability of CHESS to predict time to adverse outcome (institutionalization or death) among home care clients was comparable to that of two other frailty measures, the Edmonton Frail Scale and the Frailty Index. The predictive validity of CHESS has also been examined in a population of home care clients with stroke, and was found to be a strong predictor of mortality within this population (Hirdes, Poss, Mitchell, Korngut, & Heckman, 2014).

Fries, Simon, Morris, Flodstrom and Bookstein (2001) developed the interRAI Pain Scale to assess pain levels among U.S. nursing home residents. Scores from the pain scale correspond to the Visual Analog Scale, a valid instrument for assessing pain. The pain scale is a hierarchical scale that uses two items from the RAI-HC, pain frequency (k4a) and pain intensity (k4b) and is scored from 0-3. At the lower end of the scale the frequency of pain is used to differentiate levels, with 0 representing no pain and 1 representing those with less than daily pain. Among those with daily pain, the intensity of pain is used to differentiate into scores of 2 (daily pain, not severe) and 3 (daily severe pain) (Fries et al., 2001).

The CPS was developed to measure cognitive impairment among nursing home residents. It includes both direct and indirect measures of cognitive function. Direct measures of cognition include short-term memory (b1a) and decision-making skills (b2a). Indirect measures of cognition include ability to be understood by others (c2) and self-performance in eating (h2g). These items are combined in a hierarchy to create the scale, with scores ranging from 0 (intact cognition) to 6 (very severe cognitive impairment). The CPS is correlated with other valid measures of cognitive impairment including the Mini Mental State Exam and Test for Severe Impairment (Hartmaier et al., 1995; Morris et al., 1994). The CPS has also been found to correlate with nurse's judgements of disorientation and Alzheimer's or dementia diagnoses among nursing home residents (Morris et al., 1994). Landi et al (2000), compared the CPS to the MMSE in a home care population, and reported excellent agreement between the scales.

The DRS is a summative scale, developed to measure the severity of mood symptoms among nursing home residents. It includes 7 RAI-HC items, coded on the basis of frequency: negative statements (e1a), persistent anger (e1b), expressions of unrealistic fears (e1c), repetitive health complaints (e1d), repetitive anxious complaints (e1e), sad, pained, worried facial expression (e1f) and tearfulness (e1g). Scores range from 0 to 14, with higher scores indicating greater severity of mood symptoms. The DRS is highly correlated with two other valid measures of depression in older adults, the Hamilton Depression Rating Scale and the Cornell Scale for Depression. When compared to the presence of psychiatric depression diagnoses, the DRS also demonstrated excellent sensitivity and acceptable sensitivity (Burrows, Morris, Simon, Hirdes, & Phillips, 2000). The DRS has also been used to examine the presence of depressive symptoms among older home care clients (Szczerbińska, Hirdes, & Życzkowska, 2012).

The ADL Hierarchy scale groups selected ADL items from the MDS into early, middle and late loss categories (Morris, Fries, & Morris, 1999). It is made up of 4 ADL items from the RAI-HC, including one early loss ADL (personal hygiene-h2i), two middle loss ADLs (toilet use-h2h and

locomotion-h2c), and one late loss ADL (h2g-eating). Scores range from 0 (independent) to 6 (total dependence) with early loss ADLs being assigned lower scores than late loss ADLs (interRAI, n.d. b).

The IADL capacity scale is a hierarchical scale that measures difficulty with three IADL items from the RAI-HC: meal preparation (h1ab), phone use (h1eb), and housework (h1bb). Within the RAI-HC individual IADLs are rated as no difficulty (0), some difficulty (1) or great difficulty (2). Scores on the IADL Capacity scale range from 0 (no difficulty) to 6 (great difficulty in all three).

In addition to the scales described above, a crosswalk of the interRAI Rehabilitation Algorithm from the interRAI CA was also used for the present study.

5.4.2.2 Clinical Assessment Protocols

Two Clinical Assessment Protocols (CAPs) from the RAI-HC were used, the Home Environment Optimization CAP and the ADL CAP. The Home Environment Optimization CAP is used to identify frail adults whose home environment has problematic features (e.g., general disrepair, unsafe flooring and rugs) and who have physical or mental conditions that exacerbate these problems or cause these problems to increase the person's risk for adverse outcomes. It is triggered for those with one or more problems in their home environment, including: lighting problem, flooring or carpeting problem, bathroom or toilet problem, kitchen problem, heating or cooling problem, significant disrepair of the home, squalid conditions; and two or more indicators of frailty, including: unable to climb stairs, less than two hours of physical activity in the last 3 days, unsteady gait, poor health, conditions or disease that make the person unstable, difficult access to home, difficult access to rooms in house, Depression Rating Scale of 3 or higher, and any of three mental-health symptoms (hallucinations, delusions or abnormal thoughts) (Morris et al., 2008).

The Activities of Daily Living CAP identifies those with a potential to improve in ADLs as well as those with ADL deficits for whom some degree of functional decline may be able to be prevented. Those who trigger the CAP to facilitate improvement in ADL performance include those who: receive at least some help in ADLs (but are not totally dependent), have a CPS score below 6,

are not end of life. In addition, individuals must have two or more of the following indicators: experiencing an acute episode or flare-up or a chronic condition, delirium, changing cognitive status, pneumonia, fall, hip fracture, receiving physical therapy, recent hospitalization, fluctuating ADLs or fluctuating care needs. The ADL CAP was modified for use in this thesis by removing the receipt of physiotherapy from the triggering criteria. Those who trigger the ADL CAP to prevent decline include those with all of the following: receive some help in ADLs (but are not totally dependent), have a CPS below 6, are not end of life and have none or only one of the indicators required to trigger the other level of the ADL CAP (facilitate improvement) (Morris et al., 2008).

5.4.3 interRAI Contact Assessment (CA)

The CA is an assessment used for screening individuals at intake to home care to determine the need for comprehensive assessment and home care services. It contains demographic, referral, and clinical information such as functional status, mental, and physical health (Hirdes et al., 2010). The CA also contains several embedded algorithms, which can be used to determine urgency of need for comprehensive assessment (assessment urgency algorithm) and home care services (rehabilitation algorithm and service urgency algorithm) (Hirdes et al., 2010). While the CA does not provide the same depth of information as the RAI-HC, it is completed for all individuals admitted to home care, and as a result it covers a broader population of home care recipients. The interRAI CA is completed in person for assessments completed in hospital settings and by telephone for individuals admitted from the community (Hirdes et al., 2010). Although there is currently no published information demonstrating the reliability and validity of the interRAI CA, many of the items are in the CA are also contained in other third-generation interRAI assessments, which have shown good reliability and validity across many different settings (Hirdes et al., 2008). Beginning in 2010, the interRAI CA was implemented at all CCACs across Ontario (Hirdes & Kehyayan, 2014).

5.4.4 Client Health Related Information System (CHRIS)

CHRIS is a web-based patient management system that is used by CCACs, which performs several administrative functions including the billing of home care services (OACCAC, n.d. a). Although administrative billing records from CCAC databases have not been formally validated for research purposes, the reliability can be assumed to be high as there are incentives on the part of both the CCAC (to pay only for those services provided) and service provider agencies (to be paid for all services that occurred) (Poss, Hirdes, Fries, McKillop, & Chase, 2008).

5.5 Case Definition of Stroke

For this thesis, individuals with stroke were identified using diagnostic information contained within the DAD. In the DAD, diagnostic information is classified using International Classification of Disease (ICD) codes 10th Canadian version (Canadian Institute for Health Information, 2011). The stroke case definition for reported by Foebel and colleagues (2013) was used to identify older adults with stroke (see Appendix E). The diagnostic codes included in the case definition were selected by a panel of clinicians based on their face validity (Foebel et al., 2013).

The reliability of ICD-10 codes for stroke has been previously evaluated by comparing coding of information abstracted from hospital charts by hospital staff with coding conducted by researchers, with excellent overall agreement (kappa=0.89) (Kokotailo & Hill, 2005)and high positive predictive values found (Kirkman, Mahattanakul, Gregson, & Mendelow, 2009; Kokotailo & Hill, 2005). However, the validity of the information recorded in patient charts, upon which these diagnostic codes are based has not been established (Kirkman & Albert, 2009). Diagnostic information contained in the DAD has shown that good reliability for both the most responsible diagnosis codes and selected other diagnostic codes contained within the hospital abstract (Canadian Institute for Health Information, 2012b). Classification of stroke based on the use of all diagnostic codes contained within the record has been found to maximize sensitivity as compared to classification based on the most responsible diagnosis alone in a study that used ICD-9 codes

(Tirschwell & Longstreth, 2002). The exclusive use of the most responsible diagnosis for stroke may also fail to identify stroke-affected individuals with a high comorbidity burden, which is particularly problematic in research on elderly populations (Meyer, Simmet, Mattle, Arnold, & Nedeltchev, 2009). For this thesis, all discharge diagnoses associated with an acute admission were included to avoid potential bias in the selection of individuals with stroke.

5.6 Study Samples

5.6.1 RAI-HC Sample

To examine factors from the RAI-HC associated with the use of rehabilitation services after a stroke, several data sources previously described were linked. Figure 3 depicts the creation of the RAI-HC sample.

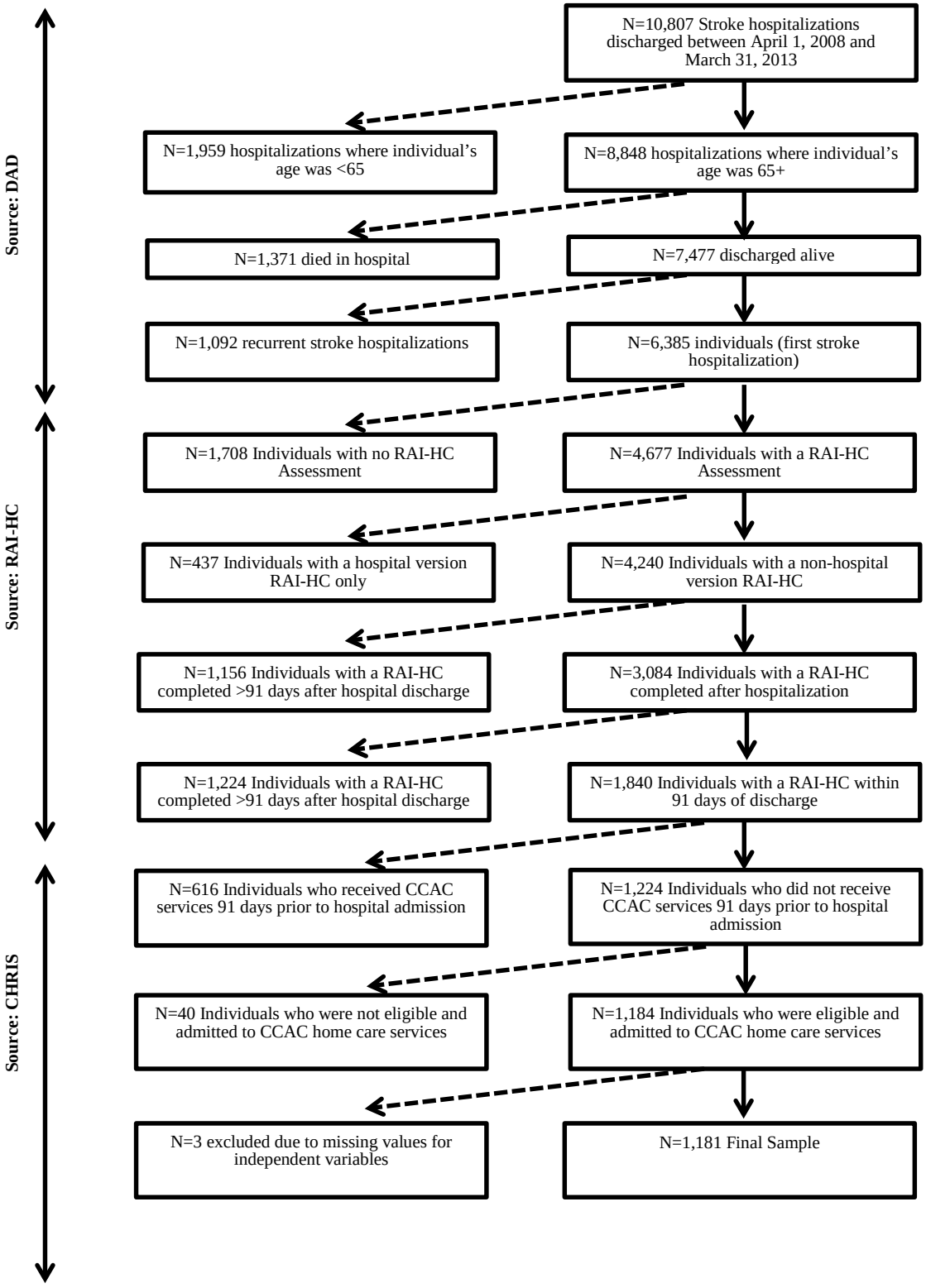
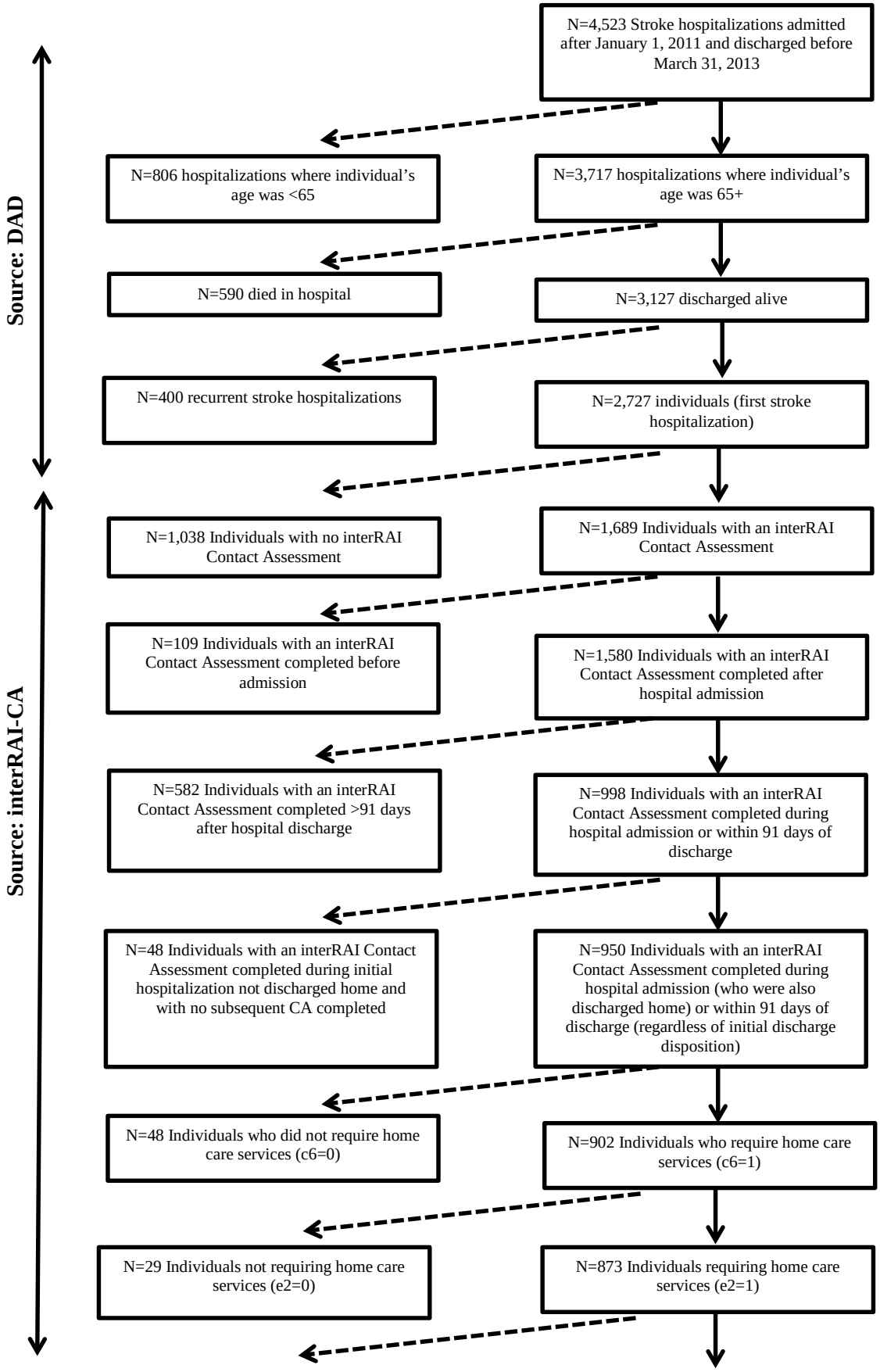


Figure 3 Overview of RAI-HC Sample Creation

DAD data were used to identify all hospital discharges between April 1, 2008 and March 31, 2013 with a diagnosis of stroke (n=10,807). DAD records were restricted to those 65+ (n=8,848) and then to records where the individual was discharged alive (n=7,477). For those with multiple stroke-related hospital admissions, the first during the study period was selected leaving n=6,385 individuals. Of these, n=4,677 individuals could be linked to a RAI-HC assessment. Individuals who only received a hospital version RAI-HC (n=437) were excluded. The hospital version RAI-HC is completed in the hospital settings only for clients who are not eligible for home care services, are unable to return to the community, and are applying for admission to LTC (Ministry of Health and Long Term Care, 2006). The sample was further restricted to individuals who had a RAI-HC completed after discharge from the index hospitalization (n=3,084) and then to those who had a RAI-HC completed within 91 days of discharge (n=1,840). Existing HNHB CCAC clients (n=616), defined as those receiving services in the 91 days prior to the index hospital admission, were also excluded resulting in n=1,224 individuals. This criterion has been used previously in a stroke population to distinguish between new and existing CCAC clients (Hall et al., 2013). Finally individuals were excluded because they were not admitted for home care services (n=40), and others were excluded due to missing values (n=3) yielding a final sample of 1,181 individuals.

5.6.2 interRAI CA Sample

To examine factors from the interRAI CA associated with the use of rehabilitation services after stroke a similar strategy to the one described above was employed. As the HNHB CCAC did not begin completing the CA until 2011, the CA sample only included individuals admitted to hospital after January 1, 2011 and discharged up until March 31, 2013. Since the CA can be completed in hospital, an admission date of January 1, 2011 was chosen to allow for all subjects to have an equal chance of being assessed. Figure 4 details the creation of the interRAI CA sample.


Source: DAD
Source: interRAI-CA
N=4,523 Stroke hospitalizations admitted after January 1, 2011 and discharged before March 31, 2013
N=806 hospitalizations where individual's age was <65
N=3,717 hospitalizations where individual's age was 65+
N=590 died in hospital
N=3,127 discharged alive
N=400 recurrent stroke hospitalizations
N=2,727 individuals (first stroke hospitalization)
N=1,038 Individuals with no interRAI Contact Assessment
N=1,689 Individuals with an interRAI Contact Assessment
N=109 Individuals with an interRAI Contact Assessment completed before admission
N=1,580 Individuals with an interRAI Contact Assessment completed after hospital admission
N=582 Individuals with an interRAI Contact Assessment completed >91 days after hospital discharge
N=998 Individuals with an interRAI Contact Assessment completed during hospital admission or within 91 days of discharge
N=48 Individuals with an interRAI Contact Assessment completed during initial hospitalization not discharged home and with no subsequent CA completed
N=950 Individuals with an interRAI Contact Assessment completed during hospital admission (who were also discharged home) or within 91 days of discharge (regardless of initial discharge disposition)
N=48 Individuals who did not require home care services (c6=0)
N=902 Individuals who require home care services (c6=1)
N=29 Individuals not requiring home care services (e2=0)
N=873 Individuals requiring home care services (e2=1)

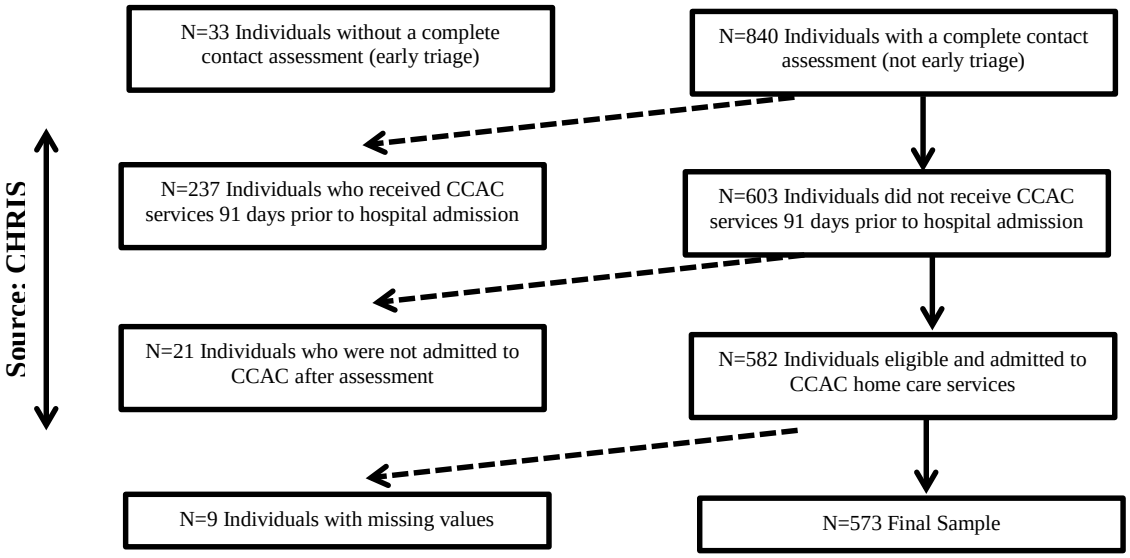


Figure 4 Overview of Contact Assessment Sample Creation

DAD data were used to identify all hospitalizations admitted after January 1, 2011 and discharged before March 31, 2013 with a diagnosis of stroke (n=4,523). DAD records were restricted to those 65+ (n=3,717) and then to records where the individual was discharged alive (n=3,127). For those with multiple stroke-related hospital admissions, the first during the study period was selected leaving 2,727 individuals. Of these, 1,689 could be linked to a Contact Assessment. The sample was further restricted individuals with a Contact Assessment completed after hospital admission (n=1,580), and then to those with a Contact Assessment completed during the hospital admission or within 91 days of discharge (n=950). Individuals who had a Contact Assessment completed during the index hospitalization, who were not discharged home, and who had no subsequent Contact Assessment completed within 91 days of discharge were excluded (n=48) as these individuals would not have been admitted to home care services. In the remaining sample, some individuals had multiple Contact Assessments completed during the follow-up period. Two different strategies were employed to select a Contact Assessment for a given individual. For those discharged home (n=496), the CA completed closest to hospital discharge was selected. For those not discharged home the CA item a10a (location of intake) was used to determine where the CA was completed (acute care vs. community). For this group, the last hospital-completed CA or first community-completed CA was selected based on the assessment reference date (e.g., if an individual had both a hospital-completed CA and a community-completed CA after discharge, the first CA completed was chosen).

Several items contained within the CA are used to trigger skip patterns during the assessment process, which result in incomplete assessments. For this study individuals with item c6 (requires home care services) = 0 (no) were excluded (n=48), as were those with e2 (services required for this person) =0 (no) (n=29). A third skip pattern resulting in incomplete Contact Assessments is the Early Triage Algorithm, which identifies patients that have an acute condition, require short term service and do not require further comprehensive assessment (OACCAC, n.d. b). Individuals with a pattern of missing values consistent with the Early Triage Algorithm were also excluded (n=33) resulting in 840 individuals. Similar to the RAI-HC sample, the sample was further restricted to new home care

clients, defined as those not receiving services in the 91 days prior to their index hospital admission (n=603). Finally, individuals who were not admitted to home care (n=21) and those with missing values for independent variables used in the study (n=9) were also excluded resulting in a final sample of 573 individuals.

5.7 Comparison Groups

To create a profile of older stroke survivors receiving home care, two comparison groups were created. For the RAI-HC stroke profile the comparison group included all individuals 65+ assessed by the HNHB CCAC between July 1, 2008 and March 31, 2013 who were admitted to home care services. Individuals with a stroke diagnosis on the RAI-HC (j1a), a hospital version RAI-HC, a previous stroke-related hospitalization (defined using DAD records with the stroke case definition applied), or who were included in the RAI-HC stroke sample were excluded leaving a comparison group of 37,467 individuals. For the interRAI CA stroke profile, the comparison group included all individuals 65+ assessed by the HNHB CCAC between January 1, 2011 and March 31, 2013. For those with multiple assessments, only the first assessment was chosen. Individuals with a previous stroke-related hospitalization (defined using DAD records with the stroke case definition applied), an incomplete CA (early triage or not requiring home care services), or who appeared in the CA stroke sample were excluded. After these exclusion criteria were applied, free text diagnosis fields from the CA (d6a1, d6a2, d6a3, d6a4) were searched to identify any other individuals with stroke, who were also excluded resulting in a final comparison group of 25,713 individuals.

5.8 Study Variables

5.8.1 Independent Variables

Independent variables were chosen based on existing literature and the Andersen-Newman Model, with additional variables included for exploratory purposes. Most independent variables came from interRAI assessments with others from DAD and CHRIS databases.

5.8.1.1 RAI-HC

Predisposing variables included: age, calculated from birth date (bb2a) and assessment date (a1) and collapsed into a categorical variable (65-74, 75-84, 85+); sex (bb1), marital status (bb4), collapsed into a binary variable (currently married vs. not); language (bb5a), which was coded as a binary variable (English vs. other language); lives alone, determined using living arrangement at referral (cc6) which was coded as alone vs. not; and education (bb6), collapsed into a binary variable (less than high school or greater than high school).

Enabling variables from the RAI-HC included: caregiver distress, a combination of two RAI-HC items into a binary variable (caregiver is unable to continue in caring activities (g2a) and primary caregiver expresses feelings of distress, anger or depression (g2c)) and was coded as a present if either was true; urban or rural residence, which was determined from Canada Post delivery areas using the second character of the individual's postal code (aa4) with 0 representing a rural postal code and 1-9 representing urban postal codes (Statistics Canada, 2007); hours of informal care per week, a sum of weekday (g3a) and weekend (g3b) hours that was converted into a categorical variable (0-20 hours/week, 21-40 hours/week, 40+ hours/week); and primary caregiver co-resides (g1ea), re-coded as 1 if the response was yes. Insurance status was also considered as a potential independent variable based on the Andersen-Newman model, but was not included as provincial funding covered 100% of the sample. Two variables from CHRIS/DAD were also included as enabling variables, year of hospital discharge (from DAD) was included to examine temporal variation in the use of services and CCAC branch (from CHRIS referral information) was included to examine potential geographical or practice pattern differences. CCAC branches were de-identified at the request of the HNHB CCAC.

Several need variables from the RAI-HC were examined including variables that were indicative of the severity of stroke-related disability. Communication items included: difficulty making self-understood (expression – c2) which was re-coded as a categorical variable with 3 levels: no difficulty (0 - understood), mild difficulty (1 - usually understood or 2 - often understood) and moderate/severe difficulty (3 – sometimes understood or 4 – rarely/never understood); ability to

understand others (comprehension – c3) which was re-coded as a categorical variable with 3 levels: no difficulty (0 - understood), mild difficulty (1 - usually understood or 2 - often understood) and moderate/severe difficulty (3 – sometimes understood or 4 – rarely/never understood); communication decline in the past 90 days (c4). Difficulty with swallowing (l3) was re-coded as a categorical variable with 3 levels: normal (0), mild difficulty (1 – requires modification to swallow solids or 2 – requires modification to swallow solids and liquids) and moderate/severe difficulty (3 – combined oral and tube feeding or 4 – no oral intake), and was included as a potential marker of stroke severity. The presence of hemiplegia/hemiparesis (j1j) was also included as it is related to stroke severity. TIA was determined using the DAD (where individuals who had a TIA diagnosis and no stroke diagnosis, were classified as TIA only). Those who only had a TIA as compared to those who had a stroke were thought to be more likely to receive rehabilitation because of greater stroke severity.

Cognition was included as a potential predictor of rehabilitation use. Cognitive impairment is common after stroke, and may be one focus of OT interventions (Hoffmann, Bennett, Koh, & McKenna, 2010). Alternatively, the presence of cognitive impairment may negatively affect rehabilitation participation by affecting one's ability to understand or remember instructions or to independently carry out a rehabilitation regimen (Skidmore et al., 2010). Cognition was measured using the CPS, which was collapsed into three levels: no cognitive impairment (0), mild cognitive impairment (1-2), and moderate to severe cognitive impairment (3-6). Post-Stroke Depression might also negatively affect rehabilitation participation through impairment in executive functioning, which may limit the ability to internalize and carry out rehabilitation instructions in a consistent manner (Skidmore et al., 2010). Depressive symptoms were measured using the DRS, which was re-coded as a categorical variable with 3 levels: no mood symptoms (0), some mood symptoms present (1-2) and signs of possible depression (3 or higher). Mood decline over the past 90 days (e2) was also included as an independent variable to examine more recent changes in mood symptoms.

Pain is a complication of stroke that can manifest in a variety of ways in including hemiplegic shoulder pain and central post-stroke pain syndrome. Since treating pain can be a focus of OT and PT interventions, the presence of pain may be associated with the use of these services (Gilmore, Spaulding, & Vandervoort, 2004). The interRAI Pain Scale was used to assess pain and was collapsed into three levels: no pain (0), mild to moderate pain (1-2), and severe and frequent pain (3). Two variables relating to the individual's perceptions of their health status were examined; poor self-rated health (k8a) and client believes they are capable of increased functional independence (h7a) were both included as independent variables. Good prospects for recovery from current disease or conditions (h7c), which represents the assessor's perspective and caregiver believes person is capable of improved function in ADLs, IADLs, and/or mobility (h7b) were also included as need variables.

Other post-stroke complications examined included bowel and bladder incontinence. Both were coded as binary variables with values of 2 or higher used to indicate the presence of incontinence. The CHESS Scale, which was re-coded as a categorical variable with 3 levels: no health instability (0), mild health instability (1 – minimal health instability or 2 – low health instability) and moderate/severe health instability (3 – moderate health instability, 4 – high health instability, or 5 – very high health instability) was also included as a measure of frailty and health instability.

The RAI-HC contains several measures of functional status, which were included as candidate independent variables. The ADL Hierarchy Scale, re-coded as a categorical variable with 3 levels: independent (0), minimal difficulty (1 – supervision requires or 2 – limited impairment) and moderate/severe difficulty (3 – extensive assistance required or greater), was used to measure the degree of ADL impairment. The IADL capacity scale, re-coded as a categorical variable with 4 levels: no difficulty (0), mild difficulty (1 – some difficulty in one but not difficulty in the other two or 2 – some difficulty in two but not difficulty in the other one), moderate difficulty (3 – some difficulty in all three) and severe difficulty (5 – great difficulty in two or 6 – great difficulty in all three), was used to measure difficulty with IADLs. ADL decline in the past 90 days (h3) was also included to measure recent functional decline. Other measures related to balance and walking were

examined including: one or more falls in the past 90 days, re-coded as binary based on the number of falls (k5); unsteady gait (k6a); difficulty with stairs (h5); uses an assistive device for outdoor locomotion (h4b), re-coded as a categorical variable: no assistive device (0), assistive device (1 – cane, 2 – walker/crutch, 3 – scooter, 4 – wheelchair), and outdoor locomotion did not occur in the past 3 days (8); and whether or not the person left the house in a typical week in the past 30 days, coded as a binary variable using the stamina item (h6a): did not leave the house (3 – no days) or left the house (0 – every day, 1 – 2-6 days/week, 2 – 1 day a week). Additionally a modified version of the ADL Clinical Assessment Protocol (with use of physiotherapy in the past 7 days excluded from the triggering criteria) and a crosswalk of the Rehabilitation Algorithm from the interRAI CA created using RAI-HC items were used to measure ADL impairment and need for rehabilitation services.

Other independent variables included: dyspnea (k3e), which was thought to affect exercise tolerance, and the Home Environment Optimization CAP, which may identify individuals who could benefit from home modifications. Several other conditions were included as potential independent variables, including: heart Failure (j1b), coronary artery disease (j1c), hypertension (j1d), diabetes (j1y), emphysema/COPD/asthma (j1z), Alzheimer's disease or related dementias (ADRD) (coded as present if j1g or j1h were present) and fracture (coded as present if j1n or j1o were present). Finally, a count of these and other conditions recorded in the RAI-HC, re-coded as a categorical variable: 0 conditions, 1-2 conditions and 3 or more conditions was included as an independent variable to measure comorbidity burden.

5.8.1.2 interRAI CA

For the interRAI CA, predisposing variables included: age, calculated from birth date (a3) and assessment date (b1) and collapsed into a categorical variable (65-74, 75-84, 85+); sex (a2); language (a7), which was coded as a binary variable (English vs. other language); lives alone, determined using expected living arrangement during service provision (b3), which was recoded as a binary variable (alone vs. not).

Enabling variables included: location of intake (a10a), re-coded into hospital/ED (2 – hospital inpatient, 3 – emergency department) or community (1); referral to continue or initiate rehabilitation (b2b); primary caregiver co-resides (d19ba), which was re-coded as a binary variable (1 – yes, 6 months or less or 2 – yes, more than 6 months were used to indicate that the caregiver lived with the patient); primary caregiver distress (d20b); urban or rural residence, which was determined using the second character of the individual's postal code (aa4) as described in the previous section) and year of hospital discharge, determined using the discharge date from the DAD.

Need variables included: poor self-reported health (c4), coded as a categorical variable, including could not/would not respond (8), poor (3) and fair/good/excellent (0,1,2); presence of mood symptoms in the past 3 days (d3); requires supervision or assistance with ADLs including: bathing (c2a), personal hygiene (c2b), dressing (c2c), locomotion (c2d); ADL decline in the past 90 days, re-coded as a binary variable from change in ADL status (c5); number of ADL impairments, created using a count of the four ADL items listed above; requires supervision or assistance with IADLs including: meal preparation (d4a), housework (d4b), medication management (d4c) and stairs (d4d); number of IADL impairments including, created using a count of the four IADL items; ability to understand others (comprehension – c3) which was re-coded as a categorical variable with 3 levels: no difficulty (0 - understood), mild difficulty (1 - usually understood or 2 - often understood) and moderate/severe difficulty (3 – sometimes understood or 4 – rarely/never understood); cognitive decline in the past 90 days, re-coded as a binary variable using change in decision-making in the past 90 days (d1); severe and frequent pain, which was a combination of pain frequency (d9a) and pain intensity (d9b); one or more falls in the past 90 days (d7); unstable health (c5a); dyspnea (d3); Rehabilitation Algorithm and TIA only, coded as a binary variable using DAD data.

5.8.2 Dependent Variables

The dependent variables for both studies were the use of PT, use of OT, and number of rehabilitation visits (PT or OT) in the 91-day period following assessment. The use of PT and OT

services were identified using billing codes, with visit dates from service records being used to identify when the visit occurred with respect to the assessment date. Individuals were classified as receiving PT services if they received any PT visits during the follow-up period, and the same approach was taken for those who received OT. For bivariate and logistic regression analysis individuals were coded as '0' if they did not receive services (PT, OT) and '1' if they did. For rehabilitation services, individuals were grouped into categories based on the number of PT/OT visits they received due to the high proportion of individuals receiving either of these services in both samples. Three categories were used: 0 visits, 1-4 visits, and 5 or more visits. Categories for the number of PT/OT visits were created based on an examination of the percentile distribution for the number of PT/OT visits for the RAI-HC and interRAI CA samples, with 5 visits corresponding to the 75th percentile for the number of visits within both samples.

5.9 Missing Values

For both the RAI-HC sample and interRAI CA sample, the distribution of all independent variables was examined to identify any missing values. For the RAI-HC sample, n=3 observations were missing values for living arrangement at referral (cc6). For the CA sample, n=1 observation did not specify the location of intake as hospital or community and n=8 observations were missing values for pain intensity (d9b). Individuals with missing values for these variables were excluded from the analysis through listwise deletion. For other variables where non-response was a valid response, it was analyzed as a separate category. This was done for two variables from the RAI-HC: stair use (h5) and mode of outdoor locomotion (h4b), and two variables from the CA which had an option for "could not/would not respond": presence of mood symptoms (d3) and self-rated health (c4). For two other variables in the CA, change in cognition and change in ADL status, "uncertain" was a response option. This response was selected for 7.2% (n=41) of the sample in response to the change in decision-making item and 3.8% (n=22) of the sample for the change in ADL status item. Since these variables were re-coded as binary, based on the presence of decline, values with an "uncertain"

response were re-coded as 0 (no decline) so as not to overestimate any potential effects of ADL and cognitive decline, respectively.

5.10 Statistical Analysis

All statistical analysis was done using SAS version 9.4 (SAS Institute Inc.). Sample characteristics are reported using frequencies and percentages for categorical variables, mean and standard deviation for continuous variables Chi-square tests were used to compare the frequency distributions for characteristics of individuals with stroke to the comparison group. Similarly, for the use of PT, OT, and number of PT/OT visits, differences in independent variables were compared using chi-square tests to compare the proportion of individuals receiving services across different levels of the independent variable (e.g. across age groups). For both sets of analyses (stroke profile and use of rehabilitation services) a p-value of less than 0.05 was used as a threshold for statistical significance. For service use, unadjusted odds ratios were also reported with corresponding 95% confidence limits, to provide an estimate of effect size.

Following bivariate analysis for OT, PT, and the number of PT/OT visits; multiple logistic regression models were developed, using binary logistic regression models for the PT and OT and ordinal logistic regression for the number of PT/OT visits. The ordinal logistic regression model is an extension of the binary logistic model that is used where the response variable consists of ordered categories (Brant, 1990). For both types of multivariate models, variables were considered for inclusion if they had a significance level below p=0.05 in the bivariate analysis. For PT and OT separate models were constructed for predisposing, enabling and need variables first in order to test the relative contribution of each class of independent variables, followed by a fourth model combining all three classes of variables. Automatic methods, including forward selection, backward elimination, stepwise selection, and best subsets regression (where appropriate) were explored at the initial stages of model building; however, final models were conducted manually to avoid order of entry/deletion effects. Model construction was done while paying attention to potential confounding

and interaction effects between variables, with separate models constructed where collinearity was thought to be a potential issue. For the CA sample, final models for all three dependent variables were stratified by referral for rehabilitation. For each dependent variable, the original unstratified model was compared to a reduced model (removing any effects from the full model that were not statistically significant in the strata), and an expanded model (which included additional covariates, as appropriate to identify factors that were unique to that strata).

5.11 Model Diagnostics

Final models were examined to assess calibration, discrimination and model assumptions. For binary logistic regression the Hosmer-Lemeshow goodness of fit test was used to assess the goodness of fit of final models. The Hosmer-Lemeshow goodness of fit test groups observed and predicted values based on probability and compares them (Hosmer & Lemeshow, 2000). Values greater than 0.05 were used to indicate a model with adequate fit. For ordinal logistic regression the Deviance and Pearson goodness of fit tests were used to assess model fit with a p-value greater than 0.05 used to indicate adequate fit. For both binary and ordinal logistic regression models, the c-statistic was used to compare the strength of candidate models. The c-statistic is a measure of the area under the Receiver Operating Characteristic Curve that provides a measure of discrimination for the model (Hosmer & Lemeshow, 2000). Hosmer & Lemeshow (2000) suggest guidelines for interpreting the c-statistic, where a value of 0.50 suggests discrimination no better than chance, values of 0.70 to 0.79 are considered acceptable, values of 0.80 to 0.89 are considered excellent and those above 0.90 are considered outstanding.

A key assumption of the model used in ordinal logistic regression is that the odds are proportional, meaning that the relationship between each pair of response levels is the same. This assumption was tested using the score test, where the assumption is valid if the p-value for the score test is >0.05. Models that did not satisfy the proportional odds assumption were re-run as partial proportional odds models which allow for different parameters for each cumulative logit for variables

that do not satisfy the assumption (Stokes, Davis, & Koch, 2012). For binary logistic regression, diagnostic plots were examined to identify potential outliers and violations of model assumptions.

Chapter 6
Results

All results tables are presented at the end of this chapter. Parameter estimates and standard errors for all multivariate models can be found in Appendix F.

6.1 Sample Description

6.1.1 RAI-HC Sample Description

Characteristics of the RAI-HC assessed sample are presented in Table 3. The RAI-HC sample included 1,181 individuals 65 years of age or older receiving services from the HNHB CCAC after stroke. The mean age was 80.8 years (SD=7.2), 57.1% were female, and 45.4% were married. Most individuals spoke English and resided in an urban area. About two-thirds (68.6%) had some degree of cognitive impairment and 41.8% were impaired in ADLs. The prevalence of selected co-morbid conditions was as follows: ADRD (16.9%; N=199), diabetes (26.4%), coronary artery disease (31.2%), hypertension (71%;) and hemiplegia/hemiparesis (6.4%). Prior to RAI-HC assessment, individuals were hospitalized with a mean length of stay of 15.5 days (SD=18.9). Following hospitalization, 47.8% were discharged directly home, 45.3% were discharged to a continuing care setting, 5.6% were discharged to another acute care setting (including rehabilitation) and 1.3% were discharged elsewhere. After RAI-HC assessment, 57.8% received any OT services, 41.5% received any PT services and 74.9% received any PT/OT services within 91 days. Those receiving OT had a mean of 2.4 visits (SD=1.6), those receiving PT had a mean of 3.9 visits (SD=2.6) and those receiving PT/OT had a mean of 4.0 visits (SD=3.2).

6.1.2 interRAI CA Sample Description

Characteristics of the interRAI CA assessed sample of older adults receiving home care services from the HNHB CCAC after stroke are presented in Table 4. The interRAI CA sample

included 573 individuals with a mean age of 80 years (SD = 7.6), 53.1% of who were female. English was the dominant language and most individuals resided in an urban area. The most common setting for assessment with the CA was in hospital, with 87.8% of the sample being assessed in a hospital setting. Supervision or assistance with ADLs was required by 71.5% of individuals, and 40.5% required assistance making daily decisions. Following the stroke-related hospitalization, 49.6% were discharged directly home, 42.6% were discharged to a continuing care setting and 7.5% were discharged to another acute care setting. After assessment with the CA, 68.2% received any OT services, 39.6% received any PT services, and 83.6% received any PT/OT services. Those receiving OT had a mean of 2.9 visits (SD=1.6), those receiving PT had a mean of 4.2 visits (SD=2.3) and those receiving PT/OT had a mean of 4.3 visits (SD=3.1).

6.2 Profile of Older Stroke Survivors

6.2.1 RAI-HC Stroke Profile

The RAI-HC sample was compared to a sample of older adults without stroke receiving home care services from the HNHB CCAC. The results are shown in Table 5. Compared to those without stroke, older adults with stroke were significantly younger, more likely to be male and married. Those with stroke were also more likely to receive a higher amount of informal care and to have a caregiver who believes that they are capable of improved function. Despite the higher level of informal care provided to those with stroke, the prevalence of caregiver distress did not differ significantly. Stroke survivors were less likely to report that their health was poor and more likely to believe they could improve in function. Difficulty with communication and a recent communication decline were significantly more prevalent among the stroke population. A recent mood decline and mood symptoms indicative of potential depression were also more prevalent among this population, as was the prevalence of cognitive impairment and health instability. Compared to those without stroke, the prevalence of pain was lower.

As compared to the general older home care population, those with stroke tended to have greater functional impairment. Recent ADL decline, difficulty with IADLs and ADL impairment were more prevalent among those with stroke. Stroke survivors were also significantly more likely to have unsteady gait, require assistance with stairs, use an assistive device for outdoor locomotion and were less likely to have left the house recently. Stroke survivors also had a significantly higher prevalence of bowel incontinence. Despite a higher functional impairment, the prevalence of falls in the past 90 days did not differ between groups. Higher scores on the Rehabilitation Algorithm, indicating greater need for rehabilitation services, were also observed among those with stroke. Certain co-morbid conditions were more common among those with stroke including: coronary artery disease, hypertension and hemiplegia/hemiparesis. Cardio-respiratory conditions, including heart failure and emphysema/COPD/asthma were significantly less prevalent among those with stroke. Overall, those with stroke had a significantly lower comorbidity burden when compared to the general older home care population.

6.2.2 interRAI CA Stroke Profile

The sample of older stroke survivors assessed with the interRAI CA was compared to a sample of older adults without stroke who were assessed with the interRAI CA. The results are shown in Table 6.

Older stroke survivors assessed with the CA had a similar age distribution compared to those without stroke, although stroke survivors were more likely to be male and less likely to live alone. Those with stroke were also significantly more likely to be referred for rehabilitation and to have been assessed in a hospital setting.

In terms of clinical characteristics, significant differences in mood and self-reported health were observed. Stroke survivors were more likely to report mood symptoms and less likely to report poor self-reported health, although the rate of non-response across groups for both items was fairly high (20%). Stroke survivors tended to have greater impairment in ADLs and IADLs as compared to

the general home care population. A significantly greater proportion of individuals in the stroke group required supervision or assistance with ADLs including: bathing; personal hygiene; dressing lower body; and locomotion. Survivors of stroke were also more likely to have experienced a recent decline in their ability to carry out ADLs independently. Those with stroke were also significantly more likely to experience difficulty with IADLs including: meal preparation, housework, medication management, and stair use. Those with stroke also reported a significantly higher prevalence of falls in the past 90 days.

Cognitive impairment was also more prevalent among stroke survivors assessed with the CA. Stroke survivors were more likely to have some difficulty with comprehension, twice as likely to require supervision or assistance with making daily decisions, and had a significantly higher prevalence of recent cognitive decline. For other health indicators, those with stroke had a lower prevalence of severe and frequent pain and dyspnea but were significantly more likely to have unstable health. Those with stroke also tended to have higher scores on the rehabilitation algorithm, indicating a greater need for rehabilitation services.

6.3 Bivariate Analysis

6.3.1 RAI-HC Bivariate Analysis

Relationships between predisposing, enabling and need characteristics and the use of services were examined at the bivariate level for individuals assessed with the RAI-HC.

6.3.1.1 Use of OT After RAI-HC Assessment

Bivariate results examining the relationships between independent variables and the use of OT services within 91 days of RAI-HC assessment are displayed in Table 7.At the bivariate level, predisposing characteristics including language and education were associated with OT use. Non-English language (OR: 1.50; 95% CI: 1.08-2.07) was associated with increased odds of receiving OT, while higher education was associated with significantly decreased odds (OR: 0.78; 95% CI: 0.61-0.99) of receiving OT.

Enabling variables associated with the use of OT included: caregiver distress, CCAC branch, year of hospital discharge and the amount of informal care provided. Individuals with distressed caregivers were 1.57 times more likely (95% CI: 1.17-2.11) to receive OT compared to those without distressed caregivers. There was significant variation in the likelihood of receiving services by CCAC branch and year of hospital discharge at the bivariate level. Those receiving a moderate amount of informal care (20-40 hours/week) were more likely to receive OT services than those receiving 0-20 hours/week; however those receiving more than 40 hours/week did not differ significantly from the 0-20 hour/week group.

Several need variables were associated with the use of OT at a bivariate level, including comprehension and swallowing difficulties. Individuals with a DRS score indicative of potential depression (3+) and mild-moderate pain (1-2) were also significantly more likely to receive OT. Several variables measuring functional status including triggering the ADL CAP to facilitate improvement of (OR: 1.63; 95% CI: 1.28-2.08), ADL Hierarchy score of 3 or greater (OR: 3.29; 95% CI: 2.25 – 4.82), previous falls (OR: 1.32; 95% CI: 1.05-1.68), unsteady gait (OR: 1.74; 95% CI: 1.37-2.22) and an IADL Capacity Scale score of 5-6 (OR: 2.47; 95% CI: 1.16-5.26) were associated with significantly increased likelihood of receiving OT. There was an overall significant effect of the Rehabilitation Algorithm crosswalk, with higher scores on the algorithm corresponding to a greater proportion of individuals receiving OT. Requiring assistance with stairs (or not using stairs) and using an assistive device for outdoor locomotion were both significantly associated with an increased likelihood of receiving OT. In contrast, individuals who reported leaving their house in a typical week were significantly less likely to receive OT. Other variables associated with increased likelihood of receiving OT included: the Home Environment Optimization CAP (OR: 2.54; 95% CI: 1.46-4.42), bowel incontinence (OR: 1.62; 95% CI: 1.16-2.28), and fractures (OR: 1.87; 95% CI: 1.08-3.23).

6.3.1.2 Use of PT After RAI-HC Assessment

Bivariate results examining the relationships between predisposing, enabling and need variables and the use of OT services within 91 days of RAI-HC assessment are displayed in Table 7. For predisposing characteristics, being married had an increased odds of receiving PT (OR: 1.77; 95% CI: 1.41-2.24) while living alone was associated with decreased odds of receiving PT (OR: 0.71; 95% CI: 0.55-0.92).

With respect to enabling characteristics, individuals who had a co-residing caregiver (OR: 1.70; 95% CI: 1.34-2.16) and those who received more informal care were both significantly more likely to receive PT. Similar to OT, there was a significant overall variation in the proportion of individuals receiving PT by CCAC branch.

Among need variables self-reported health and individual perceptions of the potential for functional improvement were both positively associated with the use of physiotherapy services after stroke. Individuals who reported that their health was poor (OR: 1.40; 95% CI: 1.00-1.97) and those who believed that they were capable of increased function (OR: 1.35; 95% CI: 1.07-1.71) were significantly more likely to receive PT. In contrast, recent communication decline and cognitive impairment (CPS score, ADRD diagnosis) were associated with significantly lower likelihood of receiving PT services. Several variables measuring aspects of functional status were positively associated with the use of PT services. There was an overall significant association between the rehabilitation algorithm crosswalk and the use of PT services, with increasing levels of the algorithm corresponding to greater proportions of individuals receiving PT services. The presence of unsteady gait was associated with increased odds of receiving PT (OR: 2.13; 95% CI: 1.65-2.75). Individuals who had difficulty with stairs (OR: 2.46; 95% CI: 1.65-2.75) and those who did not use stairs (OR: 1.65; 95% CI: 1.25-2.19) were both more likely to receive PT. Similarly, those requiring an assistive device for outdoor locomotion (OR: 2.29; 95% CI: 1.66-3.16) and those for whom outdoor

locomotion did not occur (OR: 2.44; 95% CI: 1.60-3.72) were significantly more likely to use PT services.

6.3.1.3 Use of PT/OT Services After RAI-HC Assessment

Results examining relationships between independent variables and the number of rehabilitation visits, categorized as none, 1-4 visits and 5 or more visits are displayed in Table 8. Predisposing variables significantly associated with the number of rehabilitation visits received included marital status, language and living arrangement. Being married and speaking a language other than English were positively associated with the amount of rehabilitations services received, while living alone was associated with a decrease in the proportion of individuals receiving a higher amount of PT/OT visits.

Enabling variables significantly associated with the number of PT/OT visits included a co-residing caregiver, CCAC branch, and amount of informal care provided. There was significant variation by CCAC branch in the proportion of individuals receiving high amount of PT/OT visits. The presence of a co-residing caregiver, hours of informal care provided per week and caregiver's beliefs that function could improve were all associated with increased PT/OT utilization.

For need variables, both self-perceived (client believes they are capable of increased functional independence) and evaluated functional improvement potential (good prospects for functional improvement, caregiver believes function can improve) were associated with receiving a greater number of PT/OT visits. Several indicators of functional status were associated with an increased number of PT/OT visits received by stroke survivors including: recent ADL decline, ADL hierarchy scale score, triggering the ADL CAP, IADL Capacity scale score, previous falls, unsteady gait, Rehabilitation Algorithm crosswalk, difficulty with stairs and requiring an assistive device for outdoor locomotion. In contrast, those who reported leaving the house in the past week tended to receive a lower number of PT/OT visits; 23.6% (N=226) of those who left the house received 5+ PT/OT visits as compared to 33% (N=74) of those who were housebound. Other indicators associated

with the number of PT/OT visits included the Home Environment Optimization CAP, bowel incontinence and the presence of an ADRD diagnosis. Individuals who triggered the Home Environment optimization CAP and those who had bowel incontinence were significantly more likely to receive a greater number of PT/OT visits. An ADRD diagnosis significantly decreased the likelihood that an individual would receive a high volume of PT/OT services.

6.3.2 interRAI CA Bivariate Analysis

Relationships between predisposing, enabling and need characteristics and the use of rehabilitation services were examined at the bivariate level for individuals assessed with the interRAI CA.

6.3.2.1 Use of OT Services After interRAI CA Assessment

Bivariate results examining the relationships between predisposing, enabling and need variables and the use of OT services within 91 days of interRAI CA assessment are displayed in Table 9. Predisposing variables associated with the use of OT included sex and language. Males were significantly less likely to receive OT services (OR: 0.65; 95% CI: 0.45 – 0.92), while those who did not speak English were 2.93 times (95% CI: 1.29-6.66) more likely to receive OT.

The only enabling characteristic associated with the use of OT at a bivariate level was the location of intake. Community intakes were 0.34 times less likely (95% CI: 0.20-0.56) to receive OT services than those assess with the CA in hospital settings.

Need variables associated with the use of OT were predominately those related to functional status. Recent ADL decline (OR: 1.70; 95% CI: 1.16-2.51), impairment in bathing (OR: 1.75; 95% CI: 1.21-2.53), requiring assistance with housework (OR: 1.75; 95% CI: 1.02-3.02) and meal preparation (OR: 1.65; 95% CI: 1.05-2.59) were all significantly associated with receipt of OT. The Rehabilitation Algorithm had an overall significant association with the use of OT services. Other health indicators associated with increased use of OT services included unstable health (OR: 1.45; 95% CI: 1.02-2.07) and cognitive decline (OR: 1.60; 95% CI: 1.08-2.37).

6.3.2.2 Use of PT After interRAI CA Assessment

Bivariate results examining the relationships between predisposing, enabling and need variables and the use of PT services following interRAI CA assessment are displayed in Table 9. No predisposing variables were significantly associated with the use of PT at a bivariate level. With respect to enabling characteristics, referral for rehabilitation (OR: 2.85; 95% CI: 1.98-4.09) and having a co-residing caregiver (OR: 2.25; 95% CI: 1.57-3.21) significantly increased the likelihood of receiving PT.

Need variables associated with the use of PT included**:** difficulty with locomotion (OR: 1.82; 95% CI: 1.29-2.56), difficulty with stairs (OR: 1.86; 95% CI: 1.29-2.69), and recent ADL decline (OR: 2.71; 95% CI: 1.78-4.13); all of which increased the likelihood of receiving PT services. In contrast, those with cognitive impairment were significantly less likely (OR: 0.67; 95% CI: 0.48-0.95) to receive PT services. The Rehabilitation Algorithm was also significantly associated with the use of PT services overall, with a trend towards higher levels of the algorithm being associated with a greater proportion of individuals receiving services.

6.3.2.3 Use of PT/OT Services After interRAI CA Assessment

Results examining relationships between independent variables and the number of PT/OT visits, categorized as none, 1-4 visits and 5 or more visits are presented in Table 10. No predisposing variables were significantly associated with the amount of PT/OT services.

Enabling characteristics associated with the amount of PT/OT received included location of intake, referral to continue or initiate rehabilitation and year of hospital discharge. The presence of a referral to continue or initiate rehabilitation was associated with receiving more PT/OT visits, while being assessed in the community was associated with a receiving a lower number of PT/OT visits. Year of discharge was also associated with the amount of rehabilitation received. Individuals discharged in more recent years were more likely to receive a greater number of PT/OT visits.

Several need variables were associated with the number of PT/OT visits. Self-reported health had a significant association with the amount of PT/OT received, with those with good health being more likely to receive any PT/OT as compared to those with poor health and those who could not/would not respond. Impairment in ADLs (including: bathing, personal hygiene, locomotion and dressing) was associated with receiving a greater number of PT/OT visits. Recent ADL decline was also positively associated with the number of PT/OT visits. There was a significant overall effect of the Rehabilitation Algorithm, with higher levels of the algorithm corresponding to a greater percentage of individuals receiving 5+ PT/OT visits. Those that had a TIA only were less likely to receive a greater number of PT/OT visits.

6.4 Binary Logistic Regression Results

6.4.1 RAI-HC Logistic Regression

Binary logistic regression was used to examine associations between the use of any OT or services after RAI-HC assessment. Separate models were tested for predisposing, enabling and need variables as well as a final model incorporating all independent variables.

6.4.1.1 Models Predicting the Use of OT After RAI-HC Assessment

Table 11 presents the final logistic regression models examining the use of OT after RAI-HC assessment. The only variable significantly associated with the use of OT in the predisposing only model was language; individuals who did not speak English were 1.50 times (95% CI: 1.08 – 2.07) more likely to receive OT.

The final model with enabling variables consisted of CCAC branch and caregiver distress. There was statistically significant variation in the odds of receiving OT according to CCAC branch. The presence of caregiver distress (OR: 1.53; 95% CI: 1.13-2.06) was associated with significantly increased odds of receiving OT.

In the final model containing only need variables, an ADL Hierarchy Scale of 3 or greater was associated with 2.59 greater odds (95% CI: 1.74 – 3.86) of receiving OT. Individuals with unsteady gait (OR: 1.46; 95% CI: 1.13 – 3.83) and those who triggered the Home Environment Optimization CAP (OR: 2.17; 95% CI: 1.23 – 3.83) were also more likely to receive OT services after controlling for the influence of other variables in the model. Stair use was another significant predictor of OT use, individuals who were dependent (OR: 1.44; 95% CI: 1.03 – 2.01) and those who did not use stairs (OR: 1.60; 95% CI: 1.19 – 2.13) were significantly more likely to receive OT. The need only model had the highest c-statistic of the three models (c=0.64).

After controlling for need-related variables language, caregiver distress was no longer an independent predictor of OT use. Despite adjustment for need variables, there was still statistically significant variation in the likelihood of receiving OT by CCAC branch. ADL Hierarchy score, unsteady gait, difficulty with stair use and the Home Environment Optimization CAP remained in the final model, and were all associated with increased odds of receiving OT.

6.4.1.2 Models Predicting the Use of PT After RAI-HC Assessment

Table 12 presents the logistic regression models examining the use of PT. The only predisposing variable that remained significantly associated with the use of PT in the final model was marital status. Stroke survivors who were currently married were 1.77 times more likely (95% CI: 1.40 – 2.24) than those who were not married to receive PT services following stroke.

In the final enabling only model, there was statistically significant variation in the likelihood of receiving PT services according to CCAC branch after adjusting for difference in informal care. Those who had a co-residing caregiver and received higher hours of informal care were significantly more likely to receive PT services.

In the final model containing need variables, variables related to cognitive impairment were associated with decreased odds of receiving PT. Those with an ADRD diagnosis were 0.54 times less likely (95% CI: 0.37 – 0.77) to receive PT services. After controlling for the presence of an ADRD

diagnosis, cognitive impairment was also associated with decreased odds. In contrast, those with: unsteady gait (OR: 1.98; 95% CI: 1.51 – 2.59), difficulty with stairs (OR: 2.23; 95% CI: 1.59 – 3.12) and who did not use stairs (OR: 1.54; 95% CI: 1.15 – 2.59) were significantly more likely to receive PT. The need only model was the best individual model with a c-statistic of 0.65, although it was comparable to the enabling only model (c=0.63).

In the full model consisting of all variables, being married remained positively associated with the use of PT services after controlling for the influence of other variables. CCAC branch and the amount of informal care were also independently associated with PT in the final model. Having a co-residing caregiver was not associated with the use of PT after controlling for marital status. All need variables from the previous model remained in the final model (ADRD, CPS, unsteady gait and stair use).

6.4.2 interRAI CA Logistic Regression

Binary logistic regression was used to examine associations between independent variables and the use of any OT services after assessment with the interRAI Contact Assessment. Separate models were developed for predisposing, enabling and need variables as well as a final model incorporating all independent variables.

6.4.2.1 Models Predicting the Use of OT After interRAI CA Assessment

Table 13 contains the final logistic regression models examining the relationship between predisposing, enabling and need variables and the use of OT after assessment with the CA. Predisposing variables associated with the use of OT included sex and language. Males were 0.64 times less likely (95% CI: 0.45 – 0.92) to receive OT services, while those who did not speak English were 2.94 more likely to receive OT (95% CI: 1.29 – 6.70).

The only enabling variable associated with the use of OT was location of intake. As compared to those assessed with the CA in hospital, community intakes were 0.34 times less likely (95% CI: 0.20 – 0.56) to receive OT services.

The need only model contained a significant interaction between cognitive decline and unstable health. The interaction between unstable health and cognitive decline is depicted in Figure 5

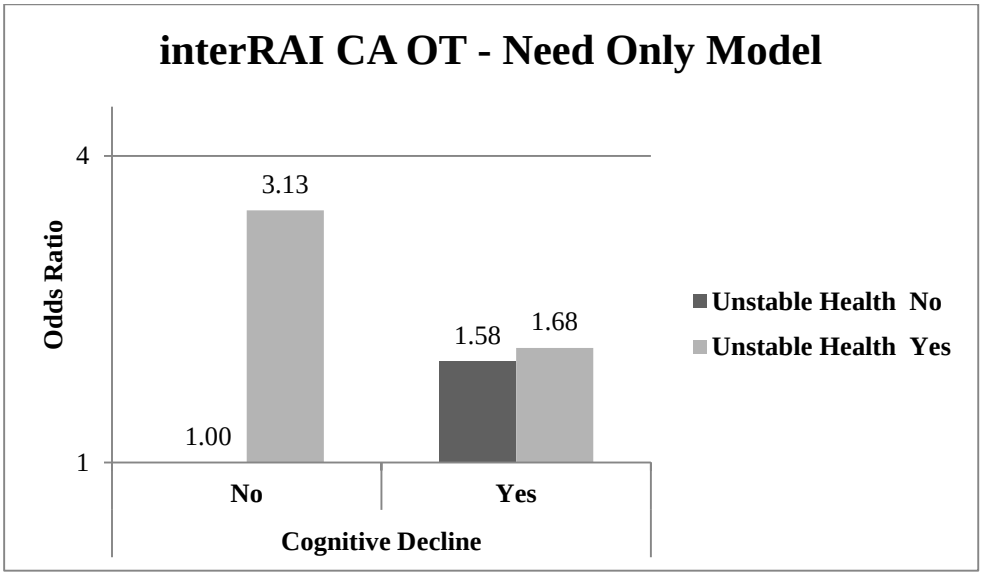


Figure 5 Interaction between Cognitive Decline and Unstable Health

As shown in Figure 5, health instability had a greater effect on the use of OT services in the absence of cognitive decline. When an individual had cognitive decline, the presence of unstable health did not affect their likelihood of receiving OT services. However, when an individual did not have cognitive decline, the presence of unstable health was associated with increased odds of receiving OT. Among those with unstable health, the presence of cognitive decline reduced the likelihood of receiving OT. In contrast, among those with stable health, the presence of cognitive decline increased the odds of receiving OT.

In the combined model, sex and language remained significant predictors of OT use after controlling for the influence of location of intake, cognitive decline and unstable health. The interpretation of the interaction in the full model is the same as the interaction presented in Figure 5.

To avoid repetition, the odds ratios for the variables involved in the interaction in the combined model can be found in Appendix G.

6.4.2.2 Models Predicting the Use of PT After interRAI CA Assessment

Table 14 presents the final logistic regression models examining the use of PT following CA assessment. No predisposing variables were significantly associated with the use of PT after assessment with the interRAI CA.

Two enabling variables were associated with an increased odds of receiving PT following assessment with the interRAI CA. Individuals who were referred to continue or initiate rehabilitation services were 2.87 times more likely (95% CI: 1.98 – 4.15) to receive PT services. Those with a co-residing caregiver were 2.27 times more likely (95% CI: 1.57 – 3.27) to receive PT after controlling for the presence of a rehabilitation referral.

In the need only model impairment in ADLs was associated with increased odds of receiving PT. Individuals with a recent ADL decline were 2.62 times more likely (95% CI: 1.67 – 4.10) to receive PT services. After adjusting for ADL decline, those requiring supervision or assistance with locomotion were 1.96 times more likely (95% CI: 1.31 – 2.93) to receive PT than those who were independent in locomotion. Cognitive impairment had the opposite effect. Those who required supervision or assistance for daily decision-making were 0.43 times less likely (95% CI: 0.29 – 0.64) to receive PT services after adjusting for the influence of other variables in the model.

In the full model, the presence of a rehabilitation referral became a stronger predictor of PT use. Those with a rehabilitation referral were 3.24 times more likely (95% CI: 2.18 – 4.81) to receive PT services after adjusting for other covariates. Cognitive impairment remained a significant negative predictor or PT use (OR: 0.49; 95% CI: 0.32 – 0.74), while ADL decline remained positively associated with the use of PT (OR: 2.62; 95% CI: 1.65 – 4.16). The final model contained a significant interaction between locomotion and caregiver co-resides which is shown in Figure 6.

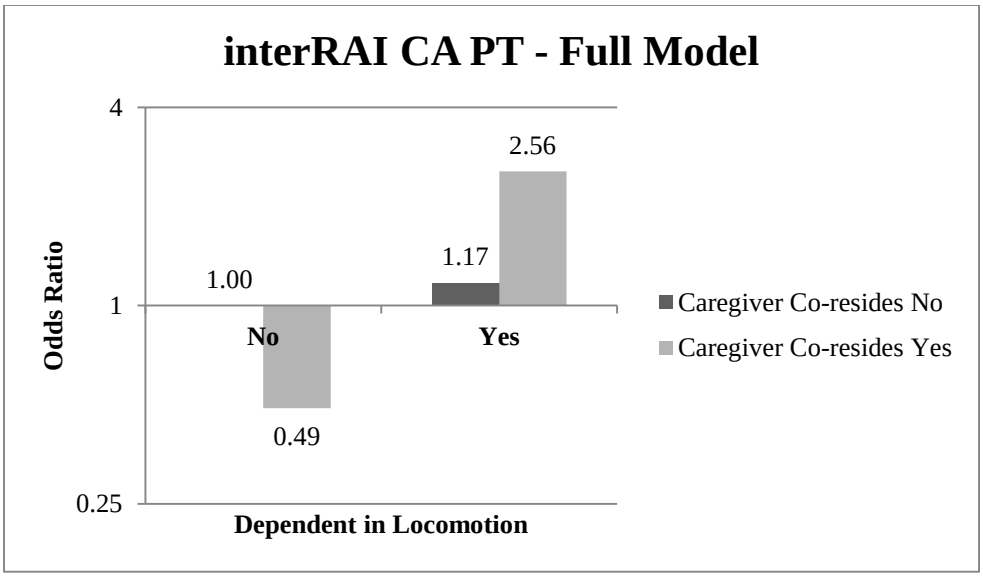


Figure 6 Interaction between Co-residing Caregiver and Dependent in Locomotion

As shown in Figure 6, the effect of locomotion impairment on PT use was dependent on whether or not the primary caregiver lived with the individual. For those who were independent in locomotion, having a co-residing caregiver decreased the odds of receiving PT (OR: 0.49). For those who were dependent in locomotion, the presence of a co-residing caregiver increased the odds of receiving PT. Individuals who lived with their primary caregiver and required assistance for locomotion were 2.56 times more likely to receive PT than those who did not live with a caregiver and were independent in locomotion. For those who did not co-reside with a caregiver locomotion impairment only slightly increased the odds of receiving PT.

6.4.3 Stratified interRAI CA Logistic Regression Models by Referral for Rehabilitation

For PT and OT, both combined models were further stratified by referral for rehabilitation to determine if predictors of service use had differential effects according to whether or not the individual was initially identified as needing rehabilitation. Stratified models were first tested using the covariates included in the model developed using the full sample. Then separate models were run including other variables to identify predictors of service use unique to a given strata.

6.4.3.1 Use of OT after interRAI CA Assessment, Stratified by Referral for Rehabilitation

Table 15 displays the results for models predicting the use of OT following assessment with the interRAI CA stratified based on referral for rehabilitation. To avoid repetition, interactions present in the stratified model are appended (in Appendix G) since their interpretation is the same as the interaction in the unstratified model (presented in Figure 5).

Among those without a referral for rehabilitation sex, language and location of intake were not significant predictors of OT use. Only the interaction between cognitive decline and unstable health remained significant in the logistic regression model. The interpretation of the interaction is the same as the interaction from the full model and the odds ratios for the interaction terms contained in the stratified model can be found in Appendix G. The effect of unstable health in the absence of cognitive decline was stronger in the stratified model than in the original model. The only additional variable that was significantly associated with the use of OT among the subgroup not referred for rehabilitation was ADL decline (OR: 2.13; 95% CI: 1.12 – 4.08). With the addition of ADL decline to the model, the effect of unstable health for those with no cognitive decline became less pronounced. For a diagram of the interaction in the stratified model with ADL decline added, see Appendix G.

For those referred to rehabilitation, the only variables from the original model associated with the use of OT were sex, language and location of intake. Males (OR: 0.56; 95% CI: 0.34 – 0.93) and those admitted from community settings (OR: 0.16; 95% CI: 0.07 – 0.35) were significantly less likely to receive OT. Those who did not speak English were 11.84 times more likely to receive OT, although the confidence interval associated with this estimate was very wide (95% CI: 1.55 – 90.68). No additional variables were found to be associated with the use of OT among those referred for rehabilitation.

6.4.3.2 Use of PT after interRAI CA Assessment, Stratified by Referral for Rehabilitation

Table 16 displays the results for models predicting the use of PT following assessment with the interRAI CA stratified based on referral for rehabilitation. For those without a referral for

rehabilitation, ADL decline and cognitive impairment were not associated with the use of PT services. Only the interaction between locomotion impairment and co-residing caregiver was significant in the stratified model. To avoid repetition, the interaction is presented in Appendix G. Compared to the original model the effect of locomotion on PT use for those with a co-residing caregiver was stronger in the stratified model. For the group not referred for rehabilitation, no additional variables were significantly associated with the use of PT services.

Among those who were initially referred for rehabilitation, all variables from the original model were significant. The interaction between co-residing caregiver and locomotion was also significant among those referred for rehabilitation, although the interpretation of the interaction was different in this as shown in Figure 7.

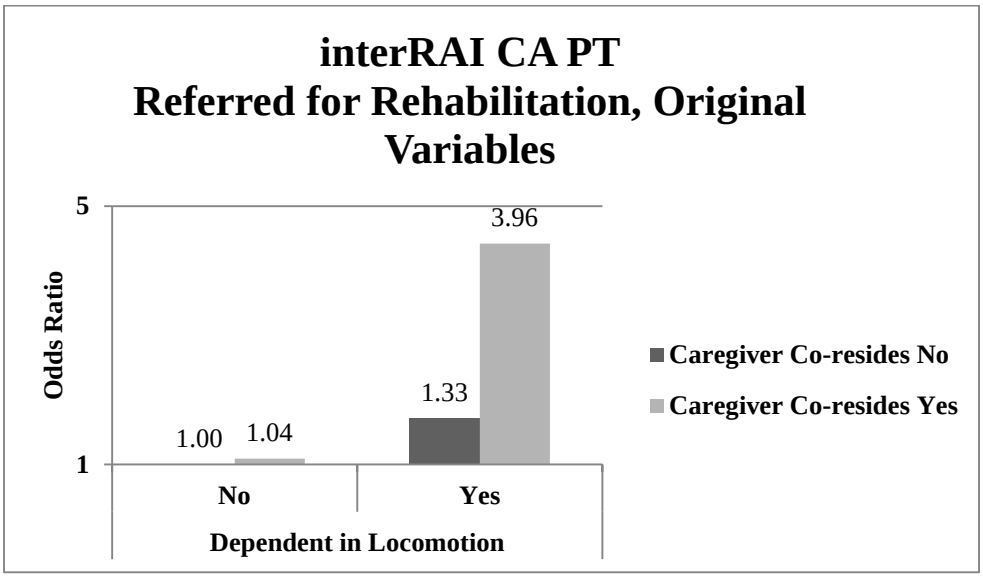


Figure 7 Interaction between Co-residing Caregiver and Dependent in Locomotion Among Those Referred for Rehabilitation

In the stratified model, the effect of having a co-residing caregiver was only present for those who were dependent in locomotion. Among those referred for rehabilitation, individuals who were independent in locomotion had an equal probability of receiving PT services regardless of whether or not they had a co-residing caregiver. Regardless of caregiver status, having difficulty with locomotion

increased the odds of receiving PT, although the effect was greater for those with a co-residing caregiver (OR=3.96). Among those referred for rehabilitation, the only additional variable that was significant in the model was stair use. Those who required assistance with stairs were 1.95 times (95% CI: 1.12 – 3.38) more likely to receive PT. To avoid repetition odds ratios for variables involved in the interaction in the expanded model can be found in Appendix G.

6.5 Ordinal Logistic Regression

Ordinal Logistic Regression was used to analyze relationships between independent variables and the number of rehabilitation visits received, conceptualized as a categorical dependent variable (0 visits, 1-4 visits, 5+ visits). For variables that did not satisfy the proportional odds assumption, odds ratios are presented separately, for each level of the dependent variable. For variables that satisfy the proportional odds assumption and have a consistent effect across levels of the dependent variable, one odds ratio is presented which represents a one-category increase in the dependent variable.

6.5.1 RAI-HC Ordinal Logistic Regression for PT/OT Visits

Multivariate relationships between predisposing, enabling and need variables from the RAI-HC and the number of PT/OT visits are examined in Ordinal Logistic Regression models presented in Table 17. After controlling for enabling and need variables, language was no longer a significant predictor of the amount of PT/OT services received. Being married continued to increase the probability that an individual would receive a higher number of PT/OT visits (5+). There was still significant variation according to CCAC branch in the final model and increasing amounts of informal care continued to be associated with receiving a greater number of PT/OT visits. After controlling for client's beliefs related to functional potential, the caregiver's beliefs were no longer significantly associated with the amount of PT/OT visits received. ADL Hierarchy score of 3+, unsteady gait, and requiring assistance with stairs (or not using stairs) remained associated with receiving a higher number of PT/OT visits. The Home Environment Optimization CAP was no longer associated with the amount of PT/OT received after predisposing and enabling variables were added

to the model. In contrast, the presence of an ADRD diagnosis reduced the probability of receiving a high number of PT/OT visits

6.5.2 interRAI CA Ordinal Logistic Regression for PT/OT Visits

Multivariate relationships between predisposing, enabling and need variables from the CA and the number of PT/OT visits are examined in Ordinal Logistic Regression models presented in Table 18. Referral for rehabilitation was positively associated with the number of PT/OT visits, although the association was stronger for 1-4 visits vs. none (OR: 5.39; 95% CI: 3.21-9.03) as compared to 5+ visits vs. 0-4 (OR: 1.78; 95% CI: 1.21-2.63). The final model had a c-statistic of 0.67, although it failed the Deviance goodness of fit test. Being assessed with the CA in a community setting was associated with a reduced utilization of PT/OT visits. However the association for location of intake was only significant for those receiving 1-4 visits vs. those receiving 0 visits (OR: 0.42; 95% CI: 0.23-0.77). Year of hospital discharge was associated with receiving 1-4 visits (as compared to none), with those being assessed after 2012 being more likely to receive PT/OT services. Finally, ADL Decline was associated with 2.64 greater odds of being in a higher PT/OT visit category, an effect that was consistent across levels.

6.5.3 Stratified interRAI CA Ordinal Logistic Regression for the Number of PT/OT Visits

Multivariate relationships between independent variables and the number of PT/OT visits were examined in Ordinal Logistic Regression models stratified according to the presence of a rehabilitation referral. These models are presented in Table 18. Among the sub-group not referred for rehabilitation, the only independent variable from the full sample model that was significantly associated with the amount of PT/OT visits ADL decline. No additional variables were significantly associated with the amount of PT/OT visits among those not initially referred for rehabilitation.

Within the subgroup of individuals referred for rehabilitation all of the covariates contained in the original model from the full sample remained associated with the amount of PT/OT received.

The effect of location of intake was similar in direction to the original model, although the magnitude of the effect was greater in the stratified model. Year of discharge also remained in the stratified model as a significant predictor of PT use. No additional variables were significantly associated with the amount of PT/OT visits among those initially referred for rehabilitation.

6.6 Summary Tables

A summary of the main multivariate results from the final models (containing predisposing, enabling, and need variables) can be found in tables 19 (RAI-HC) and 20 (interRAI CA) at the end of the chapter.

Table 3 RAI-HC Sample Description (N=1,181)

Variable		% (n)
Age	65-74	22.4 (265)
	75-84	47.5 (561)
	85+	30.1 (355)
Sex	Female	57.1 (674)
	Male	42.9 (507)
Marital Status	Not Married	54.6 (645)
	Married	45.4 (536)
Language	English	84.2 (994)
	Other	15.8 (187)
Residence	Urban	88.4 (1,044)
	Rural	11.6 (137)
Cognitive Performance Scale	0	31.5 (372)
	1-2	55.9 (660)
	3-4	9.7 (114)
	5-6	3.0 (35)
ADL Hierarchy Scale	0	58.0 (685)
	1-2	26.3 (311)
	3-4	9.2 (109)
	5-6	6.4 (76)
Other Diagnoses	ADRD	16.9 (199)
	Diabetes	26.4 (312)
	Coronary Artery Disease	31.2 (369)
	Hypertension	71.0 (839)
	Hemiplegia/Hemiparesis	6.4 (75)
Length of Stay in Hospital	0-7 days	37.9 (448)
	8-14 days	29.3 (346)
	15-21 days	12.0 (142)
	22-28 days	7.4 (87)
	>28 days	13.4 (158)
Discharge Disposition After hospitalization	Home	47.8 (565)
	Continuing Care	45.3 (535)
	Acute Care	5.6 (66)
	Other	1.3 (15)
Use of Rehabilitation Services (Within 91 days of RAI-HC)	Occupational Therapy	57.8 (682)
	Physiotherapy	41.5 (490)
	PT/OT[1]	74.9 (885)

[1]refers to physiotherapy and occupational therapy combined

Table 4 InterRAI CA Sample Description (N=573)

Variable		% (n)
Age	65-74	29.8 (171)
	75-84	40.8 (234)
	85+	29.3 (168)
Sex	Female	53.1 (304)
	Male	47.0 (269)
Language	English	91.6 (525)
	Other	8.4 (48)
Residence	Urban	85.7 (491)
	Rural	14.3 (82)
Location of Intake	Community	12.2 (70)
	Hospital	87.8 (503)
Number of ADL Impairments	0	28.5 (163)
	1	20.2 (116)
	2	8.9 (51)
	3	13.6 (78)
	4	28.8 (165)
Cognitive Skills for Decision Making	Not Impaired	59.5 (341)
	Impaired	40.5 (232)
Length of Stay in Hospital	0-7 days	42.1 (241)
	8-14 days	30.5 (175)
	15-21 days	10.8 (62)
	22-28 days	6.1 (35)
	>28 days	10.5 (60)
Discharge Disposition after hospitalization	Home	49.6 (284)
	Continuing Care	42.6 (244)
	Acute Care	7.5 (43)
	Other	0.4 (2)
Use of Rehabilitation Services[2]	Occupational Therapy	68.2 (391)
	Physiotherapy	39.6 (227)
	PT/OT[3]	83.6 (479)

[1] hospital includes assessments completed as a hospital inpatient (a10a=2) and those completed in the emergency department (a10a=3)
[2] refers to services received within 91 days of assessment
[3] refers to physiotherapy and occupational therapy combined

Table 5 Comparison of RAI-HC Study Sample with an Older Non-Stroke Population Assessed with the RAI-HC

Variables		Individuals with Stroke N= 1,181 % (n)	Individuals without Stroke N=35,957 % (n)	Chi-sq. p-value
PREDISPOSING				
Age	65-74	22.4 (265)	21.3 (7,656)	0.0001
	75-84	47.5 (561)	42.7 (15,368)	
	85+	30.1 (355)	36.0 (12,933)	
Sex	Female	57.1 (674)	65.0 (23,379)	<.0001
Married		45.4 (536)	40.0 (14,395)	0.0002
Language	English	84.2 (994)	86.2 (30,980)	0.05
Education Level	High school or greater	35.9 (424)	37.6 (13,512)	0.24
Lives Alone		31.6 (373)	39.2 (14,087)	<.0001
ENABLING				
Caregiver Co-resides		55.9 (660)	48.9 (17,571)	<.0001
Caregiver Distress		20.3 (240)	18.3 (6,582)	0.08
Residence	Rural	11.6 (137)	11.9 (4,289)	0.73
Hours of Informal Care	0 – 20/week	59.7 (705)	70.2 (25,237)	<.0001
	21 – 40/week	30.4 (359)	23.3 (8,392)	
	> 40/week	9.9 (117)	6.5 (2,328)	
NEED				
Poor self-reported health		13.4 (158)	16.4 (5,882)	0.006
Caregiver believes function can improve		34.5 (407)	18.3 (6,563)	<.0001
Client believes function can improve		48.9 (577)	30.0 (10,795)	<.0001
Good prospects for functional improvement		24.6 (291)	16.7 (6,012)	<.0001
Expression Difficulty	None	63.8 (753)	82.2 (29,543)	<.0001
	Mild	30.9 (365)	16.1 (5,770)	
	Moderate/Severe	5.3 (63)	1.8 (644)	
Comprehension Ability	No	70.6 (834)	78.7 (28,287)	<.0001
	Mild	24.6 (291)	18.8 (6,764)	
	Moderate/Severe	4.7 (56)	2.5 (906)	
Communication Decline		23.7 (280)	6.9 (2,472)	<.0001
Swallowing Ability	None	86.6 (1,023)	95.2 (34,231)	<.0001
	Mild	11.9 (140)	4.3 (1,532)	
	Moderate/Severe	1.5 (18)	0.5 (194)	
Mood Decline[1]		21.2 (250)	14.0 (5,018)	<.0001
Depression Rating Scale	0	59.9 (707)	65.7 (23,609)	0.0002
	1-2	24.7 (292)	21.2 (7,627)	
	3+	15.4 (182)	13.1 (4,721)	
Cognitive Performance Scale	0	31.5 (372)	51.5 (18,532)	<.0001
	1-2	55.9 (660)	41 (14,728)	
	3+	12.6 (149)	7.5 (2,697)	
CHESS Scale	0	14.7 (173)	22.7 (8,173)	<.0001
	1-2	66.1 (781)	61.4 (22,093)	
	3+	19.2 (227)	15.8 (5,691)	
Pain Scale	0	47.3 (559)	31.1 (11,196)	<.0001
	1-2	46.2 (545)	55.3 (19,893)	
	3	6.5 (77)	13.5 (4,867)	

Variables		Individuals with Stroke N= 1,181 % (n)	Individuals without Stroke N=35,957 % (n)	Chi-sq. p-value
ADL Decline[1]		73.8 (871)	55.9 (20,115)	<.0001
Modified ADL CAP	Not Triggered	59.4 (702)	70.3 (25,288)	<.0001
	Triggered - prevent decline	1.9 (22)	5.2 (1,859)	
	Triggered - facilitate improvement	38.7 (457)	24.5 (8,809)	
ADL Hierarchy Scale	0	58.0 (685)	69.7 (25,074)	<.0001
	1-2	26.3 (311)	22.2 (7,993)	
	3+	15.7 (185)	8.0 (2,889)	
IADL Capacity Scale	0	2.5 (29)	5.5 (1,961)	<.0001
	1-2	18.3 (216)	24.3 (8,725)	
	3-4	24.9 (294)	26.7 (9,581)	
	5-6	54.4 (642)	43.6 (15,689)	
Rehabilitation Algorithm	1	1.4 (17)	3.4 (1,218)	<.0001
	2	13.6 (160)	23.0 (8,255)	
	3	30.4 (359)	34.7 (12,459)	
	4	13.3 (157)	11.8 (4,243)	
	5	41.3 (488)	27.2 (9,781)	
1+ Falls[1]		42.0 (496)	39.5 (14,201)	0.08
Unsteady Gait		66.0 (779)	59.9 (21,518)	<.0001
Stair Use	Independent	31.2 (369)	39.9 (14,344)	<.0001
	Dependent	23.5 (277)	18.6 (6,689)	
	Did not Occur	45.3 (535)	41.5 (14,923)	
Outdoor Locomotion	No assistive device	20.2 (239)	28.4 (10,219)	<.0001
	Assistive device	66.0 (779)	60.9 (21,904)	
	Did not occur	13.8 (163)	10.7 (3,833)	
Left the House[2]		81.0 (957)	85.5 (30,742)	<.0001
Bladder Incontinence		38.4 (453)	36.4 (13,104)	0.18
Bowel Incontinence		15.1 (178)	11.3 (4,044)	<.0001
Home Environment CAP triggered		6.2 (73)	5.5 (1,979)	0.32
Dyspnea		18.8 (222)	25.7 (9,245)	<.0001
Comorbid Conditions	Heart Failure	8.1 (96)	11.3 (4,048)	0.0008
	Coronary Artery Disease	31.2 (369)	26.9 (9,664)	0.0009
	Hypertension	71.0 (839)	59.2 (21,302)	<.0001
	Diabetes	26.4 (312)	24.0 (8,612)	0.05
	Cancer	9.6 (113)	15.6 (5,603)	<.0001
	Emphysema/COPD/Asthma	14.6 (172)	16.8 (6,051)	0.04
	Hemiplegia/Hemiparesis	6.4 (75)	0.3 (104)	<.0001
	ADRD[3]	16.9 (199)	18.7 (6,726)	0.11
	Any Fracture	5.6 (66)	14.3 (5,123)	<.0001
Number of Comorbid Conditions	0-1	15.6 (184)	11.4 (4,097)	<.0001
	2-4	62.2 (735)	61.7 (22,187)	
	5+	22.2 (262)	26.9 (9,672)	

[1] In the past 90 days
[2] In the past week
[3] Alzheimer's disease and related dementias

Table 6 Comparison of interRAI CA Study Sample with an Older Non-Stroke Population assessed with the InterRAI CA

Variables		Individuals with Stroke N=573 % (n)	Individuals without Stroke N=25,713 % (n)	Chi-sq. p-value
PREDISPOSING				
Age	65-74	29.8 (171)	30.6 (7,868)	0.90
	75-84	40.8 (234)	40.0 (10,280)	
	85+	29.3 (168)	29.4 (7,565)	
Sex	Female	53.1 (304)	57.6 (14,808)	0.03
Language	English	91.6 (525)	93.4 (24,011)	0.10
Lives Alone		24.6 (141)	30.7 (7,885)	0.002
ENABLING				
Referral for Rehabilitation		59.0 (338)	35.1 (9,029)	<.0001
Primary Caregiver Co-resides		60.0 (344)	56.2 (14,444)	0.07
Caregiver Distress		9.4 (54)	10.7 (2,759)	0.32
Location of intake	Community	12.2 (70)	42.4 (10,908)	<.0001
	Hospital/ED	87.8 (503)	53.6 (13,793)	
	Other	0.0 (0)	3.9 (1,012)	
Residence	Rural	14.3 (82)	13.6 (3,508)	0.65
NEED				
Poor Self-reported health	No	75.7 (434)	72.7 (18,694)	<.0001
	Yes	3.5 (20)	8.7 (2,229)	
	No Response[1]	20.8 (119)	18.6 (4,790)	
Mood Symptoms	No	67.9 (389)	67.4 (17,323)	0.009
	Yes	10.7 (61)	14.6 (3,743)	
	No Response[1]	21.5 (123)	18.1 (4,647)	
ADL Impairment	Bathing	67.9 (389)	54.2 (13,926)	<.0001
	Personal Hygiene	39.8 (228)	26.4 (6,790)	<.0001
	Dressing[2]	46.6 (267)	35.6 (9,156)	<.0001
	Locomotion	39.8 (228)	24.9 (6,403)	<.0001
ADL Decline[3]		73.3 (420)	55.0 (14,150)	<.0001
Number of ADL Impairments	0	28.5 (163)	40.5 (10,425)	<.0001
	1	20.2 (116)	20.6 (5,295)	
	2	8.9 (51)	11.6 (2,981)	
	3	13.6 (78)	11.8 (3,030)	
	4	28.8 (165)	15.5 (3,982)	
IADL Difficulty	Meal Preparation	83.1 (476)	66.8 (17,170)	<.0001
	Housework	89.5 (513)	78.2 (20,106)	<.0001
	Medication[4]	56.5 (324)	35.3 (9,076)	<.0001
	Stair Use	66.3 (380)	52.9 (13,610)	<.0001
Number of IADL Impairments	0	6.6 (38)	16.0 (4,123)	<.0001
	1	6.3 (36)	11.6 (2,993)	
	2	16.6 (95)	21.3 (5,486)	
	3	26.0 (149)	25.1 (6,447)	
	4	44.5 (255)	25.9 (6,664)	
Cognitive Skills	Dependent	40.5 (232)	20.4 (5,256)	<.0001
Cognitive Decline[3]		32.6 (187)	14.8 (3,808)	<.0001
Comprehension Difficulty	None	59.3 (340)	75.3 (19,364)	<.0001
	Mild	33.5 (192)	20.8 (5,346)	
	Moderate/Severe	7.2 (41)	3.9 (1,003)	

Variables		Individuals with Stroke N=573 % (n)	Individuals without Stroke N=25,713 % (n)	Chi-sq. p-value
Severe and Frequent Pain		2.8 (16)	13.4 (3,452)	<.0001
Falls[5]		40.0 (229)	35.3 (9,067)	0.02
Unstable Health[6]		49.7 (285)	33.8 (8,689)	<.0001
Dyspnea		22.3 (128)	36.3 (9,336)	<.0001
Rehabilitation Algorithm	1	4.7 (27)	12.6 (3,242)	<.0001
	2	16.4 (94)	22.7 (5,834)	
	3	20.6 (118)	26.0 (6,678)	
	4	22.3 (128)	20.2 (5,182)	
	5	36.0 (206)	18.6 (4,777)	

[1] Could not or would not respond
[2] In the past 90 days
[3] Refers to dressing lower body
[4] Refers to requiring supervision or assistance with managing medications
[5] One or more falls in the past 90 days
[6] Conditions/diseases that make cognitive, ADL, mood or behaviour patterns unstable (fluctuating, precarious or deteriorating

Table 7 RAI-HC OT and PT Bivariate Comparisons

Variable		Occupational Therapy		Physiotherapy	
		% (n)	O.R. (95% CI)	% (n)	O.R. (95% CI)
PREDISPOSING					
Age	65-74	61.5 (163)	1.00 (reference)	43.4 (115)	1.00 (reference)
	65-84	55.3 (310)	0.77 (0.57-1.04)	43.0 (241)	0.98 (0.73-1.32)
	85+	58.9 (209)	0.90 (0.65-1.24)	37.8 (134)	0.79 (0.57-1.09)
Sex	Female	57.7 (389)	1.00 (reference)	39.6 (267)	1.00 (reference)
	Male	57.8 (293)	1.00 (0.79-1.27)	44.0 (223)	1.20 (0.95-1.51)
Married	No	56.7 (366)	1.00 (reference)	35.2 (227)**	1.00 (reference)**
	Yes	59.0 (316)	1.10 (0.87-1.38)	49.1 (263)**	1.77 (1.40-2.24)**
Language	English	56.2 (559)*	1.00 (reference)*	40.9 (406)	1.00 (reference)
	Other	65.8 (123)*	1.50 (1.08-2.07)*	44.9 (84)	1.18 (0.86-1.62)
Education	Less than High school	60.0 (454)*	1.00 (reference)*	41.2 (312)	1.00 (reference)
	High school or greater	53.8 (228)*	0.78 (0.61-0.99)*	42.0 (178)	1.03 (0.81-1.31)
Lives Alone	No	57.8 (467)	1.00 (reference)	44.1 (356)**	1.00 (reference)**
	Yes	57.6 (215)	0.99 (0.78-1.27)	35.9 (134)**	0.71 (0.55-0.92)**
ENABLING					
Caregiver Co-resides	No	56.4 (294)	1.00 (reference)	34.4 (179)**	1.00 (reference)**
	Yes	58.8 (388)	1.10 (0.87-1.39)	47.1 (311)**	1.70 (1.34-2.16)**
Caregiver Distress	No	55.6 (523)**	1.00 (reference)**	40.6 (382)	1.00 (reference)
	Yes	66.3 (159)**	1.57 (1.17-2.11)**	45.0 (108)	1.20 (0.90-1.59)
Residence	Urban	58.1 (606)	1.00 (reference)	41.0 (428)	1.00 (reference)
	Rural	55.5 (76)	0.90 (0.63-1.29)	45.3 (62)	1.19 (0.83-1.70)
Branch	Not Assigned	57.1 (4)**	0.61 (0.13-2.74)**	28.6 (2)**	0.49 (0.09-2.56)**
	Branch A	43.0 (58)**	0.34 (0.23-0.51)**	29.6 (40)**	0.52 (0.34-0.78)**
	Branch B	58.2 (89)**	0.63 (0.43-0.92)**	36.6 (56)**	0.71 (0.49-1.04)**
	Branch C	50.0 (44)**	0.45 (0.29-0.72)**	59.1 (52)**	1.77 (1.12-2.82)**
	Branch D	51.5 (185)**	0.48 (0.36-0.64)**	39.8 (143)**	0.81 (0.61-1.08)**
	Branch E	68.8 (302)**	1.00 (reference)**	44.9 (197)**	1.00 (reference)**
Year of Hospital Discharge	2008	59.1 (107)*	1.00 (reference)*	50.8 (92)	1.00 (reference)
	2009	50.2 (126)*	0.70 (0.47-1.03)*	40.2 (101)	0.65 (0.44-0.96)
	2010	53.8 (148)*	0.81 (0.55-1.18)*	43.3 (119)	0.74 (0.51-1.08)
	2011	62.3 (132)*	1.14 (0.76-1.71)*	35.9 (76)	0.54 (0.36-0.81)
	2012	64.1 (132)*	1.23 (0.82-1.86)*	38.4 (79)	0.60 (0.40-0.90)
	2013	66.1 (37)*	1.35 (0.72-2.52)*	41.1 (23)	0.67 (0.37-1.24)
Hours of Informal Care per Week	0 – 20	54.2 (382)**	1.00 (reference)**	34.5 (243)**	1.00 (reference)**
	21 – 40	63.5 (228)**	1.47 (1.13-1.91)**	51.0 (183)**	1.98 (1.53-2.56)**
	> 40	61.5 (72)**	1.35 (0.91-2.02)**	54.7 (64)**	2.30 (1.55-3.41)**
NEED					
Poor Self-reported health	No	57.3 (586)	1.00 (reference)	40.4 (413)*	1.00 (reference)*
	Yes	60.8 (96)	1.16 (0.82-1.63)	48.7 (77)*	1.40 (1.00-1.97)*
Caregiver believes function can improve	No	55.9 (433)	1.00 (reference)	39.8 (308)	1.00 (reference)
	Yes	61.2 (249)	1.24 (0.97-1.59)	44.7 (182)	1.22 (0.96-1.56)
Client believes function can improve	No	56.0 (338)	1.00 (reference)	37.9 (229)*	1.00 (reference)*
	Yes	59.6 (344)	1.16 (0.92-1.46)	45.2 (261)*	1.35 (1.07-1.71)*

Variable		Occupational Therapy		Physiotherapy	
		% (n)	O.R. (95% CI)	% (n)	O.R. (95% CI)
Good prospects for functional improvement	No	56.3 (501)	1.00 (reference)	40.2 (358)	1.00 (reference)
	Yes	62.2 (181)	1.28 (0.97-1.68)	45.4 (132)	1.23 (0.95-1.61)
Expression Difficulty	None	56.0 (422)	1.00 (reference)	43.6 (328)	1.00 (reference)
	Mild	61.1 (223)	1.23 (0.96-1.59)	36.4 (133)	0.74 (0.57-0.96)
	Moderate/Severe	58.7 (37)	1.12 (0.66-1.88)	46.0 (29)	1.11 (0.66-1.85)
Comprehension Difficulty	None	54.9 (458)**	1.00 (reference)**	43.3 (361)	1.00 (reference)
	Mild	64.6 (188)**	1.50 (1.14-1.98)**	36.1 (105)	0.74 (0.56-0.97)
	Moderate/Severe	64.3 (36)**	1.48 (0.84-2.60)**	42.9 (24)	0.98 (0.57-1.70)
Communication Decline	No	56.7 (511)	1.00 (reference)	43.6 (393)**	1.00 (reference)**
	Yes	61.1 (171)	1.20 (0.91-1.58)	34.6 (97)**	0.69 (0.52-0.91)**
Swallowing Difficulty	None	56.6 (579)*	1.00 (reference)*	40.8 (417)	1.00 (reference)
	Mild	62.9 (88)*	1.30 (0.90-1.87)*	45.0 (63)	1.19 (0.83-1.7)
	Moderate/Severe	83.3 (15)*	3.83 (1.10-13.32)*	55.6 (10)	1.82 (0.71-4.64)
Mood Decline	No	56.5 (526)	1.00 (reference)	41.6 (387)	1.00 (reference)
	Yes	62.4 (156)	1.28 (0.96-1.70)	41.2 (103)	0.99 (0.74-1.31)
Depression Rating Scale	0	55.3 (391)*	1.00 (reference)*	40.3 (285)	1.00 (reference)
	1-2	58.9 (172)*	1.16 (0.88-1.53)*	45.2 (132)	1.22 (0.93-1.61)
	3+	65.4 (119)*	1.53 (1.09-2.14)*	40.1 (73)	0.99 (0.71-1.38)
Cognitive Performance Scale	0	53.0 (197)	1.00 (reference)	48.1 (179)**	1.00 (reference)**
	1-2	59.6 (393)	1.31 (1.01-1.69)	39.9 (263)**	0.71 (0.55-0.92)**
	3+	61.7 (92)	1.43 (0.97-2.11)	32.2 (48)**	0.51 (0.34-0.76)**
CHESS Scale	0	51.5 (89)	1.00 (reference)	41.6 (72)	1.00 (reference)
	1-2	57.6 (450)	1.28 (0.92-1.79)	41.5 (324)	1.00 (0.71-1.39)
	3+	63.0 (143)	1.61 (1.08-2.40)	41.4 (94)	0.99 (0.66-1.48)
Pain Scale	0	54.0 (302)*	1.00 (reference)*	39.4 (220)	1.00 (reference)
	1-2	60.9 (332)*	1.33 (1.04-1.69)*	43.5 (237)	1.19 (0.93-1.51)
	3	62.3 (48)*	1.41 (0.86-2.30)*	42.9 (33)	1.16 (0.71-1.87)
ADL Decline	No	53.2 (165)	1.00 (reference)	38.1 (118)	1.00 (reference)
	Yes	59.4 (517)	1.28 (0.99-1.67)	42.7 (372)	1.21 (0.93-1.58)
Modified ADL CAP	Not Triggered	53.0 (372)**	1.00 (reference)**	39.9 (280)	1.00 (reference)
	Triggered to prevent decline	63.6 (14)**	1.55 (0.64-3.75)**	45.5 (10)	1.26 (0.54-2.95)
	Triggered to facilitate improvement	64.8 (296)**	1.63 (1.28-2.08)**	43.8 (200)	1.17 (0.92-1.49)
ADL Hierarchy Scale	0	52.4 (359)**	1.00 (reference)**	39.3 (269)	1.00 (reference)
	1-2	57.2 (178)**	1.22 (0.93-1.59)**	44.7 (139)	1.25 (0.95-1.64)
	3+	78.4 (145)**	3.29 (2.25-4.82)**	44.3 (82)	1.23 (0.89-1.71)
IADL Capacity Scale	0	41.4 (12)**	1.00 (reference)**	44.8 (13)	1.00 (reference)
	1-2	50.0 (108)**	1.42 (0.65-3.11)**	39.4 (85)	0.80 (0.37-1.74)
	3-4	52.4 (154)**	1.56 (0.72-3.38)**	38.4 (113)	0.77 (0.36-1.66)
	5-6	63.6 (408)**	2.47 (1.16-5.26)**	43.5 (279)	0.95 (0.45-2.00)
Rehabilitation Algorithm	1	47.1 (8)**	0.45 (0.17-1.19)**	35.3 (6)**	0.64 (0.23-1.75)**
	2	43.8 (70)**	0.39 (0.27-0.57)**	30.0 (48)**	0.50 (0.34-0.73)**
	3	53.8 (193)**	0.59 (0.45-0.78)**	37.9 (136)**	0.71 (0.54-0.94)**
	4	55.4 (87)**	0.63 (0.44-0.91)**	47.8 (75)**	1.07 (0.75-1.53)**
	5	66.4 (324)**	1.00 (reference)**	46.1 (225)**	1.00 (reference)**
Falls	0	54.9 (376)*	1.00 (reference)*	40.6 (278)	1.00 (reference)
	1+	61.7 (306)*	1.32 (1.05-1.68)*	42.7 (212)	1.09 (0.87-1.38)
Unsteady Gait	No	48.8 (196)**	1.00 (reference)**	29.9 (120)**	1.00 (reference)**
	Yes	62.4 (486)**	1.74 (1.37-2.22)**	47.5 (370)**	2.13 (1.65-2.75)**
Stair Use	Independent	45.8 (169)**	1.00 (reference)**	31.2 (115)**	1.00 (reference)**
	Dependent	60.3 (167)**	1.80 (1.31-2.46)**	52.7 (146)**	2.46 (1.78-3.40)**

Variable		Occupational Therapy		Physiotherapy	
		% (n)	O.R. (95% CI)	% (n)	O.R. (95% CI)
	Did not Occur	64.7 (346)**	2.17 (1.65-2.84)**	42.8 (229)**	1.65 (1.25-2.19)**
Outdoor Locomotion	No assistive device	47.7 (169)**	1.00 (reference)**	26.4 (63)**	1.00 (reference)**
	Assistive device	58.5 (167)**	1.55 (1.16-2.07)**	45.1 (351)**	2.29 (1.66-3.16)**
	Did not occur	68.7 (346)**	2.41 (1.59-3.65)**	46.6 (76)**	2.44 (1.60-3.72)**
Left House	No	68.8 (154)**	1.00 (reference)**	46.4 (104)	1.00 (reference)
	Yes	55.2 (528)**	0.56 (0.41-0.76)**	40.3 (386)	0.78 (0.58-1.05)
Transient Ischemic Attack	No	58.4 (589)	1.00 (reference)	41.5 (418)	1.00 (reference)
	Yes	53.8 (93)	0.83 (0.60-1.14)	41.6 (72)	1.01 (0.73-1.40)
Bladder Incontinence	No	55.8 (406)	1.00 (reference)	41.4 (301)	1.00 (reference)
	Yes	60.9 (276)	1.24 (0.97-1.57)	41.7 (189)	1.02 (0.80-1.29)
Bowel Incontinence	No	56.0 (562)**	1.00 (reference)**	40.5 (406)	1.00 (reference)
	Yes	67.4 (120)**	1.62 (1.16-2.28)**	47.2 (84)	1.31 (0.95-1.81)
Home Environment CAP	No	56.5 (626)**	1.00 (reference)**	40.9 (453)	1.00 (reference)
	Yes	76.7 (56)**	2.54 (1.46-4.42)**	50.7 (37)	1.49 (0.93-2.39)
Dyspnea	No	58.0 (556)	1.00 (reference)	40.7 (390)	1.00 (reference)
	Yes	56.8 (126)	0.95 (0.71-1.28)	45.1 (100)	1.20 (0.89-1.61)
Heart Failure	No	57.1 (619)	1.00 (reference)	41.8 (453)	1.00 (reference)
	Yes	65.6 (63)	1.44 (0.93-2.23)	38.5 (37)	0.88 (0.57-1.34)
Coronary Artery Disease	No	57.6 (468)	1.00 (reference)	43 (349)	1.00 (reference)
	Yes	58.0 (214)	1.02 (0.79-1.30)	38.2 (141)	0.82 (0.64-1.06)
Hypertension	No	58.2 (199)	1.00 (reference)	40.6 (139)	1.00 (reference)
	Yes	57.6 (483)	0.98 (0.76-1.26)	41.8 (351)	1.05 (0.81-1.36)
Diabetes	No	58.6 (509)	1.00 (reference)	41.2 (358)	1.00 (reference)
	Yes	55.5 (173)	0.88 (0.68-1.14)	42.3 (132)	1.05 (0.81-1.36)
Emphysema/ COPD/Asthma	No	57.7 (582)	1.00 (reference)	41.7 (421)	1.00 (reference)
	Yes	58.1 (100)	1.02 (0.73-1.41)	40.1 (69)	0.94 (0.67-1.30)
Hemiplegia/ Hemiparesis	No	57.2 (633)	1.00 (reference)	41.2 (456)	1.00 (reference)
	Yes	65.3 (49)	1.41 (0.86-2.30)	45.3 (34)	1.18 (0.74-1.89)
ADRD[1]	No	57.7 (567)	1.00 (reference)	44.1 (433)**	1.00 (reference)**
	Yes	57.8 (115)	1.00 (0.74-1.36)	28.6 (57)**	0.51 (0.37-0.71)**
Any Fracture	No	57.0 (635)**	1.00 (reference)**	41.6 (464)	1.00 (reference)
	Yes	71.2 (47)**	1.87 (1.08-3.23)**	39.4 (26)	0.91 (0.55-1.52)
Number of Comorbid Conditions	0-1	52.2 (96)	1.00 (reference)	42.4 (78)	1.00 (reference)
	2-4	58.6 (431)	1.30 (0.94-1.80)	41.6 (306)	0.97 (0.70-1.34)
	5+	59.2 (155)	1.33 (0.91-1.94)	40.5 (106)	0.92 (0.63-1.35)

*p<0.05

** p<0.001

[1] Past 90 days

[2] Alzheimer's disease and related dementias

Table 8 RAI-HC PT/OT Bivariate Comparison

Variable		Number of PT/OT Visits		
		0 Visits (N=296) % (n)	1-4 Visits (N=585) % (n)	5+ Visits (N=300) % (n)
PREDISPOSING				
Age	65-74	23.0 (61)	47.6 (126)	29.4 (78)
	75-84	26.4 (148)	47.2 (265)	26.4 (148)
	85+	24.5 (87)	54.7 (194)	20.9 (74)
Sex	Female	25.4 (171)	50.7 (342)	23.9 (161)
	Male	24.7 (125)	47.9 (243)	27.4 (139)
Married	No	27.0 (174)**	52.7 (340)**	20.3 (131)**
	Yes	22.8 (122)**	45.7 (245)**	31.5 (169)**
Language	English	25.8 (256)**	50.6 (503)**	23.6 (235)**
	Other	21.4 (40)**	43.9 (82)**	34.8 (65)**
Education	Less than High school	24.2 (183)	49.5 (375)	26.3 (199)
	High school or greater	26.7 (113)	49.5 (210)	23.8 (101)
Lives Alone	No	24.9 (201)**	46.5 (376)**	28.6 (231)**
	Yes	25.5 (95)**	56 (209)**	18.5 (69)**
ENABLING				
Primary Caregiver Co-resides	No	28.0 (146)**	51.8 (270)**	20.2 (105)**
	Yes	22.7 (150)**	47.7 (315)**	29.6 (195)**
Caregiver Distress	No	26.1 (246)	49.4 (465)	24.4 (230)
	Yes	20.8 (50)	50.0 (120)	29.2 (70)
Residence	Urban	25.5 (266)	49.0 (511)	25.6 (267)
	Rural	21.9 (30)	54.0 (74)	24.1 (33)
Branch	Not Assigned	28.6 (2)**	71.4 (5)**	0.0 (0)**
	Branch A	40.7 (55)**	37.8 (51)**	21.5 (29)**
	Branch B	24.8 (38)**	54.3 (83)**	20.9 (32)**
	Branch C	17.1 (15)**	60.2 (53)**	22.7 (20)**
	Branch D	28.7 (103)**	51.8 (186)**	19.5 (70)**
	Branch E	18.9 (83)**	47.2 (207)**	33.9 (149)**
Year of Hospital Discharge	2008	21.6 (39)	45.9 (83)	32.6 (59)
	2009	29.5 (74)	45.4 (114)	25.1 (63)
	2010	24.4 (67)	49.5 (136)	26.2 (72)
	2011	28.8 (61)	51.4 (109)	19.8 (42)
	2012	20.9 (43)	55.8 (115)	23.3 (48)
	2013	21.4 (12)	50.0 (28)	28.6 (16)
Hours of Informal Care	0 – 20 hours/week	28.8 (203)**	51.5 (363)**	19.7 (139)**
	21 – 40 hours/week	18.4 (66)**	47.4 (170)**	34.3 (123)**
	> 40 hours/week	23.1 (27)**	44.4 (52)**	32.5 (38)**
NEED				
Poor Self-reported health	No	25.7 (263)	49.9 (510)	24.4 (250)
	Yes	20.9 (33)	47.5 (75)	31.7 (50)
Caregiver believes function can improve	No	27.3 (211)**	50.3 (389)**	22.5 (174)**
	Yes	20.9 (85)**	48.2 (196)**	31.0 (126)**
Client believes function can improve	No	28 (169)**	50.8 (307)**	21.2 (128)**
	Yes	22.0 (127)**	48.2 (278)**	29.8 (172)**
Good prospects for functional improvement	No	26.9 (239)*	49.1 (437)*	24.0 (214)*
	Yes	19.6 (57)*	50.9 (148)*	29.6 (86)*
Expression Difficulty	None	24.4 (184)	50.6 (381)	25.0 (188)
	Mild	26.0 (95)	49.6 (181)	24.4 (89)

Variable		Number of PT/OT Visits		
		0 Visits (N=296) % (n)	1-4 Visits (N=585) % (n)	5+ Visits (N=300) % (n)
	Moderate/Severe	27.0 (17)	36.5 (23)	36.5 (23)
Comprehension Difficulty	None	25.8 (215)	49.6 (414)	24.6 (205)
	Mild	23.0 (67)	50.5 (147)	26.5 (77)
	Moderate/Severe	25.0 (14)	42.9 (24)	32.1 (18)
Communication Decline[1]	No	24.0 (216)	50.4 (454)	25.6 (231)
	Yes	28.6 (80)	46.8 (131)	24.6 (69)
Swallowing Difficulty[2]	No	25.7 (263)	50.1 (512)	24.2 (248)
	Yes	20.9 (33)	46.2 (73)	32.9 (52)
Mood Decline[1]	No	26.2 (244)	48.1 (448)	25.7 (239)
	Yes	20.8 (52)	54.8 (137)	24.4 (61)
Depression Rating Scale	0	26.7 (189)	49.4 (349)	23.9 (169)
	1-2	23.3 (68)	48.6 (142)	28.1 (82)
	3+	21.4 (39)	51.7 (94)	26.9 (49)
Cognitive Performance Scale	0	23.9 (89)	48.9 (182)	27.2 (101)
	1-2	24.9 (164)	50.6 (334)	24.6 (162)
	3+	28.9 (43)	46.3 (69)	24.8 (37)
CHESS Scale	0	27.2 (47)	51.5 (89)	21.4 (37)
	1-2	25.5 (199)	48.0 (375)	26.5 (207)
	3+	22.0 (50)	53.3 (121)	24.7 (56)
Pain Scale	0	28.3 (158)	48.8 (273)	22.9 (128)
	1-2	22.0 (120)	51.2 (279)	26.8 (146)
	3	23.4 (18)	42.9 (33)	33.8 (26)
ADL Decline[1]	No	29.4 (91)*	51.0 (158)*	19.7 (61)*
	Yes	23.5 (205)*	49.0 (427)*	27.4 (239)*
Modified ADL CAP	Not Triggered	27.6 (194)**	50.6 (355)**	21.8 (153)**
	Triggered to prevent decline	18.2 (4)**	50.0 (11)**	31.8 (7)**
	Triggered to facilitate improvement	21.4 (98)**	47.9 (219)**	30.6 (140)**
ADL Hierarchy Scale	0	28.0 (192)**	50.8 (348)**	21.2 (145)**
	1-2	23.5 (73)**	49.8 (155)**	26.7 (83)**
	3+	16.8 (31)**	44.3 (82)**	38.9 (72)**
IADL Capacity Scale	0	17.2 (5)**	75.9 (22)**	6.9 (2)**
	1-2	31.0 (67)**	50.5 (109)**	18.5 (40)**
	3-4	28.9 (85)**	50 (147)**	21.1 (62)**
	5-6	21.7 (139)**	47.8 (307)**	30.5 (196)**
Rehabilitation Algorithm	1	17.7 (3)**	82.4 (14)**	0.0 (0)**
	2	39.4 (63)**	46.3 (74)**	14.4 (23)**
	3	30.4 (109)**	47.4 (170)**	22.3 (80)**
	4	19.1 (30)**	52.9 (83)**	28.0 (44)**
	5	18.7 (91)**	50.0 (244)**	31.4 (153)**
Falls[1]	0	27.7 (190)*	48.3 (331)*	23.9 (164)*
	1+	21.4 (106)*	51.2 (254)*	27.4 (136)*
Unsteady Gait	No	36.1 (145)**	48.8 (196)**	15.2 (61)**
	Yes	19.4 (151)**	49.9 (389)**	30.7 (239)**
Stair Use	Independent	37.7 (139)**	46.3 (171)**	16.0 (59)**
	Dependent	18.1 (50)**	49.1 (136)**	32.9 (91)**
	Did not Occur	20.0 (107)**	52.0 (278)**	28.0 (150)**
Outdoor Locomotion	No assistive device	37.7 (90)**	48.5 (116)**	13.8 (33)**
	Assistive device	22.5 (175)**	50.8 (396)**	26.7 (208)**
	Did not occur	19.0 (31)**	44.8 (73)**	36.2 (59)**

Variable		Number of PT/OT Visits		
		0 Visits (N=296) % (n)	1-4 Visits (N=585) % (n)	5+ Visits (N=300) % (n)
Left House	No	19.2 (43)**	47.8 (107)**	33.0 (74)**
	Yes	26.4 (253)**	50.0 (478)**	23.6 (226)**
Transient Ischemic Attack	No	24.6 (248)	49.8 (502)	25.6 (258)
	Yes	27.8 (48)	48.0 (83)	24.3 (42)
Bladder Incontinence	No	26.1 (190)	49.0 (357)	24.9 (181)
	Yes	23.4 (106)	50.3 (228)	26.3 (119)
Bowel Incontinence	No	26.7 (268)**	49.3 (494)**	24.0 (241)**
	Yes	15.7 (28)**	51.1 (91)**	33.2 (59)**
Home CAP Triggered	No	25.8 (286)**	49.9 (553)**	24.3 (269)**
	Yes	13.7 (10)**	43.8 (32)**	42.5 (31)**
Dyspnea	No	25.6 (245)	49.1 (471)	25.3 (243)
	Yes	23.0 (51)	51.4 (114)	25.7 (57)
Heart Failure	No	25.3 (274)	49.3 (535)	25.4 (276)
	Yes	22.9 (22)	52.1 (50)	25.0 (24)
Coronary Artery Disease	No	24.0 (195)	50.4 (409)	25.6 (208)
	Yes	27.4 (101)	47.7 (176)	24.9 (92)
Hypertension	No	24.3 (83)	48.8 (167)	26.9 (92)
	Yes	25.4 (213)	49.8 (418)	24.8 (208)
Diabetes	No	24.9 (216)	50.3 (437)	24.9 (216)
	Yes	25.6 (80)	47.4 (148)	26.9 (84)
Emphysema/COPD/Asthma	No	25.1 (253)	49.8 (502)	25.2 (254)
	Yes	25.0 (43)	48.3 (83)	26.7 (46)
Hemiplegia/ Hemiparesis	No	25.4 (281)	49.2 (544)	25.4 (281)
	Yes	20.0 (15)	54.7 (41)	25.3 (19)
ADRD[3]	No	24.0 (236)*	49.1 (482)*	26.9 (264)*
	Yes	30.2 (60)*	51.8 (103)*	18.1 (36)*
Any Fracture	No	25.6 (285)	49.2 (549)	25.2 (281)
	Yes	16.7 (11)	54.6 (36)	28.8 (19)
Number of Comorbid Conditions	0-1	27.7 (51)	44.6 (82)	27.7 (51)
	2-4	23.8 (175)	51.6 (379)	24.6 (181)
	5+	26.7 (70)	47.3 (124)	26.0 (68)

*p<0.05

** p<0.001

[1]Past 90 days

[2] Due to small cell sizes, swallowing difficulty was recoded as a binary variable (with l3=1-4 representing any difficulty)

[3]Alzheimer's disease and related dementias

Table 9 interRAI CA OT and PT Bivariate Comparison

	Variable	Occupational Therapy		Physiotherapy	
		% (n) received	O.R. (95% CI)	% (n) received	O.R. (95% CI)
PREDISPOSING					
Age	65-74	63.2 (108)	1.00 (reference)	41.5 (71)	1.00 (reference)
	75-84	70.1 (164)	1.37 (0.90-2.08)	42.3 (99)	1.03 (0.69-1.54)
	85+	70.8 (119)	1.42 (0.90-2.23)	33.9 (57)	0.72 (0.47-1.12)
Sex	Female	72.7 (221)*	1.00 (reference)*	39.5 (120)	1.00 (reference)
	Male	63.2 (170)*	0.65 (0.45-0.92)*	39.8 (107)	1.01 (0.72-1.42)
Language	English	66.7 (350)*	1.00 (reference)*	39.2 (206)	1.00 (reference)
	Other	85.4 (41)*	2.93 (1.29-6.66)*	43.8 (21)	1.20 (0.66-2.19)
Lives Alone	No	67.4 (291)	1.00 (reference)	41.4 (179)	1.00 (reference)
	Yes	70.9 (100)	1.18 (0.78-1.79)	34.0 (48)	0.73 (0.49-1.09)
ENABLING					
Location of Intake	Community	45.7 (32)**	0.34 (0.20-0.56)**	31.4 (22)	0.67 (0.39-1.14)
	Hospital/ED	71.4 (359)**	1.00 (reference)**	40.8 (205)	1.00 (reference)
Referral to Continue or initiate Rehabilitation	No	64.3 (151)	1.00 (reference)	25.5 (60)**	1.00 (reference)**
	Yes	71.0 (240)	1.36 (0.96-1.94)	49.4 (167)**	2.85 (1.98-4.09)**
Caregiver Co-resides	No	68.6 (157)	1.00 (reference)	28.4 (65)**	1.00 (reference)**
	Yes	68.0 (234)	0.98 (0.68-1.40)	47.1 (162)**	2.25 (1.57-3.21)**
Caregiver Distress	No	68.4 (355)	1.00 (reference)	40.1 (208)	1.00 (reference)
	Yes	66.7 (36)	0.92 (0.51-1.68)	35.2 (19)	0.81 (0.45-1.46)
Residence	Urban	68.2 (335)	1.00 (reference)	39.5 (194)	1.00 (reference)
	Rural	68.3 (56)	1.00 (0.61-1.66)	40.2 (33)	1.03 (0.64-1.66)
Year of Hospital Discharge	2011	59.2 (61)	1.00 (reference)	38.8 (40)	1.00 (reference)
	2012	70.9 (263)	1.68 (1.07-2.64)	40.7 (151)	1.08 (0.69-1.69)
	2013	67.7 (67)	1.44 (0.81-2.57)	36.4 (36)	0.90 (0.51-1.59)
NEED					
Poor Self-reported health[1]	No	67.5 (293)	1.00 (reference)	42.2 (183)	1.00 (reference)
	Yes	65.0 (13)	0.89 (0.35-2.29)	30.0 (6)	0.59 (0.22-1.56)
	No Response[1]	71.4 (85)	1.20 (0.77-1.88)	31.9 (38)	0.64 (0.42-0.99)
Mood Symptoms[1]	No	68.1 (265)	1.00 (reference)	39.6 (154)	1.00 (reference)
	Yes	59.0 (36)	0.67 (0.39-1.17)	49.2 (30)	1.48 (0.86-2.54)
	No Response[1]	73.2 (90)	1.28 (0.81-2.01)	35.0 (43)	0.82 (0.54-1.25)
ADL – Bathing	Independent	59.8 (110)*	1.00 (reference)**	35.3 (65)	1.00 (reference)
	Dependent	72.2 (281)*	1.75 (1.21-2.53)**	41.7 (162)	1.31 (0.91-1.88)
ADL – Personal Hygiene	Independent	66.4 (229)	1.00 (reference)	38.3 (132)	1.00 (reference)
	Dependent	71.1 (162)	1.24 (0.87-1.79)	41.7 (95)	1.15 (0.82-1.62)
ADL – Dressing	Independent	66.0 (202)	1.00 (reference)	36.0 (110)	1.00 (reference)
	Dependent	70.8 (189)	1.25 (0.88-1.78)	43.8 (117)	1.39 (0.99-1.95)
ADL – Locomotion	Independent	68.4 (236)	1.00 (reference)	33.9 (117)**	1.00 (reference)**
	Dependent	68.0 (155)	0.98 (0.69-1.40)	48.3 (110)**	1.82 (1.29-2.56)**
ADL Decline[2]	No	59.5 (91)**	1.00 (reference)**	23.5 (36)**	1.00 (reference)**
	Yes	71.4 (300)**	1.7 (1.16-2.51)**	45.5 (191)**	2.71 (1.78-4.13)**
Number of ADL Impairments	0	60.1 (98)	1.00 (reference)	32.5 (53)	1.00 (reference)
	1	75.9 (88)	2.08 (1.23-3.54)	38.8 (45)	1.32 (0.80-2.16)
	2	66.7 (34)	1.33 (0.69-2.57)	37.3 (19)	1.23 (0.64-2.37)
	3	68.0 (53)	1.41 (0.80-2.49)	50.0 (39)	2.08 (1.20-3.60)
	4	71.5 (118)	1.67 (1.05-2.64)	43.0 (71)	1.57 (1.00-2.46)
IADL – Meal	Independent	58.8 (57)*	1.00 (reference)*	36.1 (35)	1.00 (reference)

	Variable	Occupational Therapy		Physiotherapy	
		% (n) received	O.R. (95% CI)	% (n) received	O.R. (95% CI)
Preparation	Dependent	70.2 (334)*	1.65 (1.05-2.59)*	40.3 (192)	1.20 (0.76-1.88)
IADL - Housework	Independent	56.7 (34)*	1.00 (reference)*	33.3 (20)	1.00 (reference)
	Dependent	69.6 (357)*	1.75 (1.02-3.02)*	40.4 (207)	1.35 (0.77-2.38)
IADL - Medication Management	Independent	64.7 (161)	1.00 (reference)	41.8 (104)	1.00 (reference)
	Dependent	71.0 (230)	1.34 (0.94-1.91)	38.0 (123)	0.85 (0.61-1.20)
IADL - Stairs	Independent	65.8 (127)	1.00 (reference)	30.1 (58)**	1.00 (reference)**
	Dependent	69.5 (264)	1.18 (0.82-1.71)	44.5 (169)**	1.86 (1.29-2.69)**
Number of IADL Impairments	0	47.4 (18)	0.36 (0.18-0.72)	31.6 (12)	0.62 (0.30-1.28)
	1	72.2 (26)	1.04 (0.48-2.27)	36.1 (13)	0.76 (0.37-1.56)
	2	67.4 (64)	0.83 (0.50-1.38)	39.0 (37)	0.85 (0.53-1.38)
	3	67.8 (101)	0.84 (0.55-1.31)	37.6 (56)	0.81 (0.53-1.22)
	4	71.4 (182)	1.00 (reference)	42.8 (109)	1.00 (reference)
Cognitive Skills	Independent	66.6 (227)	1.00 (reference)	43.4 (148)*	1.00 (reference)**
	Dependent	70.7 (164)	1.21 (0.84-1.74)	34.1 (79)*	0.67 (0.48-0.95)**
Comprehension Difficulty	None	66.8 (227)	1.00 (reference)	40.9 (139)	1.00 (reference)
	Mild	69.8 (134)	1.15 (0.79-1.69)	37.0 (71)	0.85 (0.59-1.22)
	Moderate/Severe	73.2 (30)	1.36 (0.66-2.81)	41.5 (17)	1.02 (0.53-1.98)
Cognitive Decline[2]	No	65.0 (251)*	1.00 (reference)*	42.2 (163)	1.00 (reference)
	Yes	74.9 (140)*	1.60 (1.08-2.37)*	34.2 (64)	0.71 (0.50-1.02)
Severe and Frequent Pain	No	68.8 (383)	1.00 (reference)	39.3 (219)	1.00 (reference)
	Yes	50.0 (8)	0.45 (0.17-1.23)	50.0 (8)	1.54 (0.57-4.17)
Falls[2]	No	67.4 (232)	1.00 (reference)	39.5 (136)	1.00 (reference)
	Yes	69.4 (159)	1.10 (0.77-1.57)	39.7 (91)	1.01 (0.72-1.42)
Unstable Health	No	64.2 (185)*	1.00 (reference)*	41.0 (118)	1.00 (reference)
	Yes	72.3 (206)*	1.45 (1.02-2.07)*	38.3 (109)	0.89 (0.64-1.25)
Dyspnea	No	68.1 (303)	1.00 (reference)	39.8 (177)	1.00 (reference)
	Yes	68.8 (88)	1.03 (0.68-1.58)	39.1 (50)	0.97 (0.65-1.45)
Rehabilitation Algorithm	1	40.7 (11)**	0.33 (0.15-0.75)**	29.6 (8)**	0.43 (0.18-1.03)**
	2	62.8 (59)**	0.81 (0.49-1.35)**	31.9 (30)**	0.48 (0.29-0.80)**
	3	73.7 (87)**	1.35 (0.82-2.24)**	25.4 (30)**	0.35 (0.21-0.57)**
	4	74.2 (95)**	1.39 (0.85-2.27)**	44.5 (57)**	0.82 (0.53-1.28)**
	5	67.5 (139)**	1.00 (reference)**	49.5 (102)**	1.00 (reference)**
Transient Ischemic Attack	No	69.2 (333)	1.00 (reference)	41.0 (197)	1.00 (reference)
	Yes	63.0 (58)	0.76 (0.48-1.21)	32.6 (30)	0.70 (0.44-1.12)

*p<0.05, **p<0.001

[1] could not/would not respond

[2] past 90 days

Table 10 Number of PT/OT Visits after interRAI CA Assessment

Variable		Number of PT/OT Visits		
		0 Visits (N=94) % (n)	1-4 Visits (N=307) % (n)	5+ Visits (N=172) % (n)
PREDISPOSING				
Age	65-74	18.1 (31)	53.2 (91)	28.7 (49)
	75-84	15.0 (35)	50.0 (117)	35.0 (82)
	85+	16.7 (28)	58.9 (99)	24.4 (41)
Sex	Female	13.8 (42)	54.6 (166)	31.6 (96)
	Male	19.3 (52)	52.4 (141)	28.3 (76)
Language	English	16.8 (88)	53.9 (283)	29.3 (154)
	Other	12.5 (6)	50.0 (24)	37.5 (18)
Lives Alone	No	17.4 (75)	53.2 (230)	29.4 (127)
	Yes	13.5 (19)	54.6 (77)	31.9 (45)
ENABLING				
Location of Intake	Community	34.3 (24)**	42.9 (30)**	22.9 (16)**
	Hospital/ED	13.9 (70)**	55.1 (277)**	31.0 (156)**
Referral to Continue or initiate Rehabilitation	No	28.9 (68)**	47.2 (111)**	23.8 (56)**
	Yes	7.7 (26)**	58.0 (196)**	34.3 (116)**
Caregiver Co-resides	No	17.9 (41)	55.9 (128)	26.2 (60)
	Yes	15.4 (53)	52.0 (179)	32.6 (112)
Caregiver Distress	No	16 (83)	53.4 (277)	30.6 (159)
	Yes	20.4 (11)	55.6 (30)	24.1 (13)
Residence	Urban	16.3 (80)	52.8 (259)	31.0 (152)
	Rural	17.1 (14)	58.5 (48)	24.4 (20)
Year of Hospital Discharge	2011	26.2 (27)**	48.5 (50)**	25.2 (26)**
	2012	12.7 (47)**	57.1 (212)**	30.2 (112)**
	2013	20.2 (20)**	45.5 (45)**	34.3 (34)**
NEED				
Poor Self-reported health	No	13.8 (60)*	56.2 (244)*	30.0 (130)*
	Yes	25.0 (5)*	45.0 (9)*	30.0 (6)*
	Missing[1]	24.4 (29)*	45.4 (54)*	30.3 (36)*
Mood Symptoms	No	13.4 (52)	56.6 (220)	30.1 (117)
	Yes	21.3 (13)	50.8 (31)	27.9 (17)
	Missing[1]	23.6 (29)	45.5 (56)	30.9 (38)
ADL – Bathing	Independent	17.4 (32)*	60.9 (112)*	21.7 (40)*
	Dependent	15.9 (62)*	50.1 (195)*	33.9 (132)*
ADL – Personal Hygiene	Independent	14.2 (49)**	58.8 (203)**	27 (93)**
	Dependent	19.7 (45)**	45.6 (104)**	34.7 (79)**
ADL – Dressing	Independent	15.0 (46)*	58.5 (179)*	26.5 (81)*
	Dependent	18.0 (48)*	47.9 (128)*	34.1 (91)*
ADL – Locomotion	Independent	14.8 (51)**	59.7 (206)**	25.5 (88)**
	Dependent	18.9 (43)**	44.3 (101)**	36.8 (84)**
ADL Decline[2]	No	26.1 (40)**	57.5 (88)**	16.3 (25)**
	Yes	12.9 (54)**	52.1 (219)**	35 (147)**
Number of ADL Impairments	0	19.0 (31)**	60.1 (98)**	20.9 (34)**
	1	7.8 (9)**	60.3 (70)**	31.9 (37)**
	2	17.7 (9)**	54.9 (28)**	27.5 (14)**
	3	11.5 (9)**	53.9 (42)**	34.6 (27)**
	4	21.8 (36)**	41.8 (69)**	36.4 (60)**

Variable		Number of PT/OT Visits		
		0 Visits (N=94) % (n)	1-4 Visits (N=307) % (n)	5+ Visits (N=172) % (n)
IADL – Meal Preparation	Independent	19.6 (19)	54.6 (53)	25.8 (25)
	Dependent	15.8 (75)	53.4 (254)	30.9 (147)
IADL - Housework	Independent	23.3 (14)	50.0 (30)	26.7 (16)
	Dependent	15.6 (80)	54.0 (277)	30.4 (156)
IADL - Medication Management	Independent	14.5 (36)	55.8 (139)	29.7 (74)
	Dependent	17.9 (58)	51.9 (168)	30.3 (98)
IADL - Stairs	Independent	17.1 (33)	58 (112)	24.9 (48)
	Dependent	16.1 (61)	51.3 (195)	32.6 (124)
Number of IADL Impairments	0	29 (11)	47.4 (18)	23.7 (9)
	1	11.1 (4)	61.1 (22)	27.8 (10)
	2	12.6 (12)	55.8 (53)	31.6 (30)
	3	14.8 (22)	60.4 (90)	24.8 (37)
	4	17.7 (45)	48.6 (124)	33.7 (86)
Cognitive Skills	Independent	14.7 (50)	54 (184)	31.4 (107)
	Dependent	19 (44)	53 (123)	28 (65)
Comprehension Difficulty	None	14.4 (49)	54.7 (186)	30.9 (105)
	Mild	18.8 (36)	54.7 (105)	26.6 (51)
	Moderate/Severe	22.0 (9)	39.0 (16)	39.0 (16)
Cognitive Decline[2]	No	16.1 (62)	53.9 (208)	30.1 (116)
	Yes	17.1 (32)	52.9 (99)	30.0 (56)
Falls[2]	No	18.3 (63)	53.2 (183)	28.5 (98)
	Yes	13.5 (31)	54.2 (124)	32.3 (74)
Unstable Health	No	16.0 (46)	51.7 (149)	32.3 (93)
	Yes	16.8 (48)	55.4 (158)	27.7 (79)
Dyspnea	No	15.7 (70)	53 (236)	31.2 (139)
	Yes	18.8 (24)	55.5 (71)	25.8 (33)
Rehabilitation Algorithm	1	40.7 (11)**	33.3 (9)**	25.9 (7)**
	2	14.9 (14)**	61.7 (58)**	23.4 (22)**
	3	16.1 (19)**	61.9 (73)**	22 (26)**
	4	9.4 (12)**	59.4 (76)**	31.3 (40)**
	5	18.5 (38)**	44.2 (91)**	37.4 (77)**
Transient Ischemic Attack	No	15.4 (74)*	52.6 (253)*	32.0 (154)*
	Yes	21.7 (20)*	58.7 (54)*	19.6 (18)*

*$p<0.05$, ** $p<0.001$

[1] Could not/would not respond

[2] Past 90 days

Table 11. Predisposing, Enabling and Need Models for use of OT after RAI-HC Assessment

Variable	Predisposing Only O.R. (95% C.I.)	Enabling Only O.R. (95% C.I.)	Need Only O.R. (95% C.I.)	Predisposing, Enabling and Need O.R. (95% C.I.)
Non-English Language	1.50 (1.08-2.07)			
Branch (Reference=E)				
Not Assigned		0.62 (0.14-2.83)		0.34 (0.07-1.66)
A		0.35 (0.24-0.53)		0.30 (0.20-0.46)
B		0.63 (0.43-0.92)		0.66 (0.44-0.98)
C		0.44 (0.28-0.70)		0.46 (0.29-0.75)
D		0.49 (0.36-0.65)		0.48 (0.35-0.64)
Caregiver Distress		1.53 (1.13-2.06)		
ADL Hierarchy Scale (reference=0)				
1-2			1.04 (0.79-1.39)	1.07 (0.80-1.44)
3+			2.59 (1.74-3.86)	2.75 (1.82-4.14)
Unsteady Gait			1.46 (1.13-1.89)	1.44 (1.10-1.87)
Home Environment CAP triggered			2.17 (1.23-3.83)	1.85 (1.04-3.30)
Stair Use (reference=Independent)				
Dependent			1.44 (1.03-2.01)	1.56 (1.10-2.21)
Did not Occur			1.60 (1.19-2.13)	1.72 (1.27-2.31)
C-Statistic	0.53	0.61	0.64	0.68
Hosmer and Lemeshow Goodness of fit test	NA	0.79	0.87	0.10

Table 12. Predisposing, Enabling, and Need Models for use of PT after RAI-HC Assessment

Variable	Predisposing Only O.R. (95% C.I.)	Enabling Only O.R. (95% C.I.)	Need Only O.R. (95% C.I.)	Predisposing, Enabling and Need O.R. (95% C.I.)
Married	1.77 (1.40-2.24)			1.59 (1.23-2.06)
Branch (Reference=E)				
Not Assigned		0.56 (0.11-2.99)		0.83 (0.15-4.67)
A		0.54 (0.36-0.83)		0.51 (0.32-0.79)
B		0.68 (0.46-0.99)		0.68 (0.46-1.02)
C		1.61 (1.00-2.59)		1.58 (0.96-2.60)
D		0.81 (0.60-1.07)		0.77 (0.57-1.04)
Primary Caregiver Co-resides		1.35 (1.04-1.74)		
Hours of Informal Care/week (reference=0-20)				
21-40 hours/week		1.73 (1.31-2.28)		1.70 (1.28-2.26)
>40 hours/week		2.01 (1.33-3.03)		2.13 (1.37-3.32)
ADRD			0.54 (0.37-0.77)	0.53 (0.37-0.78)
Stair Use (reference=independent)				
Dependent			2.23 (1.59-3.12)	1.89 (1.33-2.69)
Did not Occur			1.54 (1.15-2.06)	1.66 (1.23-2.24)
Unsteady Gait			1.98 (1.51-2.59)	1.92 (1.45-2.53)
Cognitive Performance Scale (reference=0)				
1-2			0.71 (0.54-0.93)	0.62 (0.46-0.82)
3+			0.59 (0.38-0.91)	0.46 (0.29-0.73)
C-Statistic	0.57	0.63	0.65	0.70
Hosmer and Lemeshow Goodness of fit test	NA	0.82	0.10	0.13

Table 13 Predisposing, Enabling and Need Models for use of OT after interRAI CA Assessment

Variable	Predisposing Only O.R. (95% C.I.)	Enabling Only O.R. (95% C.I.)	Need Only O.R. (95% C.I.)	Predisposing, Enabling and Need O.R. (95% C.I.)
Male Sex (reference=female)	0.64 (0.45-0.92)			0.62 (0.43-0.89)
Non-English Language	2.94 (1.29-6.70)			2.78 (1.20-6.43)
Community Intake (reference=Hosp/ED)		0.34 (0.20-0.56)		0.33 (0.19-0.55)
Cognitive Decline			See Figure 5	See Appendix G
Unstable Health			See Figure 5	See Appendix G
Cognitive Decline*Unstable Health			See Figure 5	See Appendix G
C-Statistic	0.59	0.56	0.58	0.66
Hosmer and Lemeshow Goodness of fit test	0.73	NA	1.00	0.96

Table 14. Enabling and Need Models for use of PT after interRAI CA Assessment

Variable	Enabling Only O.R. (95% C.I.)	Need Only O.R. (95% C.I.)	Predisposing, Enabling and Need O.R. (95% C.I.)
Referral for Rehabilitation	2.87 (1.98 – 4.15)		3.24 (2.18 – 4.81)
Caregiver Co-resides	2.27 (1.57 – 3.27)		See Figure 6
Dependent in Locomotion*Caregiver Co-resides			See Figure 6
Dependent in Locomotion		1.96 (1.31 – 2.93)	See Figure 6
ADL Decline		2.62 (1.67 – 4.10)	2.62 (1.65 – 4.16)
Dependent in Decision Making		0.43 (0.29 – 0.64)	0.49 (0.32 – 0.74)
C-Statistic	0.67	0.66	0.74
Hosmer and Lemeshow Goodness of fit test	0.76	0.82	0.97

Table 15 Models Stratified by Referral for Rehabilitation, use of OT after interRAI CA Assessment

Variable	Full Model	Not Referred for Rehabilitation (N=235)		Referred for Rehabilitation (N=338)
		Original Variables	Additional Variables	Original Variables
	O.R. (95% C.I.)	O.R. (95% C.I.)	O.R. (95% C.I.)	O.R. (95% C.I.)
Male Sex (reference=female)	0.62 (0.43-0.89)			0.56 (0.34 – 0.93)
Non-English Language	2.78 (1.20-6.43)			11.84 (1.55 – 90.68)
Community Intake (reference=hosp/ED)	0.33 (0.19-0.55)			0.16 (0.07 – 0.35)
ADL Decline			2.13 (1.12 – 4.08)	
Cognitive Decline	See Figure 5	See Appendix G	See Appendix G	
Unstable Health	See Figure 5	See Appendix G	See Appendix G	
Cognitive Decline*Unstable Health	See Figure 5	See Appendix G	See Appendix G	
C-Statistic	0.66	0.59	0.62	0.68
Hosmer and Lemeshow Goodness of fit test	0.96	0.79	0.79	0.99

Table 16 Models Stratified by Referral for Rehabilitation, use of PT after interRAI CA Assessment

Variable	Full Sample (N=537)	Not Referred for Rehabilitation (N=235)	Referred for Rehabilitation (N=338)	
		Original variables	Original variables	Additional Variables
	O.R. (95% C.I.)	O.R. (95% C.I.)	O.R. (95% C.I.)	O.R. (95% C.I.)
Referral for Rehabilitation	3.24 (2.18 – 4.81)			
Caregiver Co-resides	See Figure 6	See Appendix G	See Figure 7	See Appendix G
Dependent in Locomotion	See Figure 6	See Appendix G	See Figure 7	See Appendix G
ADL Decline	2.62 (1.65 – 4.16)		2.72 (1.57 – 4.70)	2.41 (1.38 – 4.23)
Dependent in Decision Making	0.49 (0.32 – 0.74)		0.50 (0.30 – 0.82)	0.47 (0.28 – 0.79)
Dependent in Locomotion* Primary Caregiver Coresides	See Figure 6	See Appendix G	See Figure 7	See Appendix G
Difficulty with Stairs				1.95 (1.12 – 3.38)
C-Statistic	0.74	0.70	0.70	0.72
Hosmer and Lemeshow Goodness of fit test	0.97	1.00	1.00	0.80

Table 17 Predisposing, Enabling and Need Model amount of PT/OT after RAI-HC

Variable	1-Category Increase O.R. (95% C.I.)	
	1-4 vs. 0 O.R. (95% C.I.)	5+ vs. 0-4 O.R. (95% C.I.)
Married	1.15 (0.86-1.54)	1.72 (1.30-2.29)
Branch (Reference=E)		
Not Assigned	0.47 (0.08-2.62)	<0.001 (<0.001->999.999)
A	0.33 (0.21-0.51)	0.58 (0.36-0.93)
B	0.69 (0.44-1.09)	0.50 (0.32-0.80)
C	1.01 (0.54-1.89)	0.48 (0.27-0.84)
D	0.54 (0.38-0.76)	0.45 (0.32-0.63)
Hours of Informal Care/week (reference=0-20)		
21-40 hours/week	1.53 (1.17-2.00)	
>40 hours/week	1.16 (0.77-1.76)	
Client believes function can improve	1.56 (1.23-1.97)	
ADL Hierarchy Scale (reference=0)		
1-2	0.92 (0.69-1.22)	
3+	1.63 (1.13-2.34)	
Unsteady Gait	1.98 (1.54-2.53)	
Stair Use (reference=independent)		
Dependent	2.14 (1.54-2.97)	
Did not Occur	2.11 (1.59-2.81)	
ADRD	0.66 (0.49-0.90)	
C-Statistic	0.69	
Deviance test p-value	0.22	
Pearson test p-value	0.65	

Table 18 Models Stratified by Referral for Rehabilitation, use of PT/OT after interRAI CA Assessment

Variables	Full Sample		Not Referred for Rehabilitation (N=235)		Referred for Rehabilitation (N=338)	
	1-Category Increase O.R. (95% C.I.)		1-Category Increase O.R. (95% C.I.)		1-Category Increase O.R. (95% C.I.)	
	1-4 vs. 0 O.R. (95% C.I.)	5+ vs. 0-4 O.R. (95% C.I.)	1-4 vs. 0 O.R. (95% C.I.)	5+ vs. 0-4 O.R. (95% C.I.)	1-4 vs. 0 O.R. (95% C.I.)	5+ vs. 0-4 O.R. (95% C.I.)
Referral for Rehabilitation	5.39 (3.21 – 9.03)	1.78 (1.21 – 2.63)				
Community Intake (Reference=Hosp/ED)	0.42 (0.23 – 0.77)	0.69 (0.38 – 1.27)			0.18 (0.07 – 0.47)	0.55 (0.23 – 1.28)
Year of Hospital Discharge (Reference=2011)						
2012	2.44 (1.35 – 4.41)	1.29 (0.78 – 2.13)			5.13 (1.93 – 13.65)	1.15 (0.63 – 2.10)
2013	2.07 (1.01 – 4.26)	1.81 (0.97 – 3.38)			1.89 (0.58 – 6.17)	2.51 (1.09 – 5.77)
ADL Decline	2.64 (1.80 – 3.86)		2.84 (1.62 – 4.97)		2.52 (1.50 – 4.23)	
C-Statistic	0.67		0.59		0.64	
Deviance p-value	0.04		0.84		0.02	
Pearson p-value	0.06		0.84		0.05	

Table 19 Summary RAI-HC Models

	OT	PT	PT/OT (0 vs. 1-4/0-4 vs. 5+)
PREDISPOSING			
Age	N.S.	N.S.	N.S.
Sex	N.S.	N.S.	N.S.
Married	N.S.	++	N.S./++
Language	N.S.	N.S.	N.S.
Education	N.S.	N.S.	N.S.
Lives Alone	N.S	N.S.	N.S.
ENABLING			
Primary Caregiver Co-resides	N.S.	N.S.	N.S.
Caregiver Distress	N.S.	N.S.	N.S.
Residence	N.S.	N.S	N.S.
Branch (reference=E)	P<0.0001	P<0.01	P<0.0001
Not Assigned	N.S.	N.S.	N.S./N.S.
Branch A	--	--	--/-
Branch B	-	N.S.	N.S./-
Branch C	--	+	N.S./-
Branch D	--	N.S.	--/--
Year of Hospital Discharge	N.S.	N.S.	N.S.
Hours of Informal Care (reference=0-20)	N.S.	++	P<0.01
<21-40 hours	N/A	++	++
>40 hours	N/A	++	N.S.
NEED			
Poor Self-reported health	N.S.	N.S.	N.S.
Caregiver believes function can improve	N.S.	N.S.	N.S
Client believes function can improve	N.S.	N.S.	++
Good prospects for functional improvement	N.S.	N.S.	N.S.
Expression Difficulty	N.S.	N.S.	N.S.
Comprehension Difficulty	N.S.	N.S.	N.S.
Communication Decline	N.S.	N.S.	N.S.
Swallowing Difficulty	N.S.	N.S.	N.S.
Mood Decline	N.S.	N.S.	N.S.
Depression Rating Scale	N.S.	N.S.	N.S.
Cognitive Performance Scale	N.S.	--	N.S.
CHESS Scale	N.S.	N.S.	N.S.
Pain Scale	N.S.	N.S.	N.S.
ADL Decline	N.S.	N.S.	N.S.
Modified ADL CAP	N.S.	N.S.	N.S.
ADL Hierarchy Scale	++	N.S.	++
IADL Capacity Scale	N.S.	N.S.	N.S.
Rehabilitation Algorithm	N.S.	N.S.	N.S.
Falls	N.S.	N.S.	N.S.
Unsteady Gait	++	++	++
Stair Use	++	++	++
Outdoor Locomotion	N.S.	N.S.	N.S.
Left House	N.S.	N.S.	N.S.
Transient Ischemic Attack	N.S.	N.S.	N.S.
Bladder Incontinence	N.S.	N.S.	N.S.
Bowel Incontinence	N.S.	N.S.	N.S.

	OT	PT	PT/OT (0 vs. 1-4/0-4 vs. 5+)
Home CAP Triggered	+	N.S.	N.S.
Dyspnea	N.S.	N.S.	N.S.
Heart Failure	N.S.	N.S.	N.S.
Coronary Artery Disease	N.S.	N.S.	N.S.
Hypertension	N.S.	N.S.	N.S.
Diabetes	N.S.	N.S.	N.S.
Emphysema/COPD/Asthma	N.S.	N.S.	N.S.
Hemiplegia/ Hemiparesis	N.S.	N.S.	N.S.
ADRD	N.S.	--	--
Any Fracture	N.S.	N.S.	N.S.
Number of Comorbid Conditions	N.S.	N.S.	N.S.

N.S. Not significant
+ positive association $p<0.05$
++ positive association $p<0.01$
- negative association $p<0.05$
-- negative association $p<0.01$
Note that p-values are provided when the direction of the effect is variable across different levels of the categories

Table 20 Summary interRAI CA Models

	OT	PT	PT/OT (0 vs. 1-4/0-4 vs. 5+)
PREDISPOSING			
Age	N.S.	N.S.	N.S.
Sex	-	N.S.	N.S.
Language	+	N.S.	N.S.
Lives Alone	N.S.	N.S.	N.S.
ENABLING			
Location of Intake	-	N.S.	N.S./-
Referral to Continue or initiate Rehabilitation	N.S.	++	++/++
Caregiver Co-resides	N.S.	*	N.S.
Caregiver Distress	N.S.	N.S.	N.S.
Urban/Rural Residence	N.S.	N.S.	N.S.
Year of Hospital Discharge (reference 2011)	N.S.	N.S.	+
2012	N/A	N/A	++/++
2013	N/A	N/A	+/N.S.
NEED			
Poor Self-reported health	N.S.	N.S.	N.S.
Mood Symptoms	N.S.	N.S.	N.S.
ADL – Bathing	N.S.	N.S.	N.S.
ADL – Personal Hygiene	N.S.	N.S.	N.S.
ADL – Dressing	N.S.	N.S.	N.S.
ADL – Locomotion	N.S.	*	N.S.
ADL Decline	N.S.	++	++
Number of ADL Impairments	N.S.	N.S.	N.S.
IADL – Meal Preparation	N.S.	N.S.	N.S.
IADL - Housework	N.S.	N.S.	N.S.
IADL - Medication Management	N.S.	N.S.	N.S.
IADL - Stairs	N.S.	N.S.	N.S.
Number of IADL Impairments	N.S.	N.S.	N.S.
Cognitive Skills	N.S.	--	N.S.
Comprehension Difficulty	N.S.	N.S.	N.S.
Cognitive Decline	*	N.S.	N.S.
Falls	N.S.	N.S.	N.S.
Unstable Health	*	N.S.	N.S.
Dyspnea	N.S.	N.S.	N.S.
Rehabilitation Algorithm	N.S.	N.S.	N.S.
Transient Ischemic Attack	N.S.	N.S.	N.S.

N.S. Not significant
+ positive association $p<0.05$
++ positive association $p<0.01$
- negative association $p<0.05$
-- negative association $p<0.01$
* indicates variable involved in an interaction
Note that p-values are provided when the direction of the effect is variable across different levels of the categories

Chapter 7
Discussion

The primary objectives of this study were to describe the characteristics of older stroke survivors receiving home care services from the HNHB CCAC and understand how these characteristics related to the use of Occupational Therapy and Physiotherapy Home Care services. Three main research questions were addressed: (1) What is the profile of older stroke survivors receiving home care services; (2) What is the relationship between predisposing, enabling, and need characteristics and the use of Occupational Therapy and Physiotherapy services after stroke; (3) What is the relative contribution of predisposing, enabling, and need characteristics to the use of CCAC rehabilitation services after stroke. This section will discuss the findings related to these research questions in the context of existing research, identify the strengths and limitations of the current study, and discuss implications of the findings for the delivery of Home Care services and future research.

7.1 Profile of Older Stroke Survivors

Comparisons between older stroke survivors receiving services from the HNHB CCAC with the general home care population without stroke identified several areas where those with stroke differed from the general home care population. Those with stroke tended to be more impaired in communication, cognition, swallowing, ADLs, IADLs than the general home care population. Findings related to the profile of older stroke survivors were generally consistent with findings reported elsewhere in the literature from other studies conducted in Canada.

Among those assessed with the RAI-HC and interRAI CA, stroke survivors tended to be younger, male, were less likely to live alone, and those assessed with the RAI-HC were more likely to be married. In contrast, Clark, Marshall, Black & Colantonio (2002) found no significant differences

in demographics. Cloutier-Fisher (2005) reported that stroke survivors were more likely to be male; however, they were less likely to be married and tended to be older than the general population. The difference in findings related to age in the present study may be a function of the reference population, which included all community dwelling seniors in the Cloutier-Fisher (2005) study. Compared to the general community-dwelling elderly population, home care recipients are generally older. Additionally, older age after stroke has been associated with institutionalization, so older adults living in the community may be less likely to remain in the community after a stroke, particularly if they are not married. Findings regarding marital status in the Cloutier-Fisher (2005) study and present study may be related to age, with populations who are younger being more likely to be married.

Important differences were found in the provision of informal support between those with stroke and those without receiving home care services. The RAI-HC study found that stroke survivors tended to receive a greater amount of informal care; however, findings from both studies indicated that caregivers for older adults with stroke did not have a higher prevalence of distress than the caregivers of those without stroke. The prevalence of caregiver burden in the present study was also lower than has been reported in previous studies. A review of studies examining the prevalence of caregiver burden following stroke reported estimates ranging from 25% to 54% (Rigby, Gubitz, & Phillips, 2009) while prevalence in the present study was 20% for those assessed with the RAI-HC and 9.4% for those assessed with the interRAI CA. Differences between existing literature may be due to differences in measures used or the populations examined. Caregiver distress is a multidimensional concept that takes into account psychological, emotional, physical, sociological, and economical domains (Rigby et al., 2009). Previous studies used more detailed measures of caregiver distress, which may have resulted in higher estimates of prevalence. The absence of a difference between those with stroke and the general older home care population may also be due to the nature of home care recipients, most who require some assistance to live independently. Although

individuals in the comparison group tended to receive less informal care, their caregivers may have been providing support for a longer period of time. This may have contributed to a higher level of distress relative to the amount of informal care provided. Finally, caregivers of those with stroke were twice as likely to believe that the individual was capable of increased functional independence. This belief may have influenced the lower rates of caregiver distress observed among the caregivers of those with stroke.

Difficulties with swallowing and communication were also found to be more prevalent among those with stroke. This was not examined in previous studies, but is not surprising as swallowing and communication are both affected by stroke. Difficulties with expression and comprehension, that were observed to be more common among stroke survivors, are likely related to aphasia resulting from the stroke. Although dysphagia can occur among older adults due to physiologic changes in swallowing associated with aging, age-related diseases like stroke are associated with higher rates of dysphagia (Sura, Madhavan, Carnaby, & Crary, 2012).

There was a significantly higher prevalence of mood symptoms among those assessed with the RAI-HC and the interRAI CA. Among those assessed with a RAI-HC, recent mood decline was also more prevalent. Despite the higher rate of mood symptoms observed the prevalence was not as high as has been reported by others. Hackett & Pickles (2014) reported a prevalence rate of 31% for depression after stroke in a recent review, however this was not limited to older populations or community settings. Cloutier-Fisher (2005) also found that those affected by stroke scored lower on the mental health subscale of the Short Form Health Survey (SF-36), indicating poorer mental health. The higher prevalence of mood symptoms observed is not surprising as depression is a recognized consequence of stroke (Mukherjee et al., 2006).

The profile of stroke survivors assessed with the interRAI CA had a higher prevalence of recent cognitive decline and were more likely to require assistance with daily decision making.

Among those assessed with the RAI-HC, a greater proportion had higher scores on the CPS compared with the general older home care population. The prevalence of Alzheimer's disease and dementia was similar among those with stroke and those without, meaning that these conditions were not responsible for the higher cognitive impairment observed among those with stroke. Clarke and colleagues (2002) reported a lower level of cognitive function among stroke survivors as compared to older community dwelling adults using the modified Mini Mental State Examination.

The profile of stroke survivors assessed with the RAI-HC and interRAI CA revealed that those with stroke had greater functional impairment as compared to the general home care population. Those with stroke had greater difficulty with ADLs as measured by individual items on the interRAI CA and summary scales on the RAI-HC. This is consistent with findings reported in previous studies (Clarke et al., 2002; Cloutier-Fisher, 2005). The higher prevalence of ADL decline observed in both samples indicates that some degree of the ADL impairment observed is recent and likely due to the occurrence of stroke. Stroke survivors were also found to have greater difficulty with outdoor locomotion and were more likely to require an assistive device, similar to that reported by Clarke and colleagues (2002). In addition to the higher rate of ADL and IADL impairment, those with stroke were also more likely to have unsteady gait. Despite this, the prevalence of falls among those with stroke tended to be similar to the general home care population. This is in contrast to the increased risk of falls associated with stroke that has been reported previously (Jorgensen, Engstad, & Jacobsen, 2002) when stroke survivors were compared with age and sex matched controls. Several reasons may be responsible for the observed difference. First, falls in the present study were measured retrospectively (past 90 days), which included the period prior to stroke. Second, the study by Jorgensen and colleagues (2002) included a wider age range (31 – 93). The comparison group in the present study likely had a higher rate of falls than the comparison group in the Jorgensen study, due to their advanced age.

Previous studies profiling community-dwelling stroke survivors in Canadian settings have reported a greater number of comorbid conditions among those affected by stroke as compared to the general community-dwelling elderly population (Clarke et al., 2002; Cloutier-Fisher, 2005). In contrast, the present study found no difference in the number of comorbidities between home care clients with stroke and those without. This discrepancy may be related to differences in the populations included in the previous study as well as differences in the comorbidities measured. A sample of community-dwelling elderly may have a lower prevalence of chronic diseases than those accessing a greater amount of formal home care services, as in the comparison groups used in the current study. The comorbidities included in previous studies may also explain the difference. The focus on conditions associated with stroke, such as hypertension, diabetes, and heart disease in previous studies may be the reason for the higher comorbidity burden observed among those with stroke in previous studies. In the present study, conditions such as hypertension and coronary artery disease were more common among those who had suffered a stroke, but other conditions (e.g., cancer, heart failure, and chronic lung conditions) were more prevalent among the general home care population. Thus, the inclusion of a wider variety of conditions may be responsible for differences in findings between the current study and previous studies conducted in Canada.

7.2 Use of Rehabilitation Services

7.2.1 Predisposing Variables

Overall, predisposing variables did not play a major role in explaining the use of rehabilitation home care services after stroke. For occupational therapy, language was a significant predictor for both the interRAI CA sample and RAI-HC sample when predisposing characteristics were examined alone. However, for the RAI-HC sample, controlling for CCAC branch resulted in language not being a significant predictor in the final model. The association between language and

OT is likely confounded by differences in branch among English and non-English speakers, as there were significant differences in the proportion of English speakers across CCAC branches. Those not speaking English appeared to have a higher utilization of OT because they received services in a CCAC branch with a higher relative utilization of OT services. As a result, once CCAAC branch was adjusted for, language was not longer independently associated with service use. In the interRAI CA model, branch was not included as a covariate so language remained in the final model. Males were also found to be less likely to receive OT services after the CA, but not after the RAI-HC. However, the reasons for this are not well understood. Adjustment for age and co-residing caregiver did not reduce the strength of the association between sex and OT use. The other predisposing factor that was associated with the use of services was marital status. Among those assessed with the RAI-HC, those who were currently married were more likely to receive PT services, and more likely to receive a higher number of PT/OT visits. This may be related to the nature of informal support provided by a person's spouse. In the PT model, co-residing caregiver was not longer significant after adjusting for marital status, suggesting that the relationship of the caregiver (as measured by marital status) was important in addition to living arrangement. In both models, marital status was also significantly associated with the use of services independent of the amount of informal care provided.

7.2.2 Enabling Variables

In comparison to the predisposing variables examined, enabling variables were stronger predictors of the use of rehabilitation services. Caregiver variables were consistent predictors across the models, which emphasizes the important role of informal care for those in need of home care services. Bass & Noelker (1987) identified potential reasons why caregivers may influence older adult's use of home care services. Caregivers may influence the use of services in a direct fashion by contacting home care organizations or service providers directly to arrange for services on behalf of the person. A caregiver may also influence the person's perceptions of illness or need for services.

Finally, a caregiver may influence the use of services if the person assessing need for services takes the caregiver's status into account (Bass & Noelker, 1987). These may be potential mechanisms for how the presence of a caregiver may influence the use of services after stroke. Among those receiving OT after assessment with the RAI-HC, the presence of caregiver distress was associated with the use of services in the enabling only model. Caregivers who are more distressed may be more likely to actively seek out services to alleviate the strain of caregiving (Bass & Noelker, 1987). However, after need variables were included into the model, caregiver distress no longer independently predicted service use. Those with distressed caregivers may have had greater ADL impairment, which may be a stronger predictor of the need for OT services. Finally, the amount of informal care provided was also an independent predictor of the use of PT services and the amount of PT/OT provided independent of need factors. This may be related to the reasons mentioned above, or the presence of an involved caregiver may improve a person's compliance with a rehabilitation program, particularly for physiotherapy services.

Among those assessed with the CA, those who were assessed in the hospital were more likely to receive rehabilitation services. This may be due to hospital pressures to reduce alternate level of care days, leading to patients being discharged earlier with greater needs for in home services in order to return home. However, adjustment for need variables did not reduce the strength of the association. In the model examining the number of PT/OT visits received after stroke, location of intake was only associated with any vs. 1-4 visits, but not 5+ rehabilitation visits. This is likely due to the process used to allocate services. For those admitted from hospital, a hospital case manager may authorize a limited number of visits, with subsequent visits being determined following in-home assessment if the individual is expected to be on services for more than 60 days. Mohammed and colleagues (2013) identified two different approaches used to allocate therapy services by CCACs, predetermined and collaborative. In the collaborative approach, the case manager authorizes a limited number of visits

with additional visits being determined following input from the therapist. This may be a potential reason why some variables were associated with contact with rehabilitation services, but not a higher (5+) number of visits.

Urban and rural place of residence was examined as a potential enabling variable associated with the use of rehabilitation services based on previous literature (Jia et al., 2012). No significant effect of urban/rural status was found on the use of home care rehabilitation services after stroke. This may be due to the setting used for the present study, which did not include remote areas. Studies including remote areas, for example Northern Ontario, in addition to urban and rural settings may be needed to see differences in service utilization. Another potential explanation is the type of service examined. Living in a rural area may have a greater effect on the use of outpatient rehabilitation services as these services may be concentrated in more populated areas. Thus, differences in the type of services examined in the study by Jia and colleagues may also explain the difference in findings.

Year of discharge was included in the models as another potential covariate to examined temporal variation in the use of services. The year of discharge was only significant in the model examining the number of PT/OT visits received after assessment with the CA. In this model year of discharge was associated with receiving 1-4 vs. 0 PT/OT visits, but was not significantly associated with the use of a higher number of PT/OT visits. Temporal trends in the use of rehabilitation home care services may be due to differences in available funding across years. A qualitative study examining allocation of PT/OT services in home care identified cost containment as a system-level factor affecting the allocation of services (Mohammed et al., 2013). Changes in the availability of rehabilitation in the acute care sector over time may also affect the demand for home care rehabilitation services resulting in differences in the utilization of PT/OT services over time.

CCAC branch was included as another enabling variable to examine geographic variation in the use of home care rehabilitation services following assessment with the RAI-HC. In all three RAI-

HC models, significant variation according to CCAC branch was found. This may be due to a number of factors. First, differences across branches in the use of physiotherapy vs. occupational therapy may account for some of the differences in the OT and PT models. In examining the process of rehabilitation home care allocation, Mohammed and colleagues (2013) reported that case managers are often permitted to authorize one service (PT or OT) at a time. Differences in the allocation of PT or OT may be due to difference in practice patterns within the different branches (e.g., some branches may be more likely to allocate PT for a given issue, while others may be more likely to allocate OT services). However, branch remained significant in the combined PT/OT model suggesting that there are differences across branches in the allocation of rehabilitation services overall. This may be due to differences in the availability of rehabilitation services in other sectors across branches (e.g., outpatient or inpatient rehabilitation). As information on the use of other rehabilitation services was not available in the present study, it was not possible to test this directly. Within the Haldimand-Norfolk branch of the HNHB CCAC, limited access to outpatient rehabilitation led to the development of a community stroke rehabilitation pilot to improve access to rehabilitation services in 2013 (HNHB LHIN, 2013).

Referral for rehabilitation was included for those assessed with the CA as a potential explanatory variable. Referral for rehabilitation was associated with an increased likelihood of receiving PT services and the number of PT/OT visits received. The strong relationship between this variable and the use of rehabilitation services was not surprising. Case managers often receive referrals for rehabilitation from other sources (e.g., family, physician). Interestingly, those referred for rehabilitation were not more likely to receive OT services. OT services may be provided for those needing equipment or assistive devices. This may not be identified as a need for rehabilitation at the time of referral, but rather a need for equipment or home modification that would be addressed by the

provision of occupational therapy. Additionally, the need for OT services may not be apparent until the person is assessed in their home environment following hospital discharge.

7.2.3 Need Variables

Perceptions of health status and the potential for functional improvement (as determined by the individual, the case manager, and the caregiver) were examined as potential predictors of the use of services. Self-reported health was not a significant predictor of the use of rehabilitation services after stroke. Although all three perceptions of functional improvement potential were significantly associated with the number of PT/OT visits at a bivariate level, only the individual's perception of personal capacity for functional improvement was significantly associated with the number of PT/OT visits received. This may be related to motivation, which could enhance participation in rehabilitation and possibly the level of functional improvement that occurred. In addition, individuals who believe that they are capable of functional improvement may also be more likely to advocate for rehabilitation services.

Communication issues including: difficulty being understood (expression), difficulty understanding others (comprehension), and recent communication decline were examined in the present study. None of these variables remained in the final models, despite being associated with the use of services at a bivariate level. These variables may only be associated with the use of services as markers of stroke severity, and once difference in functional status and cognition are adjusted for the association is no longer present. Additionally, difficulties with communication may be more related to the use of other home care services, specifically Speech Language Pathology. The treatment of communication difficulties after stroke is more closely related to the scope of practice of Speech Language Pathologists (Jordan & Hillis, 2006). Swallowing was another variable that was not significantly associated with the use of rehabilitation home care services. This may be due to similar

reasons as for communication; issues with swallowing may be more directly addressed by the provision of Speech Language Pathology or Dietetics services (Sura et al., 2012).

Mood symptoms were also examined as potential predictors of the use of rehabilitation services based on the findings from previous studies (Jia et al., 2011; Jia et al., 2006). Mood decline and DRS scores were not found to be associated with the use of rehabilitation services after stroke. This may be due to differences in the measurement of depression, study population, or type of services included in previous studies. Jia and colleagues (2011) found that it was not depression diagnosis itself, but active treatment using antidepressants that was associated with higher use of services. The exclusion of a clinical depression diagnosis and antidepressant use from the present study may be one reason for the difference in findings. Secondly, previous studies examining depression focused on the use of any outpatient health services after stroke, including primary care. A review of determinants of healthcare utilization among those with chronic illness identified depression and psychological distress as predictors of physician and hospital utilization (de Boer, Wijker, & de Haes, 1997). Thus, differences in findings related to depression across may be due to differences in the type of services examined. In the present study, mood symptoms indicative of potential depression were associated with the use of OT at a bivariate level, but became non-significant after adjusting for ADL impairment. The association between mood symptoms and the use of services may be related to greater functional impairment among those exhibiting mood symptoms, a confounder that was not adjusted for in previous studies examining the role of depression.

Cognition was negatively associated with the use of physiotherapy and the number of rehabilitation visits received. For OT, cognitive decline was associated with increased use of OT when health was stable. Cognitive rehabilitation is an identified area of practice for occupational therapists (Hoffmann et al., 2010). Cognitive issues have previously been identified in the literature as a reason for referral to occupational therapy services (Mohammed et al., 2013). However, it may be

that such interventions are not feasible for those with unstable health resulting in reduced utilization. In acute care settings, the initiation of rehabilitation may be delayed until an individual's health is stable (Duncan et al., 2005). Negative associations between cognitive impairment and the use of physiotherapy may be due to practical difficulties conducting rehabilitation interventions in this population. For those with cognitive impairment affecting executive functioning, difficulty with initiating activities, maintaining consistency of response, inhibiting impulsive behaviors and generalizing instructions to other tasks may affect their ability to participate in rehabilitation (Skidmore et al., 2010). Difficulty with memory can result in difficulty remembering exercises, advice, and previous visits potentially resulting in poorer compliance and reduced efficacy of treatment (Kempenaar, 2005). Perceptions of the effectiveness of rehabilitation for those with cognitive impairment may be a reason for the negative association between cognitive impairment and rehabilitation use. However, others have criticized the view that cognitively impaired individuals can not benefit from rehabilitation, due to the lack of evidence in this area (Poynter, Kwan, Sayer, & Vassallo, 2008). Kempenaar (2005) identified strategies that physiotherapists can use when working with people with dementia to accommodate cognitive impairment, such as adjusting communication to suit their needs and providing memory aids for exercises (Kempenaar, 2005). A diagnosis of Alzheimer's disease or dementia was also associated with reduced utilization of PT and PT/OT visits independent of the level of cognitive impairment. The inclusion of both variables in the model may be related to differences in pre-morbid cognitive impairment (e.g., due to Alzheimer's or dementia) vs. that due to the stroke itself (e.g., measured by the CPS). Preexisting cognitive impairment due to dementia or Alzheimer's disease may further reduce utilization of services.

The Home Environment Optimization CAP was a significant predictor of the use of OT services after assessment with the RAI-HC. This finding is related to those reported by Mohammed and colleagues (2013), who found that concerns about home safety were an important concern

prompting referral to rehabilitation services, such as OT. They noted that safety concerns were considered to be greater for those with multiple difficulties in physical functioning, previous falls, and impaired cognition (Mohammed et al., 2013). This is consistent with the criteria used to trigger the Home Environment Optimization CAP. The CAP identifies those who have issues with their home environment and who have physical or mental conditions that exacerbate these problems, creating safety concerns (Morris et al., 2008).

Across models, variables related to functional status were consistent predictors of the use of rehabilitation services. Stair use and unsteady gait were consistent predictors of the use of rehabilitation services following RAI-HC assessment. These may reflect difficulties with walking, resulting from impairments in muscle strength, motor control, or balance resulting from stroke (Eng & Tang, 2007). Walking ability has also been identified as an important rehabilitation goal for individuals living in the community after stroke (Harris & Eng, 2004). The ability to use stairs is another important task for community mobility (Eng & Tang, 2007). Difficulty with ambulation may also reflect unmet need for home modifications or assistive devices that may be addressed by the provision of OT services.

The mode of outdoor locomotion was also a significant predictor of rehabilitation use. This may be due to impairments related to walking or the need for equipment as mentioned above, or may be related to the eligibility criteria for in-home rehabilitation services. The use of assistive devices, such as a cane, walker, or wheelchair has been previously identified as a predictor of service use after stroke (Winkler et al., 2011). Alternatively, requiring assistance with outdoor locomotion might be related to eligibility criteria for in-home rehabilitation. Individuals are eligible for rehabilitation services if they are homebound, and thus not able to access outpatient rehabilitation.

The ADL Hierarchy Scale was another significant predictor of the use of OT services, and the amount of PT/OT services. Occupational therapy services can help stroke survivors who are

dependent in areas of self-care such as bathing and dressing by making suggestions to help improve their abilities to carry out these tasks independently (Harris & Eng, 2004). Similarly, ADL decline was a significant predictor in many of the models. Recent decline in ADL abilities, as caused by a stroke or prolonged hospitalization may also prompt referral to rehabilitation services to help improve or adapt to ADL limitations. Although measures of difficulty with IADLs were included in the present study, only those related to the use of stairs were significant predictors in the final models. Although independence in IADLs have been identified as areas of concern for individuals following stroke, issues related to mobility and ADL performance may take precedence in the early stages of rehabilitation (Harris & Eng, 2004).

The Rehabilitation Algorithm was examined as a potential predictor of the use of rehabilitation services, but was not included in any of the final models. Although the algorithm had an overall significant association with the use of services, individual levels did not provide good differentiation between the likelihood of using services as determined by the overlap of the confidence intervals. However, several individual items included in the algorithm (ADL decline, stair use) were strong and consistent predictors of rehabilitation use across models. One potential reason for the performance of the algorithm in this study could be related to the homogeneity of the stroke population as opposed to the general home care population. The Rehabilitation Algorithm was developed to differentiate among those in need of rehabilitation services within the general home care population. Thus, its application in a specific population with a higher need for rehabilitation may not be appropriate.

7.3 Models Stratified by Referral for Rehabilitation

Comparison of stratified models from the interRAI CA sample showed that prediction of service use was stronger among those referred for rehabilitation. This may be related to fluctuating health status, resulting in changes between the time of assessment in hospital and discharge home.

Alternatively, certain issues related to the person's functioning in the home environment might not be apparent until after they have returned home, resulting in unmeasured variation in the use of rehabilitation services among those not initially identified as rehabilitation candidates. For OT, among those referred for rehabilitation no need variables differentiated who received services and who did not. For those not referred for rehabilitation, the presence of ADL decline, cognitive decline, and unstable health were associated with the use of services. These characteristics may identify individuals with potential safety concerns benefit form OT services, despite not being initially referred for rehabilitation. In contrast, need variables remained strong predictors of the use of PT services among those referred for rehabilitation, with stair use further increasing the likelihood of receiving PT. Difficulty with the use of stairs likely reflects an immediate concern that needs to be addressed for a person to return home, even if it is not the original reason for the rehabilitation referral.

7.4 Relative Contribution of Predisposing, Enabling, and Need Variables

The final research question addressed was related to the relative contribution of predisposing, enabling, and need variables to the use of rehabilitation services after stroke. Comparison of the c-statistic for individual models containing each class of independent variable revealed that need variables tended to be the strongest predictor. However, enabling variables were also important predictors judging by the similar c-statistic of models containing only enabling variables. This may be related to the importance of having an informal caregiver on the use of home care services. The dominant role of need in has been reported in previous studies utilizing the Andersen-Newman model as a conceptual framework (Strain, 1991; Strain, 1990; Walter-Ginzburg et al., 2001). When comparing this study to previous studies conducted examining service use after stroke the context in which rehabilitation home care services are accessed is an important consideration. Unlike some types of health care services, where a person can freely access them, home care services are provided

following an assessment of the individual's eligibility for services and their level of need. Therefore, it is less surprising that the provision of home care services are strongly related to an individual's need for services in this context.

7.5 Strengths of the Study

There are several strengths of the current study including: the use of comprehensive, standardized assessment tools to measure independent variables, the examination of service use following two different assessments, the use of a population-based sample, the inclusion of individuals regardless of cognitive or communication impairment, and the examination of physiotherapy and occupational therapy use separately.

The use of the RAI-HC, which is a comprehensive, standardized assessment of individual need/characteristics in several domains allowed for the examination of a broader range of independent variables that was included in previous studies. Iezzoni (2002) acknowledged the importance of including information about the performance of activities of daily living when using administrative data to study individuals with disability. The inclusion of variables measuring functional status and cognition in multivariate models was another strength of the present study. Many of the studies reviewed did not include adjustment for functional status when examining relationships between individual characteristics and the use of healthcare services after stroke or included process variables from the initial hospital stay as proxies of clinical complexity (e.g., intubation use, ICU admission, LOS). As a result, residual confounding may have affected findings.

The use of both the interRAI CA and the RAI-HC in the present study allowed for the identification of individual characteristics that predict the use of services at two different points of care. Results from the present study revealed variables that were consistent across assessments (e.g., impaired cognition, caregiver variables), which enhance the validity of the findings. Given that some individuals are only assessed with the interRAI CA, because of their need for short-term services, it is

important to understand the relationship between characteristics measured on these assessments and the use of services. These findings also provide evidence that can be used to inform decision-making at two different points of care.

The use of a population-based sample is another strength of this study. The HNHB LHIN IDS database facilitated identification of all individuals hospitalized for stroke in the HNHB region who were subsequently admitted to the HNHB CCAC for home care services. Since the RAI-HC is completed for all individuals receiving long-stay home care services and the interRAI CA is completed for all individuals at intake, the sample used in the present study is representative of older stroke survivors receiving home care services in this region. Previous studies using a population-based sample were limited to a restricted set of independent variables due to the use of administrative data, while those which included comprehensive measurements of health status were limited to small or non-representative samples. The use of these assessments in other regions in Ontario and other provinces across Canada (for the RAI-HC) further enhances the external validity of the findings. The use of these assessments in other jurisdictions provides opportunities to replicate the findings from the present study.

Inclusion of individuals regardless of cognitive or communication ability was a significant advantage of the present study. Previous studies excluded those with aphasia, cognitive impairment, or those who lacked a caregiver, limiting the generalizability of their findings to the general stroke population. The inclusion of those with cognitive impairment in the present study adds to the existing literature by identifying cognitive impairment as a variable associated with reduced home care physiotherapy utilization among older adults after stroke.

Finally, the examination of OT and PT separately allowed for the identification of factors that were unique to each discipline. The analysis of factors associated with the number of PT/OT visits using partial proportional odds models allowed for differentiation of variables that were associated

with contact with services (any vs. none) and those that were associated with the volume of services received.

7.6 Limitations of the Study

Several limitations of the present study are important to acknowledge. First, the present study only focused on those admitted and assessed by the HNHB CCAC, as this was the only population for whom comprehensive information was available. By excluding those who were discharged home from hospital, but did not access CCAC services, important information about a subset of community dwelling stroke survivors was not available. The use of a regional database to identify those with stroke is another limitation. Individuals, who resided in the HNHB LHIN geographic area, were hospitalized outside of the LHIN, and received services from the HNHB CCAC were not included in the present study. Another limitation of the present study is the exclusion of certain characteristics related to stroke, as they were not available within the interRAI assessments used. The RAI-HC and interRAI CA do not include information about fatigue or emotional lability, two issues affecting stroke survivors that may be associated with the use of services. However, the inclusion of these items in newer versions of interRAI instruments will allow for the examination of these factors in future studies. Finally, information about the use of other rehabilitation services, such as outpatient rehabilitation or services for which the individual paid out of pocket is another important limitation of this study that is important to consider.

7.7 Implications of the Findings

Increased survival after stroke combined with changing patterns of care are expected to result in greater number of older stroke survivors living in the community. Due to the impairments experienced as a result of stroke, many of these individuals will require a variety of health care services, including rehabilitation to live independently. Understanding this population in relation to

the general home care population can help inform the development of services to address the specific needs of stroke survivors. The greater difficulty with communication and swallowing among those with stroke indicates a greater need for specialized home care services, such as speech language pathology and dietetics. The greater impairment in multiple domains observed among those with stroke may encourage the implementation of integrated services to better address the needs of stroke patients, such as interprofessional stroke teams. The greater need for rehabilitation services observed among those with stroke in the present study may encourage policymakers to increase funding for home care rehabilitation services to better support those living with the effects of stroke in the community. The need for a paradigm shift in stroke care in Canada towards a greater focus on rehabilitation has been acknowledged previously (Teasell, Hussein, McClure, & Meyer, 2014). Previous research has also acknowledged the need to better understand the use of home care services after stroke in Canada. This study contributes to the literature by providing information about the use of home care services after stroke, the characteristics of older adults receiving home care services after stroke, and the relationships between these characteristics and the use of services.

The use of interRAI home care assessments in the present study enhances the relevance of the findings for policy and practice in Ontario home care, as these are the current clinical standards for assessment in these settings. The use of these assessments in other Canadian jurisdictions further enhances the applicability of the findings to policy and practice at a national level. Knowledge of factors associated with the use of rehabilitation home care services after stroke can help to inform clinical decision-making regarding the allocation of services and priority setting, both of which are important issues to consider when resources are limited. Evidence regarding the relationships between items from these assessments and the use of rehabilitation services after stroke also enhances their validity for care planning within this population.

The present study contributes to the existing research on the use of health services after stroke by providing information about the use of home care rehabilitation services using a comprehensive set of need-related variables. By using a comprehensive measure of individual's needs, strengths, and preferences, the present study was able to identify novel predictors of service utilization that have were not identified in the previous literature, such as cognitive impairment, while providing greater adjustment for confounders. Although previous studies examining the use of services after stroke adopted the Andersen-Newman Behavioral model as a conceptual framework, this study is the first to compared the relative contribution of predisposing, enabling, and need characteristics to the use of rehabilitation services after stroke.

7.8 Future Directions

Based on the findings from the present study, several directions for future research are suggested. First, future studies should include all stroke survivors discharged to community settings in order to better identify gaps in the provision of home care services to this population. Inclusion of all stroke survivors living in the community would identify those who do not access home care services, which could identify additional unmet need for home care services. The use of comprehensive assessments in acute care settings, such as the interRAI Acute Care, combined with information about the use of community care services after discharge could facilitate this.

Second, home care services are provided towards the end of the continuum of stroke care. Information about the patient's trajectory over the course of acute and post-acute care settings could provide important information about the person's status prior to accessing home care services. The pre-stroke status of older stroke patients is also an important consideration in determining an individual's potential for recovery, and subsequent need for rehabilitation services. Again, the use of comprehensive assessments (e.g., interRAI AC) that incorporates information about the individual's pre-morbid status could address this (Gray et al., 2008).

Additionally, previous studies have identified system-level factors as potentially important in explaining the use of services after stroke (Freburger et al., 2011; Mohammed et al., 2013). Future studies, using methods such as multilevel modeling, could incorporate information about system-level factors, such as the availability of other rehabilitation resources in the area (inpatient and outpatient rehabilitation) or wait lists, when examining the use of services after stroke. Such methods could also control for variation due to clustering (e.g., by CCAC, branch, or caseload). Finally, additional research on the effectiveness of rehabilitation services provided in the home after stroke, particularly with respect to specific sub-populations (e.g., those with cognitive impairment, those with limited caregiver support) could help to guide service provision and facilitate evidence-based decision-making for future stroke patients.

7.9 Conclusion

Compared to the general older home care population, those with stroke were found to have greater functional and cognitive impairment, which translated into a higher need for rehabilitation services. Following hospitalization, approximately 75% of stroke survivors admitted to the HNHB CCAC received any PT or OT services. Analysis of factors associated with the use of OT, PT and PT/OT services using the Andersen Newman Model as a conceptual framework identified need-related variables as the primary determinant of service use; however enabling characteristics, particularly those related to informal support, also played an important role. Across models, variables related to functional status and the presence of informal support were consistent predictors of the use of rehabilitation services, while variables related to cognition tended to be negatively associated with the use of PT services. Findings may help inform the provision of rehabilitation services for future stroke patients and inform areas for quality improvement in home care agencies. This study adds to the existing literature on the use of services after stroke by incorporating a wider variety of need-related variables, comparing the relative contribution of predisposing, enabling, and need variables,

and providing evidence from a Canadian setting on the needs of older stroke survivors receiving home care services.

Appendix A

Literature Review Search Strategy

Literature Review Strategy (Results N=3,631)

MEDLINE PubMed Search Strategy: The purpose of this literature review was to identify determinants of outpatient rehabilitation utilization post-stroke. Due to the heterogeneity in the delivery of outpatient rehabilitation services across different health care systems a very general search strategy was used to identify potential articles for inclusion.

Search Strategy: ((((("Health Services/epidemiology"[Mesh] OR "Health Services/rehabilitation"[Mesh] OR "Health Services/statistics and numerical data"[Mesh] OR "Health Services/supply and distribution"[Mesh] OR "Health Services/trends"[Mesh] OR "Health Services/utilization"[Mesh]) OR ("Home Care Agencies/statistics and numerical data"[Mesh] OR "Home Care Agencies/trends"[Mesh] OR "Home Care Agencies/utilization"[Mesh])) OR ("Occupational Therapy/statistics and numerical data"[Mesh] OR "Occupational Therapy/supply and distribution"[Mesh] OR "Occupational Therapy/trends"[Mesh] OR "Occupational Therapy/utilization"[Mesh])) OR ("Physical Therapy Modalities/epidemiology"[Mesh] OR "Physical Therapy Modalities/statistics and numerical data"[Mesh] OR "Physical Therapy Modalities/supply and distribution"[Mesh] OR "Physical Therapy Modalities/trends"[Mesh] OR "Physical Therapy Modalities/utilization"[Mesh] OR "Postacute"[All Fields])) AND ("Cerebrovascular Disorders/epidemiology"[Mesh] OR "Cerebrovascular Disorders/rehabilitation"[Mesh] OR "Cerebrovascular Disorders/statistics and numerical data"[Mesh] OR "stroke"[All fields])

Inclusion and Exclusion Criteria: Results from the search statement were further filtered exclude articles not published in English, articles with non-human subjects, and those without the full text and abstract available. This resulted in 2,807 articles.

Results: In total, 3,631 articles were found using the search strategy listed above. After exclusion criteria was applied there were 2,807 articles remaining. Manual review of article titles and relevant abstracts reduced the number of potential articles to 35. Based on review of the full text of these articles, 16 were selected for the final literature review. 1 additional article was found through a reference search of the 16 articles mentioned previously. Articles were excluded if they did not analyze stroke patients separately (for articles examining multiple conditions), or if they only included rehabilitation in a hospital setting. Studies examining outpatient rehabilitation in conjunction with other types of health services (e.g. all outpatient visits), and those examining rehabilitation in a clinic based setting were included due to a limited number of articles examining determinants of home-based rehabilitation use. The methodology and findings of these studies are summarized in Appendix B.

Appendix B

Summary of Articles Included in the Literature Review

Author **Region**	**Purpose**	**Sample**	**Design**	**Determinants Tested** (Bold if Significant p<0.05)*
Cohort Studies				
(Huang et al., 2013) Ontario, Canada	To determine whether post-hospital care and medication adherence differ after stroke according to neighbourhood SES	N=11,050 patients with ischemic stroke or TIA admitted to a specialized stroke center between 2003-2008 **Stroke Ascertainment:** Chart abstraction	**Dependent Variable:** proportion and median number of physiotherapy and occupational therapy visits **Source:** CCAC administrative data **Follow-up period**: 3 months after discharge **Analysis:** Cochrane-Armitage trend test, simple linear regression and median regression	Neighbourhood SES
(Clark et al., 2010) United States	To determine the contribution of caregiver characteristics to health service utilization after stroke	N=61 primary caregivers of minority persons with first episode stroke discharged from an inpatient rehabilitation facility between 2004-2006 **Stroke Ascertainment:** Neuroradiology reports **Exclusion Criteria:** prior history of acquired brain injury, available primary caregiver, able to communicate	**Dependent Variable:** compliance with medical and therapy appointments (dichotomized as high and low attendance using 50th percentile) **Source:** Assessed by telephone, confirmed with hospital records **Follow-up period:** 6 months after discharge from inpatient rehabilitation **Analysis:** Logistic Regression	Ethnicity, FRS, SF-36 General Health, ISEL, MHLC (internal, powerful others, **chance**)

Author Region	**Purpose**	**Sample**	**Design**	**Determinants Tested** (Bold if Significant p<0.05)*
(Hinojosa et al., 2009)	To examine racial and ethnic variation in health service use among stroke survivors	N=125 Veterans hospitalized for stroke discharged directly home between 2000 and 2001 in Florida or Puerto Rico **Stroke Ascertainment:** ICD-9 Diagnostic codes **Exclusion Criteria:** no informal caregiver	**Dependent Variable:** Number of outpatient clinic visits **Source:** VHA medical records **Follow-up period:** 1, 6, and 12 months post-stroke **Analysis:** Poisson regression	Predisposing**:** Age, **educational level, race** Enabling: **income, number of hours of informal care, caregiver co-resides, caregiver receives outside help** **Need: ADL (FIM), IADL** (Frenchday activities index)
(Jia et al., 2011) United States	To examine association between SSRI dispensing and inpatient and outpatient service use in veterans with stroke	N=785 individuals in a VHA service network with a stroke-related medical encounter during 2000-2001. **Stroke Ascertainment:** ICD-9 Diagnostic codes from medical records	**Dependent Variable:** Number of weighted outpatient clinic stops **Source:** VHA and Medicare Administrative databases **Follow-up period:** 1 year post-stroke **Analysis:** Negative binomial regression	Weighted No. Of Outpatient Clinic Stops: *365 days post-stroke:* **SSRI dispensing**, depression diagnosis, age, sex, **race, marital status**, VHA priority *180 days prestroke:* SSRI dispensing, Charlson index, depression diagnosis, *During Acute Stay:* **ICU stays, Intubation use**
(Chan et al., 2009) United States	To examine the existence of disparities in outpatient and home care utilization after stroke	N=11,119 patients hospitalized for a stroke between 1996 and 2003 in the Kaiser Permanente healthcare system in Northern California **Stroke Ascertainment:** ICD-9 primary discharge diagnostic code	**Dependent Variable:** number outpatient rehabilitation visits and home health care enrolment **Source:** Kaiser Permanente Administrative Database **Follow-up period:** 1 year after discharge **Analysis:** Poisson and logistic regression	Number of Outpatient Visits: **age, gender, race/ethnicity, urban/rural, income, type of stroke, acute care LOS** Enrolment in Home Health Care: **Age, gender, race/ethnicity, urban/rural, type of stroke, acute care LOS**
(Ostwald et al., 2009) United States	To determine predictors of resuming PT, OT, and ST after discharge from inpatient rehabilitation	N=131 patients 50+ discharged home from inpatient rehabilitation, with a spouse recruited between 2001-2005 **Stroke Ascertainment:** not specified **Exclusion Criteria:** non-English	**Dependent Variable:** PT, OT, ST use **Source:** self-reported **Follow-up period:** 4 weeks after discharge from inpatient rehabilitation **Analysis:** logistic regression	PT: age, SES, FIM, **SIS physical**, SIS recovery, GDS15, Inpatient LOS, no. comorbidities, no. impairments, no. complications, gender, **race**, education, insurance coverage, aphasia, apraxia, ataxia, cognitive impairment, dysarthria, dysphagia, facial paralysis,

Author Region	Purpose	Sample	Design	Determinants Tested (Bold if Significant p<0.05)*
		speaking, global aphasia, on hospice, major physical/psychiatric complication (e.g. dementia)		hemiparesis/hemiplegia, sensory changes, spasticity, **visual neglect**, pain, diplopia, emotional lability OT: age, SES, FIM**, SIS physical**, SIS recovery, GDS15, Inpatient LOS, no. comorbidities, no. impairments, no. complications, **gender**, **race,** education, insurance coverage, aphasia, apraxia, ataxia, cognitive impairment, dysarthria, dysphagia, facial paralysis, hemiparesis/hemiplegia, sensory changes, spasticity, **visual neglect**, pain, diplopia, emotional lability
(Winkler et al., 2011) United States	To determine how the provision of ATDs relates to inpatient/outpatient utilization after stroke	N=12,046 veterans who experienced a stroke receiving services from the VHA **Stroke Ascertainment:** ICD-9 diagnostic codes applied to VA databases	**Dependent Variable**: Number of outpatient visits **Source:** VA databases **Follow-up period:** 12 months **Analysis:** multivariate analysis of covariance	**Age, death, male, nursing home PTA, married**, hemorrhagic stroke, dysphagia, ventilator use, **treated in acute rehabilitation**, FRG, **comorbidity index**, wheelchair use, **scooter use, walker/crutch/cane only, multiple ATD device use**
(van den Bos et al., 2002)** Netherlands	To quantify the socioeconomic gap in health care utilization after stroke	N=465 patients discharged from hospital **Stroke Ascertainment:** Chart Abstraction	**Dependent Variable:** Use of outpatient therapy services **Source:** Self-report **Follow-up period:** 6 months, 3 years and 5 years post-stroke **Analysis:** logistic regression	SES (adjusted for age, gender, stroke type, stroke severity, and recurrent stroke [2])
(Bhalla et al., 2004) Portugal, Spain, Italy, France,	To identify factors associated with mortality and functional outcome in older as compared to younger stroke patients	N=1,847 individuals with first in a lifetime stroke admitted to hospital (1994-1998) **Stroke Ascertainment:** WHO Stroke definition at enrolment	**Dependent Variable:** use of physiotherapy and occupational therapy **Source:** Not specified **Follow-up period:** 3 months	**Age**

Author Region	**Purpose**	**Sample**	**Design**	**Determinants Tested** (Bold if Significant p<0.05)*
Denmark, Finland, UK, Poland, Lithuania, Latvia		**Exclusion Criteria:** Subarachnoid Hemorrhage	**Analysis:** Chi-square	
(Ghose et al., 2005) United States	To evaluate the association between PSD and other mental health diagnoses on medical utilization after stroke	N=51,119 patients discharged from hospital (1990-1997) **Stroke Ascertainment:** ICD-9 Codes, primary diagnosis of ischemic stroke **Exclusion Criteria:** patients who died within 30 days of discharge	**Dependent Variable:** all outpatient encounters (number of outpatient clinic stops, log-transformed) **Source:** VA Administrative Databases **Follow-up period:** 3 years after index admission **Analysis:** multivariate linear regression	**PSD, MDSA, age, sex, race, Charlson Index, Hyperlipidemia, Hypertension, Diabetes, Coronary artery disease, Myocardial infarct, Congestive heart failure, Atrial Fibrillation**
(Jia et al., 2012) United States	To assess the association between the use of post stroke rehabilitation and rural-urban living setting	N=8,926 stroke patients discharged from hospital (2001-2002) **Stroke Ascertainment:** ICD-9 codes **Exclusion Criteria:** date of death could not be determined, died during hospitalization, hospitalized ≥365 days, residing in Puerto Rico or Virgin Islands	**Dependent Variable:** all types of rehabilitation utilization in the VA healthcare system **Follow-up period:** 12 months after hospitalization **Source:** VA Administrative databases **Analysis**: logistic regression	**Rural/urban/isolated, age**, race, **marital status**, 12-month mortality, travel time to VAMC, admission source, **discharge location**, **stroke type**, Charlson score, **VA medical care priority, Index intubation use**, Index LOS
(Jia et al., 2006) United States	To assess the impact of post-stroke depression on healthcare use by veterans with acute stroke	N=5,825 veterans who received inpatient care for stroke between 2000 and 2001 **Stroke Ascertainment:** ICD-9 diagnostic codes. **Exclusion Criteria:** died within 60 days of stroke, index length of stay >365 days, not a member of the VHA	**Dependent Variable:** number of hospitalization stays, number of outpatient visits, number of cumulative inpatient days **Source:** Administrative records **Follow-up period:** 12 months after hospitalization **Analysis:** Poisson regression	**Number of Outpatient Visits** *Sociodemographic:* **patient age**, **race/ethnicity**, gender, marital status, priority for VHA medical care, **VHA-medicare eligibility status, mortality (within 12 months)** *Clinical variables:* stroke type, **medical comorbid conditions**, intensive care use, mechanical ventilation or intubation use, **atrial fibrillation**, dysphasia, malnutrition, and admission type during

Author Region	Purpose	Sample	Design	Determinants Tested (Bold if Significant p<0.05)*
				index hospitalization, recurrent stroke, **post-stroke depression**
Cross-Sectional				
(Freburger et al., 2011) United States	To determine the extent of sociodemographic and geographic disparities in PARC use after stroke	N=187,188 individuals 45+ with a primary diagnosis of stroke who survived their inpatient stay **Stroke Ascertainment:** ICD-9 diagnostic codes from hospital records **Exclusion Criteria:** residing out of state, transferred to hospice care or other short term facility after hospitalization	**Dependent Variable:** Use of HH care vs. none for those discharged home **Source:** Discharge Destination **Analysis:** Multilevel logistic regression	*Sociodemographic:* **race, sex, age, insurance type,** median income, *Geographic:* **metropolitan status,** state, *Hospital Characteristics:* hospital **stroke volume**[3], No. PT/OT/ST FTEs, No. Nursing FTEs, medical school affiliation, for profit status *Hospital PARC Supply:* Has NH unit, has an IRF, has an HHA *Community PARC Supply*[4]*:* **No. PT/OTs**, No. HHAs, **No. SNF beds**, No. IRF beds
(Cook et al., 2005) United States	To determine the associational factors that contribute to attending OT/PT	N=1,393 individuals 65+ with stroke, representing a subset of participants from the Health and Retirement study database from the1998 survey wave **Stroke Ascertainment:** Self-report **Exclusion Criteria:** those residing in institutions	**Dependent Variable:** access to OT/PT, self-report, utilization of one or both during the interview period (time between stroke onset and service utilization unknown) **Source:** Self-report, survey **Analysis:** Logistic Regression	PT/OT: **attending physician, stroke weakness, age, alcohol consumption**, high blood pressure, black race, monthly income, smoking status, previous stroke, Hispanic race, dizziness, problems related to stroke, white race, education, male gender, heart condition, diabetes
(Xie et al., 2007) United States	To examine the prevalence of outpatient stroke rehabilitation among selected populations	N=4,689 individuals 18+ who reported ever having a stroke, subset of individuals from the 2005 BRFSS survey **Stroke Ascertainment:** Self-report **Exclusion Criteria:** non-civilians, those residing in institutions	**Dependent Variable:** Use of outpatient rehabilitation services after stroke (time between stroke onset and service utilization unknown) **Source:** Self-report, survey **Analysis:** Logistic Regression	Outpatient Rehabilitation (age-adjusted): **sex, race/ethnicity,** marital status, education, **employment status**, income level, insurance coverage, assigned **MSA status**
(Fan et al., 2009)	To investigate whether psychological distress is	N=7,427 individuals 35+ who reported ever having a stroke,	**Dependent Variable:** Use of outpatient rehabilitation	Serious Psychological Distress (adjusted for age, race/ethnicity, sex, marital

Author Region	**Purpose**	**Sample**	**Design**	**Determinants Tested** (Bold if Significant p<0.05)*
United States	associated with use of rehabilitation services among adults with cardiovascular conditions	subset of individuals from the 2007 BRFSS survey **Stroke Ascertainment:** Self-report	services after stroke (time between stroke onset and service utilization unknown) **Source:** Self-report, survey **Analysis:** Adjusted Prevalence Ratios	status, education, and employment status [2])
(de Haan et al., 1993)** Netherlands	Describe use of care before and after stroke, evaluate equity in access to health care	N=382 individuals living in the community who were hospitalized 6 months prior (1991-1992) **Stroke Ascertainment:** chart abstraction	**Dependent Variable:** use of therapy services after stroke (PT, OT, ST) **Source:** Self-report, semi-structured interview **Analysis:** logistic regression	*Need:* **Severe handicap**, severe disability, emotional distress, dementia, poor self-reported health *Predisposing:* **Age**, sex, living arrangement, urban setting *Enabling**:*** **Income**, **GP Sex**, GP age, GP solo practice, GP Informed of discharge

Appendix C

Ethics Clearance

UNIVERSITY OF WATERLOO

OFFICE OF RESEARCH ETHICS

Notification of Ethics Clearance of Application to Conduct Research with Human Participants

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Faculty Supervisor: John Hirdes **Department:** Health Studies & Gerontology

Student Investigator: Jenn Bucek **Department:** Health Studies & Gerontology

ORE File #: 20070

Project Title: Older Stroke Survivors in Home Care: Factors Associated with the use of Rehabilitation Services

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This certificate provides confirmation the above project has been reviewed in accordance with the University of Waterloo's Guidelines for Research with Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. This project has received ethics clearance through a University of Waterloo Research Ethics Committee.

***Note 1**: This ethics clearance is valid for one year from the date shown on the certificate and is renewable annually. Renewal is through completion and ethics clearance of the Annual Progress Report for Continuing Research (ORE Form 105).*

***Note 2**: This project must be conducted according to the application description and revised materials for which ethics clearance has been granted. All subsequent modifications to the project also must receive prior ethics clearance (i.e., Request for Ethics Clearance of a Modification, ORE Form 104) through a University of Waterloo Research Ethics Committee and must not begin until notification has been received by the investigators.*

***Note 3**: Researchers must submit a Progress Report on Continuing Human Research Projects (ORE Form 105) annually for all ongoing research projects or on the completion of the project. The Office of Research Ethics sends the ORE Form 105 for a project to the Principal Investigator or Faculty Supervisor for completion. If ethics clearance of an ongoing project is not renewed and consequently expires, the Office of Research Ethics may be obliged to notify Research Finance for their action in accordance with university and funding agency regulations.*

***Note 4**: Any unanticipated event involving a participant that adversely affected the participant(s) must be reported immediately (i.e., within 1 business day of becoming aware of the event) to the ORE using ORE Form 106. Any unanticipated or unintentional changes which may impact the research protocol must be reported within seven days of the deviation to the ORE using ORE form 107.*

Maureen Nummelin, PhD
Chief Ethics Officer

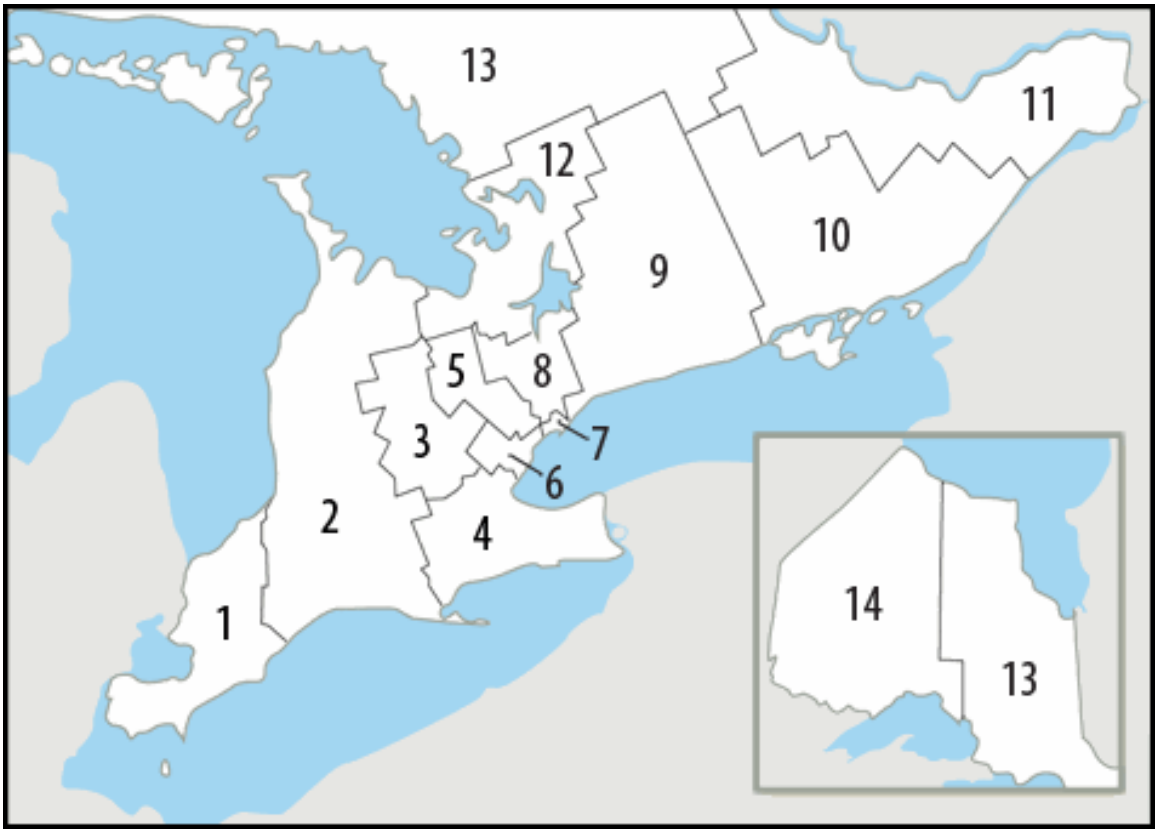
OR
Julie Joza, MPH
Senior Manager, Research Ethics

OR
Sacha Geer, PhD
Manager, Research Ethics

Date Aug 22/14

Appendix D

Map of Ontario LHIN Boundaries



1. Erie St. Clair
2. South West
3. Waterloo Wellington
4. Hamilton Niagara Haldimand Brant
5. Central West
6. Mississauga Halton
7. Toronto Central
8. Central
9. Central East
10. South East
11. Champlain
12. North Simcoe Muskoka
13. North East
14. North West

Appendix E

Case Definition of Stroke

Condition	ICD-10-CA Code(s)	Description
Transient cerebral ischemic attacks and related syndromes	G45.0	Vertebro-basilar artery syndrome
	G45.1	Carotid artery syndrome (hemispheric)
	G45.2	Multiple and bilateral precerebral artery syndromes
	G45.3	Amaurosis fugax
	G45.8	Other transient cerebral ischemic attacks and related syndromes
	G45.9	Transient cerebral ischemic attack, unspecified
Retinal vascular occlusions	H34.1	Central retinal artery occlusion
Subarachnoid Hemorrhage	I60	All sub-types included
Intracerebral Hemorrhage	I61	All sub-types included
Cerebral Infarction	I63.0	Cerebral infarction due to thrombosis of precerebral arteries
	I63.1	Cerebral infarction due to embolism of precerebral arteries
	I63.2	Cerebral infarction due to unspecified occlusion or stenosis of precerebral arteries
	I63.3	Cerebral infarction due to thrombosis of cerebral arteries
	I63.4	Cerebral infarction due to embolism of cerebral arteries
	I63.5	Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries
	I63.8	Other cerebral infarction
	I63.9	Cerebral infarction, unspecified
Stroke, not specified as hemorrhage or infarction	I64	All sub-types included

Adapted from (Foebel et al., 2013)
Descriptions from: http://www.cihi.ca/cihi-ext-portal/pdf/internet/icd_10_ca_vol1_2009_en

Appendix F

Parameter Estimates and Standard Errors from Multivariate Models

Use of OT Services after RAI-HC Assessment

Variable	Predisposing Only	Enabling Only	Need Only	Predisposing, Enabling and Need
	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)
Non-English Language	0.40 (0.17)			
Branch (Reference=E)				
Not Assigned		-0.47 (0.77)		-1.20 (0.21)
A		-1.04 (0.20)		-0.42 (0.20)
B		-0.46 (0.19)		-0.77 (0.25)
C		-0.82 (0.24)		-0.74 (0.15)
D		-0.72 (0.15)		-1.20 (0.21)
Caregiver Distress		0.42 (0.15)		
ADL Hierarchy Scale (reference=0)				
1-2			0.04 (0.15)	0.07 (0.15)
3+			0.95 (0.20)	1.01 (0.21)
Unsteady Gait			0.38 (0.13)	0.36 (0.13)
Home Environment Optimization CAP triggered			0.78 (0.29)	0.62 (0.30)
Stair Use (reference=Independent)				
Dependent			0.36 (0.17)	0.44 (0.18)
Did not Occur			0.47 (0.15)	0.54 (0.15)

Use of PT after RAI-HC Services after RAI-HC Assessment

Variable	Predisposing Only	Enabling Only	Need Only	Predisposing, Enabling and Need
	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)
Married	0.57 (0.12)			0.47 (0.13)
Branch (Reference=E)				
Not Assigned		-0.57 (0.85)		-0.19 (0.88)
A		-0.61 (0.21)		-0.68 (0.23)
B		-0.39 (0.20)		-0.38 (0.20)
C		0.48 (0.24)		0.46 (0.25)
D		-0.22 (0.15)		-0.26 (0.15)
Primary Caregiver Co-resides		0.30 (0.13)		
Hours of Informal Care/week (reference=0-20)				
21-40 hours/week		0.55 (0.14)		0.53 (0.15)
>40 hours/week		0.70 (0.21)		0.76 (0.23)
Alzheimer's Disease and Related Dementia			-0.63 (0.19)	-0.63 (0.19)
Stair Use (reference=independent)				
Dependent			0.80 (0.17)	0.64 (0.18)
Did not Occur			0.43 (0.15)	0.51 (0.15)
Unsteady Gait			0.68 (0.14)	0.65 (0.14)
Cognitive Performance Scale (reference=0)				
1-2			-0.34 (0.14)	-0.48 (0.14)
3+			-0.53 (0.23)	-0.79 (0.24)

Use of OT after interRAI CA Assessment

Variable	Predisposing Only	Enabling Only	Need Only	Predisposing, Enabling and Need
	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)
Male Sex (reference=female)	-0.44 (0.18)			-0.47 (0.19)
Non-English Language	1.07 (0.42)			1.02 (0.43)
Community Intake (reference=Hosp/ED)		-1.09 (0.26)		-1.12 (0.27)
Cognitive Decline			1.14 (0.47)	1.31 (0.48)
Unstable Health			0.46 (0.23)	0.46 (0.24)
Cognitive Decline*Unstable Health			-1.08 (0.54)	-1.30 (0.56)

Use of PT after interRAI CA Assessment

Variable	Enabling Only	Need Only	Predisposing, Enabling and Need
	P.E. (S.E.)	P.E. (S.E.)	P.E. (S.E.)
Referral for Rehabilitation	1.05 (0.19)		1.17 (0.20)
Primary Caregiver Co-resides	0.82 (0.19)		0.16 (0.24)
Dependent in Locomotion			1.50 (0.42)
ADL Decline		0.67 (0.21)	-0.27 (0.36)
Dependent in Decision Making		0.96 (0.23)	0.96 (0.24)
Dependent in Locomotion* Primary Caregiver Co-resides		-0.85 (0.20)	-0.72 (0.21)

Stratified Models for use of OT after interRAI CA Assessment

Variable	Full Model	Not Referred for Rehabilitation (N=235)		Referred for Rehabilitation (N=338)
	P.E. (S.E.)	Original Variables P.E. (S.E.)	Additional Variables P.E. (S.E.)	Original Variables P.E. (S.E.)
Male Sex (reference=female)	-0.47 (0.19)			-0.57 (0.26)
Non-English Language	1.02 (0.43)			2.47 (1.04)
Community Intake (reference=hosp/ED)	-1.12 (0.27)			-1.82 (0.40)
ADL Decline	1.31 (0.48)		0.76 (0.33)	
Cognitive Decline	0.46 (0.24)	1.89 (0.78)	1.56 (0.79)	
Unstable Health	-1.30 (0.56)	0.41 (0.35)	0.39 (0.36)	
Cognitive Decline*Unstable Health	-0.47 (0.19)	-1.90 (0.86)	-1.83 (0.87)	

Stratified Models for use of PT after interRAI CA Assessment

Variable	Full Model	Not Referred for Rehabilitation (N=235)	Referred for Rehabilitation (N=338)	
	P.E. (S.E.)	Original variables P.E. (S.E.)	Original variables P.E. (S.E.)	Additional Variables P.E. (S.E.)
Referral for Rehabilitation	1.17 (0.20)			
Primary Caregiver Coresides	0.16 (0.24)	-0.10 (0.45)	0.29 (0.29)	0.25 (0.29)
Dependent in Locomotion	-0.27 (0.36)	-1.15 (0.68)	0.03 (0.43)	-0.26 (0.45)
ADL Decline	0.96 (0.24)		1.00 (0.28)	0.88 (0.29)
Dependent in Decision Making	-0.72 (0.21)		-0.70 (0.26)	-0.75 (0.26)
Dependent in Locomotion* Primary Caregiver Coresides	1.50 (0.42)	2.52 (0.79)	1.05 (0.52)	1.08 (0.52)
Difficulty with Stairs				0.67 (0.28)

Ordinal Logistic Regression Models for the Amount of PT/OT after RAI-HC

Variable	Predisposing Only		Enabling Only		Need Only		Predisposing, Enabling and Need	
	1-Category Increase P.E. (S.E.)		1-Category Increase P.E. (S.E.)		1-Category Increase P.E. (S.E.)		1-Category Increase P.E. (S.E.)	
	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)
Married	0.21 (0.14)	0.58 (0.13)						
Non-English language	0.40 (0.15)							
Branch (Reference=E)								
Not Assigned			-0.40 (0.85)	-13.6 (498.8)			-0.77 (0.88)	-13.9 (485.9)
A			-1.03 (0.21)	-0.55 (0.24)			-1.12 (0.22)	-0.55 (0.24)
B			-0.37 (0.23)	-0.69 (0.23)			-0.37 (0.23)	-0.37 (0.23)
C			0.06 (0.31)	-0.64 (0.28)			0.01 (0.32)	-0.73 (0.29)
D			-0.55 (0.17)	-0.76 (0.17)			-0.63 (0.18)	-0.81 (0.17)
Hours of Informal Care/week (reference=0-20)								
21-40 hours/week			0.61 (0.13)				0.42 (0.14)	
>40 hours/week			0.54 (0.19)				0.15 (0.21)	
Caregiver believes person is capable of improved function			0.30 (0.12)					
Client believes they are capable of improved function							0.44 (0.12)	

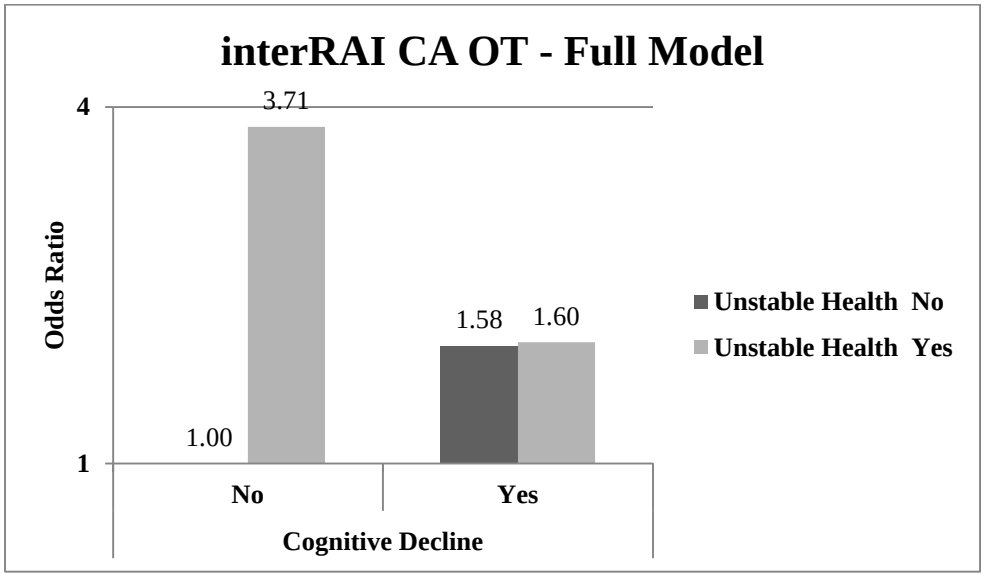
ADL Hierarchy Scale (reference=0)						
1-2					0.09 (0.14)	-0.09 (0.15)
3+					0.62 (0.17)	0.49 (0.18)
Unsteady Gait					0.68 (0.12)	0.68 (0.13)
Stair Use (reference=independent)						
Dependent					0.73 (0.16)	0.76 (0.17)
Did not Occur					0.59 (0.14)	0.75 (0.15)
Home Environment Optimization CAP					0.58 (0.24)	
ADRD					-0.46 (0.16)	-0.41 (0.16)

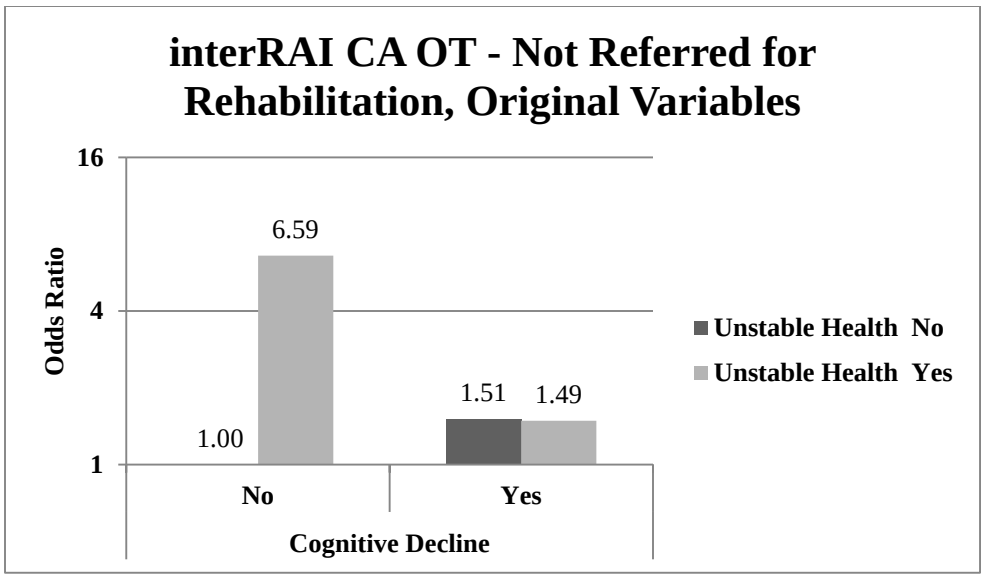
Ordinal Logistic Regression Models for the Amount of PT/OT after interRAI CA, Stratified by Referral for Rehabilitation

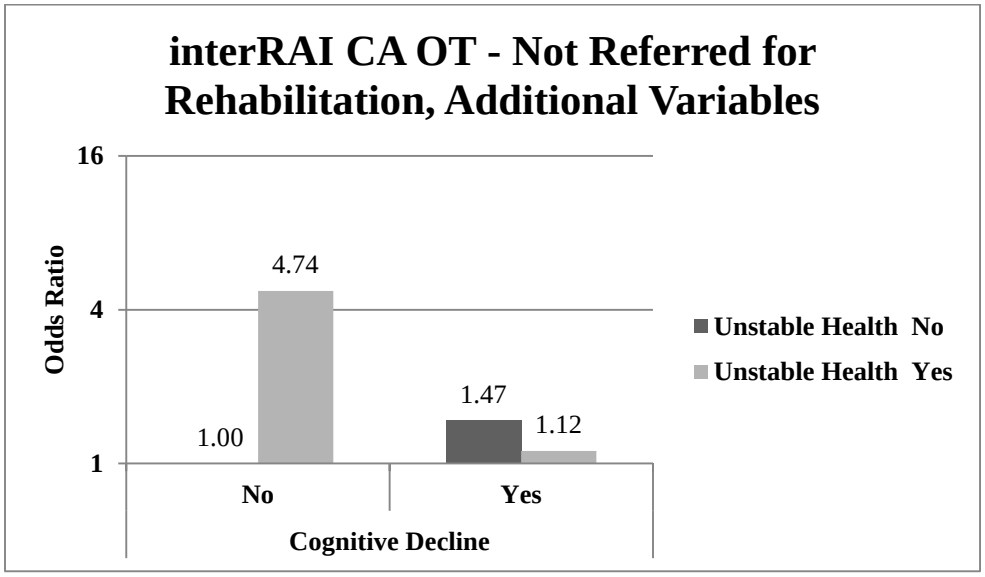
Variables	Full Sample		Not Referred for Rehabilitation (N=235)		Referred for Rehabilitation (N=338)	
	1-Category Increase P.E. (S.E.)		1-Category Increase P.E. (S.E.)		1-Category Increase P.E. (S.E.)	
	1-4 vs. 0 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)	1-4 vs. 0 P.E. (S.E.)	5+ vs. 0-4 P.E. (S.E.)
Referral for Rehabilitation	1.68 (0.26)	0.60 (0.20)				
Community Intake (Reference=Hosp/ED)	-0.86 (0.31)	-0.29 (0.31)			-1.70 (0.49)	-0.60 (0.43)
Year of Hospital Discharge (Reference=2011)						
2012	0.89 (0.30)	0.25 (0.26)			1.64 (0.50)	0.14 (0.31)
2013	0.73 (0.37)	0.58 (0.32)			0.64 (0.60)	0.92 (0.42)
ADL Decline	0.97 (0.19)		1.04 (0.29)		0.92 (0.27)	

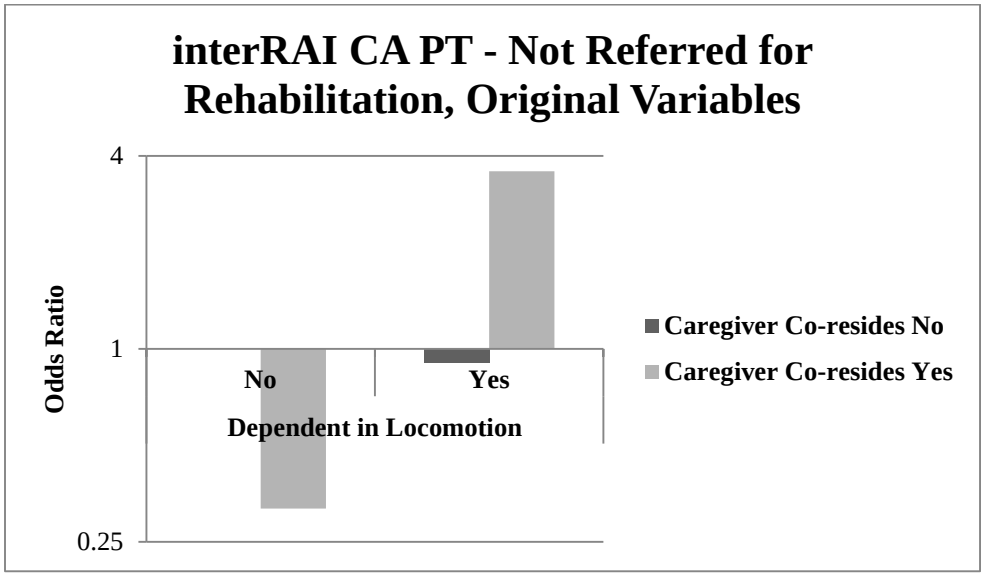
Appendix G

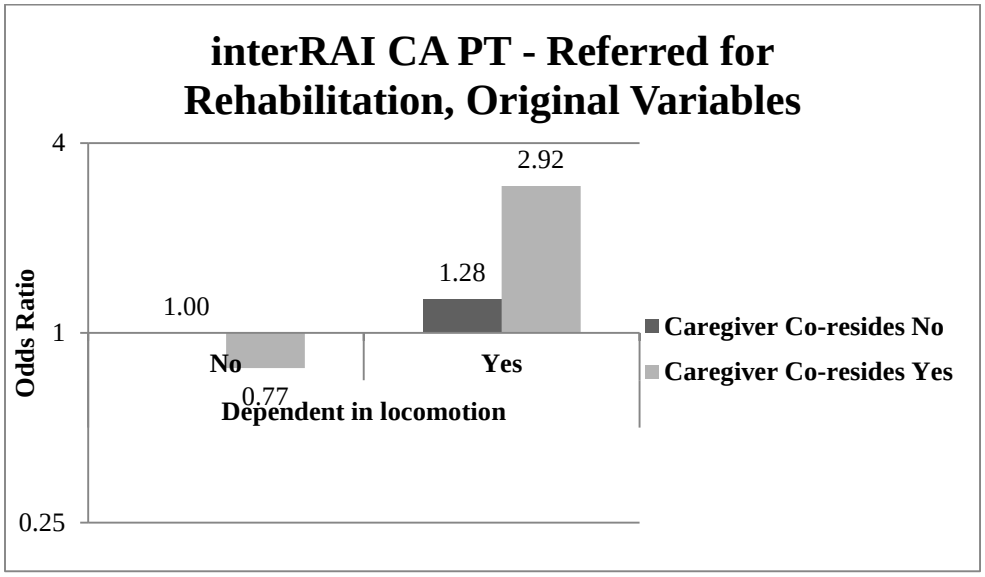
Interactions from Contact Assessment Models






interRAI CA OT - Not Referred for Rehabilitation, Additional Variables
16
4
1
Odds Ratio
4.74
1.00
1.47
1.12
No
Yes
Cognitive Decline
Unstable Health No
Unstable Health Yes


interRAI CA PT - Not Referred for Rehabilitation, Original Variables
4
1
0.25
Odds Ratio
No
Yes
Dependent in Locomotion
Caregiver Co-resides No
Caregiver Co-resides Yes


interRAI CA PT - Referred for Rehabilitation, Original Variables
Odds Ratio
4
1
0.25
1.00
0.77
1.28
2.92
No
Yes
Dependent in locomotion
Caregiver Co-resides No
Caregiver Co-resides Yes

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