HOME-BASED REHABILITATION AND ITS IMPACT ON HOSPITAL UTILIZATION

By

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Abstract

There is compelling evidence for the effectiveness of home-based occupational therapy and physiotherapy rehabilitation for community dwelling elderly who may struggle with basic activities and the functions of daily living and mobility. Nonetheless, an estimated 2% of home care's elderly clients receive these therapies. Ontario's home care data indicates that 78% of clients that could benefit from these specific therapies are not receiving them.

The study examined a subset of elderly clients receiving home care following a hospital discharge during 2009-2010. The aim of this study was to: understand the difference between those home care clients who received occupational therapy or physiotherapy and those who did not; and determine if receiving these therapies impacted the utilization of hospital emergency departments and inpatient admissions. A retrospective cohort design and multivariate and survival analysis of hospital and home care administrative data structured the study.

Results suggest that home-based rehabilitation is offered to a minority of the home care population. Distinct client characteristics and process variables significantly associated with the increased likelihood of receiving home-based occupational and physical therapies included: clients who were older, females, admitted to home care from hospital inpatient units, assessed as non-acute for clinical and service needs and required more home making support and assistance with activities of daily living.

Almost one quarter of the total sample returned to hospital. Visits to emergency departments accounted for the greater part of hospital utilization and primarily for sub-acute general symptoms and signs, post-procedural complications, infections or acute

episodes from chronic obstructive pulmonary disease and renal failure. Slightly over half of the clients returning to hospital did not receive home-based rehabilitation.

Clients who received occupational therapy returned to the hospital sooner following their home care admission whereas clients receiving physiotherapy spent the longest time before rehospitalizing. The majority of the clients receiving occupational therapy were admitted to home care having just resolved sub-acute conditions or symptoms, many of which are known to influence functional and physical decline. Moreover, analysis of process variables indicated that the wait time for a referral to occupational therapy was two times longer compared to physiotherapy. These same clients also waited, on average, over one month before an occupational therapist's first visit.

The need to discriminate who receives home-based rehabilitation is essential to understanding how specific therapies contribute to improving systems outcomes. This study is the first examination that focuses specifically on home-based occupational therapy and physiotherapy rehabilitation and the client characteristics and process variables associated with receiving/not receiving these therapies and the impact these factors have on the time-to-rehospitalization.

Co-Authorship

This dissertation presents the research conducted by T. Christine Knott under the guidance and in collaboration with her primary supervisor, Dr. Mary Ann McColl. The research question and objectives were informed by previous work Dr. McColl undertook on adverse events in publically funded community home care programs and the implications for practice, policy and research (2009).

The PhD candidate, in collaboration with Dr. McColl, designed the research, methods and analyses strategy. The candidate detailed the databases and indicators required to answer the study objectives, in consultation with Dr. McColl and clinical, information and education managers at the South East Community Care Access Centre. Consultation was also sought with the Kingston General Hospital Decision Support Department. The final database linkages, cleaning and statistical analyses were performed by the candidate. Interpretation of the results and writing of the dissertation was completed by T. C. Knott with supervision, discussion and guidance from Dr. McColl.

Other thesis chapters reflect T. C. Knott's work under the guidance and expert editorial review of Dr. McColl. Drs. Rosenberg and Green also provided support and comments as members of the thesis committee.

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In dedication to my Mom (Teresa Knott), whose love, patience, forgiveness and understanding has been unwavering, even throughout her recent years of increasing physical frailty...and in memory of my Dad (Reginald B. Knott), 1921-2003, forever watching over.

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Chapter 1

Introduction

1.1 The Problem: Home-Based Rehabilitation

Home-based rehabilitation provided to the elderly across Canada is mainly situated within a publically funded home care program and system. Publically funded home care is recognized as a critical entity in the continuum of care and a pathway that offers a valid, safe and cost-saving substitute for non-acute hospital based care (Caplan, 2005; Kushner, Baranek & Dewer, 2008; Ontario Health Coalition, 2011). It is a level of care often generally described as an extended health service providing post-hospital care, palliative care and support to vulnerable populations (e.g., seniors, disabled). For the elderly, home care programs are widely understood as maintaining and preventing further health and functional deficits, supporting the ability to live independently, delaying institutional care and decreasing and substituting for hospital care (Health Council of Canada, 2012; Kushner et al., 2008). Home-based rehabilitation therapies are considered a critical contributor to elderly home care clients' ability to maintain a level of functional autonomy (Health Council of Canada, 2012; Kushner et al., 2008).

However, accessing home-based rehabilitation through the publically funded home care system is not a certainty. Unlike hospital and physician care, home care is not insured within the Canada Health Act. Therefore, how provinces deliver home care and determine eligibility and the amounts and types of services vary. In essence, there is no

standardized model, framework or requirement for delivering home care in Canada (Health Council of Canada, 2012). As such, it has been described as a fragmented inequitable and insufficient system of care whereby individuals' right to an assessment does not mean there is a complete entitlement to actually receiving home-based service(s) (Ontario Health Coalition, 2011; Watkins, Williams, Ying & Zhu 2009). This is of particular relevance to rehabilitation therapies.

1.1.1 Access to Home-Based Rehabilitation

National data show that approximately 1 million people are receiving home care annually (Health Council of Canada, 2012). It is estimated that between 70-82% of home care clients are over the age of 65 (Canadian Institute for Health Information [CIHI], 2011; Health Council of Canada, 2012), many of whom require long-term supportive or maintenance care. The reliance on home care has been steadily increasing. Between 1997 and 2007, the number of home care clients in Canada increased by 51%, with more than 70% aged 65 or older (Canadian Home Care Association [CHCA], 2011; CIHI, 2011; Health Council of Canada, 2012). The report by CHCA indicates this increasing trend will only continue estimating 11% by 2011 to increase to 33% by 2017.

Referrals to home care are primarily from hospital inpatient and outpatient departments and are individuals experiencing multiple chronic conditions and disability (CIHI, 2007, 2011; Health Council of Canada, 2012). A national report comparing 4 provinces and one territory indicated that 36-52% of home care referrals were from a hospital. A proportion of home care admissions are patients who experience a longer

hospital stay as they wait for services to be available. These inpatients are frequently referred to as Alternate Level of Care patients (ALC). Canadian 2009-10 data showed that 14% of ALC patients were eventually discharged home with home care support (Health Council of Canada, 2012).

The Health Council of Canada's report also indicated that the majority of services (50%-69%) provided to elderly home care clients were for assistance with daily personal care and supportive activities (bathing, dressing, meal preparation); and 15-24% for nurse monitoring. The report further indicated that the proportion of elderly clients receiving home-based rehabilitation services was extremely varied across regions of Canada, specifically physiotherapy and occupational therapy 2%-11% and social work 0%-12%. Utilization data for other health professionals (e.g., speech pathology or dieticians) were noted as being even more limited, but due to inconsistent measurements were not reported (Health Council of Canada, 2012). For this reason, Health Council of Canada's report clearly identified the variance in providing occupational therapy and physiotherapy, or lack thereof, as a concern pointing to the elderly populations known risk for falls, adverse events and difficulties with basic daily care and broader activities.

Ontario's access to publically funded home-based rehabilitation shows similar trends with the national reported data. Ontario's referrals have also seen an increase. For example, during 2003-2010 there was a 66% rise in the number of clients (Ontario Health Coalition, 2011). The majority of these home care recipients are also ≥65 years of age (58%) (Kushner et al., 2008). Hospitals are also the primary referring source to home

care (Health Council of Canada, 2012) with reported referrals ranging from 54-57%, the majority of these coming from inpatient units (CIHI, 2007; Health Council of Canada, 2012). The wait list for home care in Ontario has consistently been over 10,000 people for over a decade (Ontario Health Coalition, 2011).

The largest amount of home care services (visits, hours) provided in Ontario is also primarily for personal support (67-69%) to assist with routine daily activities and care (e.g., bathing, dressing, meal preparation) (CIHI, 2007; Ontario Home Care Association [OHCA], 2010) whereas nursing accounts for between 24-26%. Rehabilitation services are provided to even a smaller proportion of Ontario home care clients (Health Council of Canada, 2012). Analysis of 2010 data indicated the proportion of elderly clients who received therapies was 10% for occupational therapy and 11% physiotherapy. However, these same therapies accounted for approximately only 1%-2% of the total number of professional services' visits/hours (Ontario Health Coalition, 2011; OHCA, 2010; The Change Foundation, 2008).

In addition, home care performance measures reported in 2010 by Ontario's Health Quality Council indicate that 77.6% of clients (majority elderly) were identified as potentially benefiting from rehabilitation therapies but were not receiving such therapies, namely occupational therapy, physiotherapy as well as exercise (Ontario Health Quality Council, 2009). The demand for rehabilitation and home care has been attributed to an elderly population that is experiencing multiple conditions and episodes, for example: ~30% with high physical limitations; 20% a dementia; ~15% severe pain; ~30% mental

health issue (depression); and 13% experiencing an adverse event (falls, unintended weight loss, emergency department visit or hospital admission, cognitive decline, urinary tract infection, pneumonia and further deterioration in a new pressure ulcer (Health Council of Canada, 2012; Hirdes et al., 1999; Sears, Baker, Barnsley & Shortt, 2013).

The migration of hospital rehabilitation services to home care, specifically occupational therapy and physiotherapy, has been one of the most significant health care reform strategies over the past two decades. Since this transition, many of the national and provincial studies and reports on home care have described, for example, incidence rates of adverse events or dementia and utilization and projections of services attributed to the elderly population. However, many of these reviews are based on data that are collected on a subset of home care's elderly clients who are defined as long(er)-stay clients. That is, the individual has exceeded a length of stay on home care ≥ 61 days (Fletcher & Hirdes, 2002; Forster et al., 2004; Stolee, Lim, Wilson & Glenny, 2013). Although these sub-set analyses are based on standardized tools (i.e., Resident Assessment Instrument), the administration of when these tools are used to assess a client remains inconsistent across home care programs.

Despite the contribution these studies have made to understanding home care and its elderly clients, there has been little concentration on identifying and distilling individual components of home care, such as specific rehabilitation therapies, and the impact an individual entity may have on specific system outcomes. This might include, for example, the referral patterns differentiating who receives home-based rehabilitation

and who does not, specifically occupational therapy and physiotherapy. There is also very little understanding on how the utilization of hospital services is different between clients that receive home-based rehabilitation and those that do not; and whether or not home-based rehabilitation may mitigate (i.e., delay) the need or time to access hospital services.

1.2 Purpose

The goal for this thesis is twofold: first, it seeks to better understand and describe the referral patterns to home-based rehabilitation; and second, it undertakes to examine the impact home-based rehabilitation services have on home care clients' utilization of hospital services. The study focused on a subset of home care clients and on the two most frequently accessed home-based therapies, occupational therapy and physiotherapy. The outcome of interest was home care clients utilization of hospital emergency departments or inpatient admissions.

1.2.1 The Research Question and Objectives

Three key objectives were proposed that further delineated the research purpose and structured the study. These included the following:

1. To discover how those who receive rehabilitation therapies through home care following a hospital discharge differ from those who do not.
2. To discern which home care client characteristics and processes are associated with returning to the hospital.

3. To establish if returning to the hospital, once on home care, occurs at the same length of time for clients who received rehabilitation and those that did not.

The thesis is organized by chapters. The second chapter presents key findings from the research literature and grey literature (e.g., government reports). This review describes the current understanding of the clinical need, access and definition of home-based rehabilitation, the specific roles of occupational therapy and physiotherapy and intended effects. Chapter 3 explains the methods and procedures used to address each research objective of the study. The study design, data sources, study sample, variables, measures and analyses are explained in Chapter 3. In Chapter 4, the study's results are presented separately for each study objective. Chapter 5, the Discussion and Conclusion, presents a summary of the findings and further discussion of the results in view of current literature. This chapter addresses the study's limitations and concludes with suggestions regarding directions for further research.

Chapter 2

Literature Review

2.1 Introduction

The literature presented in this chapter represents both peer reviewed research studies as well as information contained in grey literature (e.g., government and unpublished reports). The majority of articles and documents reviewed were relevant to Canada, Britain or the United States. The literature review provides the basis on which this study's research objectives are founded. The chapter will present an overview on home care, with emphasis on Ontario's program. The clinical need for home care and home-based rehabilitation is described in relationship to functional autonomy in the elderly, effectiveness of occupational and physical therapies and implications for hospital utilization.

2.2 Home Care

Home care, in general, is associated with publicly funded care versus privately purchased care. Unlike hospital and physician care, home care is not covered under the Canadian Health Act. As such, there are no mandated minimal standards, frameworks, definitions or models for the delivery of home care (CIHI, 2011; Canadian Health Council, 2012). This has meant that home care and home care services are delivered, managed, accessed and available in very different ways between and within provinces.

Throughout the last two decades of health care restructuring, home care has evolved into a critical and strategic element of the health system. Specifically, home care is recognized as the main facilitator required to continue care after hospitalization, in chronic disease management and for government targeted initiatives (CHCA, 2008). In Canada, home care is often attributed with having three distinct functions: 1. acute care or short-term where treatment and intervention is a substitution or continuation for acute care hospital; 2. long term maintenance or preventative care where the goal is to delay further [functional] decline and/or institutionalization; and 3. placement co-ordination for long term care facilities (Hollander and Chappell, 2002).

Home care has been described, generally, as:

> An array of services, provided in the home and community setting, that encompass health promotion and teaching, curative intervention, end-of-life care, rehabilitation, support and maintenance, social adaptation and integration, and support for the family caregiver. Home care services help people with a frailty or with acute, chronic, palliative or rehabilitative health care needs to independently live in their community. While the majority of clients receiving home care are seniors aged 65 and over, home care is provided to individuals of all ages (CHCA, 2008, p.2).

The range of home care services may include nursing care, supportive care, rehabilitation and palliative and end-of-life care. The majority of home care is for supportive care provided by Personal Support Workers (PSWs). Supportive care is

considered as direct care and assistance often for activities of daily living (e.g., bathing, dressing, eating) and/or independent activities of daily living (e.g., meal preparation, cleaning) (CIHI, 2011). Home care health professional services are delivered by registered health professionals. These professional disciplines may include registered nurses or registered practical nurses, occupational therapists, physiotherapists, speech language pathologists, social workers, dieticians and respiratory therapists (CIHI, 2011).

2.2.1 National Data

At any given time, one million Canadians are receiving home care of which 82.0% are age 65 years or older (CIHI, 2011; Health Council of Canada, 2012). Between 1997 and 2007, the number of home care clients in Canada increased by 51.0%, with more than 70.0% over 65 years of age. The growth of elderly clients requiring home care is estimated to increase to 33% by 2017 (CHCA, 2008). Admissions to home care programs are primarily from post-hospital discharges (~57.0%), females and individuals experiencing multiple chronic conditions and disability (CIHI, 2007 & 2011; Health Council of Canada, 2012).

Many of the elderly receiving home care or who will eventually require such services are diagnosed with multiple chronic conditions, functional decline and disability. The Canadian Institute for Health Information (2011) report that Canadians over 65 years of age are almost four times more likely to have a chronic condition than adults aged 18-25 (74.0% versus 19.0%). Results from CIHI's Canadian Survey of Experiences with Primary Care indicates the most frequently reported chronic conditions among the elderly

were high blood pressure, arthritis, heart disease, diabetes, cancer, chronic pain; and approximately 25.0% of seniors reported having three or more of these chronic conditions and 50.0% either one or two conditions and 25.0% none (CIHI, 2011). The proportion of the elderly dealing with at least one chronic condition increased with age (i.e., 71.0% in age group 65-74.0% to 80.0% aged 75-84) (CIHI, 2011).

Functional decline in home care clients appears to increase with age. Of the clients less than 85 years of age, 12-18% reported mild-moderate limitations whereas ≥ 85 reported 25.0% mild, 15.0% severe and 5.0% total limited functional capacity primarily as regards to bathing, walking and toileting (CIHI, 2011; Health Council of Canada, 2012). Regardless of age, 14.0% indicated an inability to perform housework without assistance, 76.0% reported a minimum of one chronic condition and 24.0% greater than three (CIHI, 2011).

The correlation between the amount of health services required and used is, in large part, determined by the number of these chronic conditions (CIHI, 2011). National data has shown that increased age correlates to an increased number of chronic conditions and functional limitations. Specifically, the elderly with three or more chronic conditions had almost three times the number of health care provider visits (e.g., physician, specialists, nurses, physiotherapists) and three times the rate of emergency department visits than the elderly with no reported chronic conditions and with one reported condition (CIHI, 2011).

2.2.1.1 Client Characteristics

The 2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) provides a more detailed profile of community dwelling elderly receiving home care across Canada. Results show that a larger percentage of women than men received home care (30.0% versus 17.9%) (Hoover and Roterman, 2012). For both women and men, the percentages receiving home care increases with age specifically: 12.0% for men and 18.0% for women aged 65-74; 44.0% of men and 59.0% of women age greater than 85. Those living alone or whose main income was a form of social assistance are more likely to receive home care (~32.0%) (Hoover and Roterman, 2012).

The CCHS-HA health utility index indicates that elderly with limited functioning are more likely to receive home care than those reporting no disability to mild disability (11.5% no-mild, 26.6% moderate and 49.7% severe) (Hoover and Roterman, 2012). A relatively high percentage of the elderly reported mobility limitations (79.1% some, 96.3% severe) and personal care limitations (88.2% some, 93.0% severe). These physical limitations were associated with a higher proportion of assistance provided for personal care activities such as bathing or toileting, compared to people who did not experience these limitations (Hoover and Roterman, 2012). Hoverman and Roterman also reported that unmet needs for professional home care were identified by 10.0% of the elderly with severe disabilities; 20.0% with severe mobility limitations; and 29.0% with severe personal care limitations. These same authors (2012) suggest such lack of home care is

associated with increased risk for adverse events, higher hospitalization rates and are more prominent as age increases and for women living alone.

The specific types of home care services received by the elderly across Canada vary and are influenced as one's age increases. Standardized data collected from a sample of long-term stay home care clients in Ontario, Nova Scotia and Yukon in 2009-2010 indicates that the greatest proportion of services received by the elderly were primarily for home making support and nursing. In contrast, younger ages received more occupational therapy, physiotherapy and nursing care (CIHI, 2011). A summary of the variation in services by age of home care clients is shown below in Table 2.1 (CIHI, 2011).

Table 2.1

Home Care Services Received by Age (Data reflects Long-Term Care Clients)

	Age Groups – (% reported)			
Services	**20-64**	**65-74**	**75-84**	**85 +**
Home Making	23	27	33	42
Nursing	40	31	21	19
Occupational Therapy	9	8	7	5
Physiotherapy	8	8	7	7
Home Health Aides[1]	42	47	53	59

[1]Refers to equipment compared to human resourced service cited in table rows 2-5 and in text.

For the elderly who receive these publicly funded home care services, it is further estimated that close to 80.0% of additional care is provided by informal caregivers (e.g., family, friends, neighbours) (CIHI, 2010).

2.3 Home Care in Ontario

In Ontario, unlike other provinces, the organization of home care and community services is separate from hospitals (Baker and Norton, 2004b). Ontario's publicly funded home care is administered and managed by Community Care Access Centres (CCACs). CCACs intended purpose is to co-ordinate and case manage the required care and services but not to be the direct care providers. The CCACs act as single points of access and are situated within fourteen distinct geographical regions of Ontario. CCACs are responsible for determining the eligibility and need for home care and the level, type and duration of care. A range of home care services are co-ordinated and provided in one's home, and these include: nursing, rehabilitation, personal support and homemaking.

Clients' level of clinical acuity, functional status and need for services and supports are determined through an admission assessment. Based on this assessment a client may be classified under one of five categories: 1. acute; 2. rehabilitation; 3. maintenance; 4. long term supportive; and 5. end-of-life (see Appendix A for documentation provided by South East CCAC). Twelve domains are used to determine a client's status and category and these include: individual's condition; medical condition(s) and frequency of hospitalization; client's service goals; types or mix of services possibly required; expected clinical outcome; prognosis; projected length of time

services required; anticipated discharge date; need for placement in managed care; functional status; need for support; and caregiver presence and coping level (Appendix A). Much of this assessment process and detail are captured within clinical history notes. Only when a client remains on home care in excess of ≥ 60 days is there a standardized comprehensive health and functional assessment performed. This assessment uses the Resident Assessment Instrument for Home Care (RAI-HC) (Forbes, Montague, Gibson, Hirdes & Clark, 2011)—this information also provided orally from the Southeastern Ontario CCAC.

Since 2002, the RAI-HC was mandated for assessing long-stay clients (≥ 60 days) and at intervals of 180 days or when a client's health status is reported as changing (Forbes et al., 2011). This does not necessarily mean that a client is immediately reassessed at or on the 61st day or that there is a standard maximum timeframe imposed for completing this assessment. Many of the studies reporting on Ontario's home care's elderly clients demographics and adverse events are based on the RAI-HC data—long-stay clients (Doran et al., 2009; Fletcher and Hirdes, 2002; Health Council of Canada, 2012; Sears et al., 2013).

2.3.1 Referrals to Home Care

The prevalence of home care use by Ontario's elderly population was 27.0%, second only to Manitoba (28.6% and New Brunswick (28.5%) (Hoover and Roterman, 2012). On any given day approximately 185,000 individuals are receiving home care across Ontario, and mainly in large to mid-size urban centres – rural and northern areas of

Ontario using the least amount (Ontario Home Care Association, 2013; Yu, 2011). During 2009-2012, Ontario home care served an average of 620,000 clients (Ontario Home Care Association, 2013). Approximately 56.0% of home care clients were ≥ 65 years of age during this same time period, 28.0%-30.0% were between 19-64 years of age and 16.0%-28.0% were between 0-18 years (Ontario Home Care Association, 2013). Patients discharged from hospitals inpatients and outpatients account for 57.0% of home care admissions followed by community referrals (37.0%) (CIHI, 2007). Over the last three years, the type or level of care required by home care clients has changed. Specifically, acute short stay clients and those described under community independence have decreased by 2.0% and 5.0% respectively (OHCA, 2013); but complex and chronic clients have increased by 5.0% and 3.0% each (OHCA, 2013).

The majority of elderly home care recipients are women (33.1% versus 18.9% males) (Hoover and Roterman, 2012). Results from an analysis of Canadian Community Health Survey (CCHS) cycles (2001-2005) for Ontario seniors showed that the majority of home care recipients: have incomes in range of $15,000-$29,999; are widowed (73.9%), separated (72.4%) or divorced (79.4%); and approximately 25.0% live alone (Yu, 2011). The CCHS analysis also showed an increase in the number of chronic conditions reported by the elderly home care users. The top five chronic conditions reported were similar to national data, specifically, arthritis, high blood pressure and heart disease. On average, 60.0% of these respondents report frequent difficulties with

activities of daily living and independent activities of daily living (i.e., mobility, regular household chores) (Yu, 2011).

2.3.2 Home Care Services Provided

The majority of direct care provided to the elderly is for personal support and homemaking (67.0%-71.2%), followed by nursing (24.8%-28.0%) (CIHI 2007; CIHI, 2011; OHCA, 2013). Only an estimated 2.0% of home care visits are accounted for by occupational and physical therapies (CIHI 2007; CIHI, 2011; OHCA, 2013). The estimate for these therapies may in fact under-report the proportion of visits for occupational and physical therapies because it is calculated by including all home care therapies and nursing visits and personal support/homemaking visits in the denominator.

For example, when Ontario CCAC 2009-2012 data are examined and disaggregated to consider *all professional visits (rehabilitation, social work, nutrition, nursing)*, occupational therapy and physiotherapy represent approximately 6.9% and 6.6% of visits and 81.4% by nursing. When visits by occupational therapy and physiotherapy are considered only as a part of all *home-based therapies* (occupational therapy, physiotherapy, speech, nutrition, social work), they represent 37.1% and 35.4% respectively (Ontario CCAC, n.d.). These results for occupational therapy and physiotherapy are within the range to national data reported by CIHI (2011) for ≥65 years of age, ranging from 5.0-8.0%. Table 2.2 details the proportion of professional services in an aggregate table collated and presented specifically for the purposes of this literature

review. These are data reported by CCAC Ontario as per the volumes of home care services provided for all ages in Ontario during the fiscal year 2009-2010.

Table 2.2

Ontario Home Care Services for Fiscal Year 2009-2010

April 1 – March 31	**Totals**	**%**	
Individuals Served	603,535	100.0	
Client Demographic Age ≥65	325,909	54.0	
Placement in Long Term Care	40,759	12.5	
Services (For All Ages)	**Total**	**% of All Professional Visits**	**% of Total Rehabilitation Visits**
Occupational Therapy Visits	506,154	6.9	37.1
Physiotherapy Visits	483,163	6.6	35.4
Speech Language Therapy Visits	251,740	3.4	18.5
Social Work Visits	70,202	1.0	5.2
Dietician Services Visits	52,877	0.7	3.9
Nursing Visits	5,962,097	81.4	*(Not Included)*
Personal Support/Homemaking (hrs) [1]	20,358,189	n/a	*(Not Included)*
Nursing Shift Hours[1]	1,735,137	n/a	
Total Visits[2]	***7,326,233***	**100.0**	**1,364,136**

[1]Excluded from total count of All Professional Visits and percentage because measure is hours
[2]Visits does not equate to number of unique clients.

Ontario CCAC also report volumes for fiscal years 2010/11 and 2011/12. Comparing these recent fiscal years to Table 2.2 (immediately preceding), there is an increasing proportion of elderly clients (56% and 57% respectively). Nursing visits remain relatively the same from 2009-2012 years, with the exception of higher visits in 2011/12 (5,799,127 for 2010-11 and 6,172,865 for 2011-12). Occupational therapy and physiotherapy visits, however, decrease in 2010 (482,051-OT and 426,690-PT) from that reported in 2009 (see above Table 2.2); but then slightly increase in 2011 (513,290-OT

and 444,054-PT) (OHCA, 2010). However, overall, physiotherapy is declining when comparing all three fiscal years 2009 to 2012. Equally important to note is a reported performance measure in 2010 that indicated 78% of Ontario CCAC home care clients (majority elderly) identified as potentially benefiting from rehabilitation therapies were not receiving such therapies (primarily occupational and physical therapies) (ON Health Quality Council, 2010).

A recent analysis of Ontario home care long-stay clients describes clusters of homogeneous groups as it relates to their functional status and use of rehabilitation services (Armstrong, Zhu, Hirdes & Stolee, 2013). Seven homogeneous clusters of clients are described and these ranged from: Clusters 1 and 2 including clients that were highly dependent on assistance for on daily activities (e.g., bathing, dressing, toileting, meals), primarily women, diagnosis of a dementia but differing only by mobility issues (dependent to assisted). In contrast, Cluster 6 and 7 were younger elderly, independent and cognitively intact but required assistance primarily with housework, shopping and minimal assistance for personal care. Clients within the middle clusters (3-5) were also primarily women that lived alone and who varied in the level of need (minimal to intermediate) with daily personal care, housework, shopping and transportation, and experienced some onset challenges in cognition, gait, pain, osteoporosis and medication management (Armstrong et al., 2013).

2.3.3 Accessibility to Home Care and Rehabilitation

2.3.3.1 Resources

Despite recognizing home care as a critical component of transitional and extended care, there remain discrepancies in its accessibility and availability (CHCA, 2008). Examples of inconsistencies are: the availability of supportive services for chronic conditions (e.g., homemaking, rehabilitation, assisted living facilities); the access to medical supplies, equipment and drugs; and the availability of human resources. Nationally, there may be a variation in the amount (limit) of home care provided. Ontario's home care, for example, limits service by predefined amounts of hours per month (capped), whereas British Columbia has no maximum service limits (MOHLTC, 2010).

Demand for home-based rehabilitation is rapidly increasing, in large part due to the aging population and the increased emphasis on community care versus hospitals (Landry, Jaglal, Wodchis, Ramam & Cott, 2008). In Ontario, accessibility to home care and rehabilitation is based on assessed eligibility, availability of funding, human resources and not merely on demand (Landry et al., 2008; CHCA, 2008; Lewis et al., 2007). It is suggested that the demand has and will continue to outweigh the supply (Landry et al., 2008; Lewis et al., 2007).

A 2007 national study estimate the ratio of therapists per population at approximately 4.8 physiotherapists and 3.7 occupational therapists per 10,000 (Landry, 2009). These ratios are concerning in view of the forecasted demands for home care

rehabilitation services to rise sharply concurrent to an aging population (Health Council of Canada, 2012; Landry 2009; Lewis et al., 2007). Forecasting the need for rehabilitation in Ontario over the next 5-10 years suggests the demand will grow by 26.0% for physiotherapists and 25.0% for occupational therapists (Lewis et al., 2007). An Ontario provincial survey projects that between 2006 and 2016 the demand for rehabilitation will vary depending on condition. For example, demand for rehabilitation for joint anthroplasty may be 19%, whereas it may be higher at 24% for diabetes.

As a consequence, the human resource issue has placed a greater emphasis on home care's personal support workers and on the client and/or family caregivers to be active participants and supporters in the care and rehabilitation process. Home care's staffing concerns are also attributed to the evolving for-profit delivery of services acquired through a competitive bidding process (Ontario Health Coalition, 2011). Organizations responsible for providing Ontario's publicly funded home care tender the delivery of specific home care services for-profit and non-profit companies. For example, a private company would bid and receive the contract to deliver nursing and/or rehabilitation therapies within a geographic region, while another company (or same) would bid for homemaking. Because for-profit companies provide most services, there is tremendous emphasis on volume. Therefore, volumes of services provided to clients are capped (i.e., number of hours/week or month) with the potential for clients to purchase additional services from provider agencies (Ontario Health Coalition, 2011).

Home care workers and clinical professionals (occupational and physical therapists), already challenged by the travel and lack of team support, are now pressured to facilitate relatively quick turnovers to maintain a profitable volume. Ontario's home care operates with the most privatized service providers relative to other provinces and as such has seen high turnover in staff and staff shortages (i.e., nursing, OT and PT) (Ontario Health Coalition, 2011).

2.3.3.2 Wait Times

Intrinsic to the multiple complexities in providing home-based rehabilitation is the wait time experienced once discharged home from hospital. Home care data on wait lists and wait times for home-based rehabilitation services, however, is not well captured. This has been, in large part, due to the variation in how home care programs are provided and resourced (MOHLTC, 2010; Ontario Health Coalition, 2011). The 2010 Auditor General Report indicates that wait lists from 11 CCACs had a total of 10,000 waiting for services, and this is similar to a 1998 report (MOHLTC, 2010).

In 2005, wait lists and wait times for occupational therapy and physiotherapy were measured across various delivery approaches (e.g., hospital, community, private) including through Ontario CCAC home care (Cott, Landry & Cott, 2006). Surveys returned from the CCAC therapists indicated that approximately 50% of clients were waiting for occupational therapy with a median wait time of 14.5 days and a maximum of 51 days. While 6 % were waiting for physiotherapy with a wait time of approximately 20-50 days. Clients with the longest wait times (maximum 221 days) had chronic

musculoskeletal and chronic stroke conditions compared to those with acute conditions (i.e., joint replacement) who were seen within approximately 30 days (Cott et al., 2006). A more recent CIHI report (2012) indicates average wait times for home-based rehabilitation is 15 days for occupational therapy and 29 days for physiotherapy. Wait times are reported to be longer if an individual lives in a rural region or decreased for those without chronic conditions or who have the ability to pay for therapy.

The Ontario Auditor General's Report identified widely variable, inadequate and inequitable rehabilitation care (MOHLTC, 2010). For example, within Ontario's 14 CCACs delivering home care, one CCAC had 1,400 clients waiting for speech language pathologists, in another 770 waiting for occupational therapy and in another 1,300 waiting for home making care (i.e., personal support workers-PSWs). The report also compares eligibility across home care programs. For example, in one CCAC program where clients were assessed as having moderate risk were deemed ineligible for services, but in two other CCAC programs clients with the same determination of moderate risk were considered eligible for services and provided care.

Clients waiting for occupational therapy and physiotherapy at home are of concern in view of the evidence that when accessed in a timely manner, these therapies could reduce the number of emergency department visits, decrease the length of inpatient hospital stays and delay the need for managed residential care (Cott, Devitt, Falter, Soever & Wong, 2004). Conversely, when home-based rehabilitation is delayed, there is

a greater likelihood for increased prevalence rates of disability and costs incurred by other health care systems (i.e., hospitals) (Cott et. al., 2004).

2.4 Clinical Need for Home-Based Rehabilitation

2.4.1 Rates of Functional Decline

Diminishing functional autonomy and mobility independence for community dwelling elderly is an increasing priority and challenge for home care. The prevalence of disease is often used as a proxy for functional decline (Hebert, 1997a). Statistics Canada, for example, reports that the prevalence of chronic disease and disability increases with age and is greatest among those ≥ 65 years of age: 65-74 years at 31.2 % and ≥ 75, 53.3% (Furrie, 2006; Statistics Canada, 2002, 2007). The three most reported disabilities among adults include mobility disability (10.5%), limitations due to pain (10.1%) and agility (9.7%) (Statistics Canada, 2002). The functional decline of home care clients increases with age. Approximately 12.0%-18.0% of clients less than 85 years of age report mild-moderate functional limitations compared to those ≥ 85 reporting 25.0% mild, 15.0% severe and 5.0% total as it related to limited functional capacity for bathing, walking and toileting (CIHI, 2011; Health Council of Canada, 2012). Overall, 14% of elderly clients indicate an inability to perform housework without assistance, 76.0% report a minimum of one chronic condition and 24.0% greater than three (CIHI, 2011).

Estimates of the incidence of functional decline in 386 community-dwelling elderly ≥ 75 years of age was measured over a two-year longitudinal study (Hebert,

1997a) and found an annual incidence of functional decline in year one of 12% and 16% in year two. In a second study, led by the same researcher (Hebert, Brayne & Speigelhalter, 1997b), the incidence of functional decline in community elderly was calculated over two years. The mostly independent population, as measured at baseline, experienced a significant functional decline during the first year of observation, with the overall probability of declining at 20.0% in year one and 12.0% in year two. The incidence of decline was 12.0%. Age was significantly associated to the observed functional decline but sex was not (Hebert et al., 1997b).

Another longitudinal study attempted to determine the transition rates between frailty states and the impact of preceding frailty on subsequent frailty changes in a community-dwelling elderly population (Gill et al., 2006). Comprehensive home assessments measured frailty as to weight loss (within a year), exhaustion (much or most of the time), decreased physical activity (occupational, household and leisure activities, muscle weakness (grip strength) and slow gait (walking speed). Frailty was defined as meeting 3 or more of the criteria, pre-frail by 1-2 and not frail in cases which none of the criteria were met. The majority of the 754 sample were women (58%). The measures, calculated at four points in time (baseline, 18, 36 and 54 months), indicate a higher incidence (transition) of frailty and decreasing proportion of non-frail seniors over time. For example, within 18 months, 40% of those classified as non-frail transitioned to pre-frail, 25% from pre-frail to frail and 13% from frail to death (Gill et al., 2006). It is suggested that the risk factors associated with long-term disability in community mobility

(walking and driving) involved a combination of factors including older age, cognitive impairment, decreased physical activity and poor physical performance. The loss of mobility independence has showed statistical association with the elderly who are no longer able to live in the community and who experience higher rates of self-care dependency, morbidity, hospitalizations, mortality, depression, isolation and overall decreased quality of life (Gill et al., 2012).

2.4.2 Etiology of Functional Decline

Described as a failure to thrive (Hebert et al., 1997b), "functional decline syndrome" or a "cascade of dependency" (Ackroyd-Stolarz, Guernsey, MacKinnon & Kvacs, 2009a, p. 35), these elderly are often clinically profiled as having multiple chronic, complex, sub-acute conditions and disabilities accrued with age (Hebert et al., 1997b). Identified as separate from disability and co-morbidity (Fried, Ferruci, Darer, Williamson and Anderson, 2004), functional decline is recognized as those elderly who are *at-risk* of loss of dependency for routine daily care activities and mobility, adverse events (e.g., falls, hip fracture), acute and chronic illness and increased use of health resources (e.g., hospital, primary care, community) (Hogan, McKnight and Bergman, 2003).

The complex etiology and resultant outcome to functional decline can clinically present as an acute episode or as sub-acute (Hebert et al., 1997a &1997b). The acute incident may be caused by a disease or incident (e.g., stroke, infection), deteriorating chronic condition (e.g., renal failure, diabetes) or a psychological or social issue (e.g.,

caregiver burden). An acute functional decline often results in a medical emergency, an emergency department visit and subsequent admission (Hebert, 1997a). Sub-acute presentations may develop over weeks or months and be the apex of an existing chronic condition(s) (e.g., Parkinson's) or of a new disease (e.g., cancer). Its presentation is often atypical and asymptomatic subsequently involving more prolonged comprehensive medical assessment and rehabilitation intervention (Hebert, 1997a; Kamaruzzaman, Ploubidis, Fletcher & Ebrahim, 2010).

There are also differing opinions in the literature as to cause and effect and to measurement of functional decline. For instance, does natural aging lead to frailty and then result in declining functional abilities (autonomy) or does declining autonomy and mobility determine levels of frailty or is it a dynamic process (Gill, Gahbauer, Allore & Han, 2006)? There is currently neither a standardized definition nor model of functional decline (frailty) applied to older adults, nor is there a consensus on how frailty/decline ought to be measured (Bandeen-Roche et al., 2006; Kamaruzzaman et. al., 2010). Bergman et al., (2004) posit that the determinants of frailty are a mix of biological, psychological, social and environmental factors that interact across the life course. The authors suggest that the development of decline or frailty is a slow and subtle process, unique in presentation and to the individual; and that its inherent complexities often results in a diagnosis often made too late along the care pathway making treatment complex and challenging (Bergman et al., 2004).

Measuring functional decline, in general, has primarily focused on rating an individual`s decreasing or loss of independence and mobility for performing activities of daily living, such as personal self-care (bathing, grooming, toileting), mobility (walking, driving), cognitive function and reasoning and independently completing tasks such as shopping, banking and laundry (Hebert et al., 1997b). A clinically meaningful empirical measurement is especially challenging for the community dwelling population (Kamaruzzaman et. al., 2010). This challenge has been associated with older populations' complex, atypical and heterogeneous health conditions as well as attributes that are latent and cannot be directly observed (Kamaruzzaman et. al., 2010). Developing an index to measure functional decline has been used to determine care paths (Kamaruzzaman et. al., 2010). For example, a three level index has been suggested based on muscle weakness, exhaustion, reduced physical activity, slow gait speed and unintentional weight loss (Fried et al., 2001). Three or more criteria indicate frailty, 1 or 2 indicate pre-frailty and 0 indicate no frailty. This index demonstrated strong concurrent validity association with age, chronic conditions, cognitive function and depression (Fried 2001; Gill et al., 2006). Moreover, the index was independently predictive of outcomes, namely hospitalizations, falls, increased disability and death (Fried, 2001). A more recent investigation suggests seven factors to explain more precisely the concept of functional decline and to predict adverse events than other indices (i.e., physical ability, cardiac symptoms/disease, respiratory symptoms/disease, physical ability-walking, mental health problems, co-morbidities and visual impairment) (Kamaruzzaman et. al., 2010).

A modified version of Fried's (2001) three level index was later applied to community dwelling elderly in an 18 month prospective cohort study (Gill et al., 2006). Over half of the adults in the study were determined to be pre-frail and were extremely close to meeting the criteria for being frail. The study suggested that frailty is a dynamic process among the elderly whereby some might transition between frailty states over time, although largely from lesser frailty to greater rather than the reverse. The concept of functional decline as a dynamic process implies there is a period of time whereby prevention and remediation may be effective. Physical frailty, if detected early (i.e., pre-frail), may subsequently allow for interventions designed to prevent increased frailty in an already at-risk population or even for reducing the degree of vulnerability felt by those who are frail and yet who sustain a level of independence (Ferucci et al., 2004). Proposed interventions specific to rehabilitation therapies (e.g., occupational and physical) and exercise are posited as a means to restore and/or maintain functional independence and prevent further progression of frailty (Ferucci et al., 2004). Targeting those in the pre-frail or frail stage could make a significant difference in reducing the progression of frailty among community-dwelling older adults (Fried 2001; Gill et al., 2006; Hebert et al., 1997a & 1997b).

2.4.3 Consequences of Functional Decline

Older adults are described as an at-risk population for adverse events and outcomes (Baker et al., 2004a) and the risk increases parallel to functional decline. Adverse outcomes associated with frailty often include falls, hip fracture, increased utilization of hospitals, medical, community and social resources and death (Hamerman, 1999; Hogan et al., 2003). These events and outcomes have been studied primarily in hospitals, where records and clinical staff are more accessible and reporting is standardized (Baker & Norton, 2004b). An initial study on adverse events and resultant burden of injury in Canadian hospitals for patients ≥ 18 years old, showed that: 8.0% of hospital admissions experience one or more adverse events, most affecting older patients (≥ 65 years of age); men and women experience similar rates of events; 64% resulted in minimal to moderate disability (recovery within 6 months) versus 5% who were left with permanent disability; and 37% of events were assessed as preventable (Baker et al., 2004a).

Few studies have examined the incidence rates of adverse events and outcomes after hospital discharges, that is, during the time follow-up home care is provided (Baker & Norton, 2004b; Doran et al., 2009; Forster et al., 2004). A seminal study estimates incidence, severity and preventability of events experienced by patients discharged from internal medicine units of Canadian teaching hospitals (Forster et al., 2004). Results indicate that 1 in 5 patients (23%) experience an adverse event, 5.0%- 6.0% of which were preventable or ameliorable (Forster et al., 2004). Events were also described as

more significantly associated with females of older age (mean age of sample was 71), with type 2 diabetes, renal or congestive heart failure, pneumonia or who had experienced longer hospital stays during the index admission.

In two separate studies conducted in Ontario and Manitoba, estimates for the occurrence of adverse events specific to home care clients indicate an incident rate ranging from 6.0%-13.0% (Johnson, 2006; Sears, Baker, Barnsley & Shortt, 2013). The most prevalent adverse events and outcomes were a new fall, unintended weight loss, new visit to emergency department, new hospital admission, new cognitive decline, new urinary tract infection, new pneumonia and further deterioration in a new pressure ulcer (Hirdes et al., 1999; Sears et al., 2013). Fletcher and Hirdes' (2002) study on risk factors for falling among elderly home care clients indicates 27% experience at least one fall and 10% experience more than two falls. In this study, more falls occur for clients that were: male, identified with low levels of cognition (a dementia), diagnosed with Parkinson's disease and perceived to have low health status (Fletcher & Hirdes, 2002). The Manitoba study chart review of 400 home care elderly clients (Johnson, 2006) reports a higher proportion of falls/injuries (46.2%) as adverse events. Moreover, the study reports 15% of the overall adverse events resulted in a hospitalization and that of the falls 93% were ascribed to home care providers and were preventable or ameliorable.

Factors associated with the occurrence of these events are multiple. For example, fear of falling and subsequent restriction of activity (e.g., walking outside) was found in 41% of a sample of 2,300 Ontario home care clients (Fletcher & Hirdes, 2004). In

addition to functional decline and individual predisposing characteristics (i.e., older age, female, cognition) other structural or system factors associated with cause and risk included absence or delay in referrals for home care and specific services (e.g., occupational or physical therapies) and premature hospital discharges (Johnson, 2006).

2.4.3.1 Impact of Functional Decline on Hospital Utilization

For those ≥ 65 years of age, hospital utilization has been identified as the resultant outcome from a condition or episode (adverse event) associated with functional decline. Hospitalization, however, can also significantly contribute to functional declines, increased risk of adverse events, increased dependency and greater need for longer term care services and premature managed care placement (Ackroyd-Stolarz et al., 2009a; Lang et al., 2009; Ontario Association of Community Care Access Centres, 2007; Sears et al., 2013). It is estimated that for every day an elderly person remains in hospital they lose 5% of their function and this could make the difference between living independently and not (CIHI, 2011). The elderly experience higher rates of hospital admissions and longer hospital stays than any other population group (Ackroyd-Stolarz et al., 2009b; Ontario Ministry of Health and Long Term Care [MOHLTC], 2010). Elderly patients often leave the hospital stay for their own home having resolved an acute illness, injury, planned procedure or non-acute illness only to acquire an increased degree of functional decline (frailty).

2.4.3.1.1 Emergency Department Visits

Nationally, emergency department visits are estimated at close to 16 million each year of which one million result in admission—that is, 1.6 in 10 were admitted (CIHI, 2012). The elderly have higher rates of emergency visits compared to younger age groups, i.e., 44,043 per 100,000 versus 29,485 per 100,000 (CIHI, 2011). The highest visit rate is for those ≥ 85 years of age—oldest old (Rowland, Maitra, Richardson, Hudson and Woodhouse, 1990). They are also more likely to be admitted as inpatients (25% versus 8% for ≤ 64 years of age) (Aminzadeh & Dalziel, 2002; CIHI, 2011). Medical reasons, specifically cardiopulmonary with chest pain and dyspnea, abdominal disorders, pain and weakness, are common symptoms in these elderly patients (Aminzadeh & Dalziel, 2002; CIHI, 201; Rowland, Maitra & Richardson, 1990). More recently, emergency departments across Canada identified a large proportion of the elderly presenting with diagnoses described as Ambulatory Care Sensitive Conditions (ACSC), for example, symptoms related to high blood pressure, diabetes and chronic obstructive pulmonary disease (CIHI, 2011). It is suggested that such conditions if treated with good primary care (e.g., testing for high blood pressure) could avoid or pre-empt emergency visits (CIHI, 2011). In 2009-2010, 47% of elderly were diagnosed in emergency with an Ambulatory Care Sensitive Condition, assessed as urgent and then admitted. The majority of these admissions were ≥ 85 years of age (CIHI, 2011).

Emergency department visits have been described as the "the most prevalent adverse outcome for home care clients" (Doran et al., 2009, p.41). A synthesis

of eleven large international studies on the utilization patterns of emergency services found that between12%-21% were by the elderly of which 24.0% discharges rehospitalized within three months and 10.0% died (Aminzadeh & Dalziel, 2002). Unlike younger age groups, the elderly attending emergency departments have more complex multiple concurrent conditions, experience longer lengths of stay and have 2.5-4.6 times the rate of admission (Aminzadeh & Dalziel, 2002).

In Canada it is estimated that between 12.0%-15.0% of community-dwelling residents experiencing adverse events resulted in an emergency department visit and 17% led to a hospital readmission (Forester, 2004; Johnson 2006). Factors identified as significantly associated with increased risk of emergency department visits and exacerbating further risk of adverse events and functional decline post-discharge and rehospitalization were: higher number of co-morbidities, physical decline, cognitive impairment, history of falls (more than 2), polypharmacy (more than 5 medications), cancer diagnosis and medications for anxiety and depression (Aminzadeh & Dalziel, 2002; Doran et. al., 2009; McCusker et al., 1999; Rowland et al., 1990). Based on Ontario population data, increasing age also appears to influence emergency visits incrementally. Seniors ≥ 75-85 years of age are more than twice as likely to attend an emergency department for a fall-related injury (Bronskill, Stevenson, Hirdes & Henry, 2011).

Other studies identified high levels of co-morbidity, physical decline, cognitive impairment and polypharmacy caused index emergency visits but these also exacerbated

the risk of adverse outcomes (i.e., further functional decline) after a discharge home, resulting in early re-hospitalizations (Aminzadeh & Dalziel, 2002; McCusker et al., 1999).

2.4.3.1.2 Hospital Admissions

The elderly experience higher rates of hospital admissions and longer hospital stays than any other population group (Ackroyd-Stolarz, Guernsey, MacKinnon & Kovacs, 2009b; MOHLTC, 2010). National hospital inpatient data indicate that 40% of all acute hospital inpatient stays are by patients ≥ 65 years of age and that the elderly experience longer lengths of stay than younger age groups, with a median length of stay of 9 versus 6 for those ≤ 64 (CIHI, 2011). Discharge data (2009-10) for Ontario's approximately 139 hospitals report that the province's elderly account for close to 60% of hospital inpatient bed days with an average length of stay of one week (MOHLTC, 2010). The majority of these hospital discharges were back to the community and approximately 20.0% of those discharged required in home support (MOHLTC, 2010).

For this same time period, there were 50,000 patients waiting in Ontario hospitals due to delays in post-hospital care service arrangements and availability of beds (e.g., rehabilitation units, long term care). Patients experiencing this form of extended inpatient stay are most commonly referred to as waiting for an alternative level of care, or ALC patients (MOHLTC, 2010). The majority of these hospital ALC bed days were for patients' ≥ 65 years. Provincially, 50% of ALC patients could have been discharged back to their own home if home care had been available (MOHLTC, 2010). Rather, these

patients waited in hospital an average of six additional days before these services became available (MOHLTC, 2010). When these ALC patients did return home, only 50% received home care services within one week and 90% received services within 28 days (1 month) (MOHLTC, 2010).

For those ≥ 65 years of age, hospitalizations significantly contribute to functional decline, increased risk of adverse events, increased dependency and greater need for longer term care services and premature managed care placement (Ackroyd-Stolarz et al.,2009b; Lang et al., 2009; Ontario Association of Community Care Access Centres, 2007; Sears et al., 2013). Elderly patients often leave the hospital stay for their own home having resolved an acute illness, injury, planned procedure or non-acute illness only to acquire an increased degree of functional decline. In circumstances where elderly patients return home without required supports (i.e., home care), there is greater association with other avoidable adverse events and subsequent hospital readmission (MOHLTC, 2010). Patients who were ≤ 64 and who were discharged home receive more services than elderly discharged patients. Of the younger patients returning home, 17.0% received home care support services versus 14.0% for the elderly; and 20.0% of patients ≤ 64 received rehabilitation services compared to 11.0% of the elderly (CIHI, 2011).

Readmission rates for Ontario's elderly reported by the Canadian Institute for Health Information over nine months in 2009 indicate only a 2.0% unplanned readmission rate within seven days from discharge, and slightly over 2% from 8-28 days post-discharge (MOHLTC, 2010). Nonetheless, it is suggested within this report that

these rates are in all likelihood understated. This is partially due to the inaccurate capturing and reporting of data by hospitals, voluntary reporting and the absence of any standardized tracking process for patients attending different hospitals (MOHLTC, 2010).

2.5 Role and Effectiveness of Home-Based Rehabilitation

Rehabilitation therapies are specialized professional services that are provided within hospitals (inpatient and outpatient) and as a part of community care (home care, private clinics). Rehabilitation, in general, is a process that involves assessment, intervention or treatment and management for injuries, disability or illness (CHCA, 2011; CIHI, 2012). Rehabilitation services and interventions associated with the elderly have been described as a tertiary level of care (complex) with the aim to reduce the consequences of functional decline, focusing on the disabilities and mobilization of resources (Hebert, 1997a). By focusing on the individual (e.g., physical activities, safety), rehabilitation interventions may in fact prevent or delay advancements or counteract the process of functional decline altogether. They can also decrease the risk of health deterioration and improve health management (CHCA, 2011; CIHI, 2012; Hebert, 1997a).

A large majority of rehabilitation services are provided by occupational therapists and physiotherapists (CIHI, 2007). Occupational therapists and physiotherapists are two of five principal therapies offered by most home care programs across Canada. The other three therapies include registered dieticians, social workers and speech-language-

pathologists (CHCA 2011). Occupational therapists are described as dealing with the complex interactions that occur between physical, psychosocial, behavioural and emotional functions and assisting with critical life skills needed for living independently (CHCA, 2011). Physiotherapists concentrate on mobility by using treatment and interventions that might reduce pain, restore function and prevent further disability (CHCA, 2011).

Today, the majority of rehabilitation provided is by community and home-based occupational and physical therapists and is largely considered an integral part of transitional care and extended health service and an intervention that may mitigate the onset of [further] adverse events and minimize the need for primary care services (Caplan, 2005; Health Council of Canada, 2012; Kushner et al., 2008). Home-based rehabilitation in this format is broadly understood as a clinical therapeutic engagement in a restoration or maintenance process for persons impeded due to pathology and impairments or functional limitations (Brandt & Pope, 1997; CHCA, 2008). This shift in focus and fiscal resources means that home care and rehabilitation are providing follow-up care and treatments to clients with greater clinical acuity (Ontario Assoc. of CCAC, 2007; Ontario Health Coalition, 2011). Demand for home-based rehabilitation (occupational and physical therapies) is rising sharply as the population is aging and as government health policy emphasizes aging in place and at home (CHCA 2011; CIHI, 2012; Landry, Jaglal, Wodchis, Raman & Cott, 2008).

2.5.1 Implications for Occupational Therapy and Physiotherapy

Home-based occupational and physical therapies are not routinely implemented and there is a lack of understanding on how at-risk elderly are impacted by these therapies or lack of, especially as it relates to clients transitioning from hospital to home (Health Council of Canada, 2012). A 2004 study reports that 71.2% of older adults within Ontario's home care program assessed as having rehabilitation potential (occupational and physical therapies specifically) did not receive any (Hirdes, et al., 2004). In 2009, this estimate rose to 77.6% (Ontario Health Quality, 2009).

Falls are frequently used as a proxy measure of unmet needs in community dwelling elderly and described as having a causal association with hospital utilization. Falls in the elderly have been attributed to decreasing functional status and mobility, muscle weakness, vision issues and side effects from polypharmacy, acute delirium or a dementia (CIHI, 2011). Research has shown that elderly who have a history of falling are at risk for recurring falls and that home-based rehabilitation plays an essential role in recuperation and prevention (Health Council of Canada, 2012). Between 28.0%-66.0% of home care clients who have fallen one or more times will experience subsequent fall(s) within 90 days (CIHI, 2011; Morros as cited in Health Council of Canada, 2012 p.20). National data indicates falls contribute to 9% of elderly visits to emergency departments and approximately 8.0% of admissions (CIHI, 2011).

Canadian Community Health Survey data for those ≥ 65 years of age who were receiving neither home care or paid support and only minimal family support shows that

18.0% had fallen at least one time within the year, 63.0% had received an injury and of these 39.0% sought medical care (Health Council of Canada, 2012). Of those who went to the hospital, 18% were hospitalized and 43.0% were continuing to receive follow-up medical care but this did not include home care services, i.e., occupational and physical therapies (Health Council of Canada, 2012).

These results concur with a 2009 Ontario study examining the management of fall-related injuries in seniors while in emergency departments and after discharge (Miller et. al., 2009). In this study, rehabilitation assessments during the emergency visit were attributed only to 1.3% by physiotherapists, 3.0% by occupational therapists and 5.3% by social workers. Yet, charts indicated these patients were at-risk for gait, balance, strength and decreased range of motion and ability to perform activities of daily living. The majority (62.0%) received no post-discharge referral and those that did were for: ambulation aid (1.6%); fracture clinic (24.0%); family physician (9.0%); occupational therapy (1.6%); physiotherapy or a rehabilitation hospital (1.2%); and home care (4.0%). The return rate of patients to the same emergency department within six months and for another fall-related incident was similar regardless of whether the original discharge was from emergency or admission (8.0% and 9.0%). However, the return rate to the emergency department within 6 months for other reasons was 19.0% for patients originally discharged from emergency and 11.0% for admitted patients (Miller et. al., 2009).

2.5.2 Effectiveness of Home-Based Occupational and Physical Therapies

The effectiveness of home-based rehabilitation is frequently examined by comparing it to conventional hospital rehabilitation, and by conducting systematic reviews and meta-analysis. Regardless of methodology, the results are varied. For example, a meta-analysis of randomized clinical trials comparing multifactorial rehabilitation intervention strategies (of which occupational and physical therapies were key entities) to exercise alone showed that both strategies were significantly associated with decreasing falls, especially for those < 80 years of age. Notably, the effectiveness was attributed to a single intervention (versus multiple approaches provided to a patient) and those provided for a short duration (i.e., 6 weeks-9 months) (Petridou, Manti, Ntinapogias, Negri, & Szczerbinska 2009; Robertson et al., 2009). A targeted behavioural and education occupational/physical therapy home intervention trial shows that community dwelling elderly receiving home care had significant improvements in performing daily activities (bathing and toileting), greater confidence and decreased number of home hazards (increased ambulation in home) and fear of falling than the controls (Gitlin et al., 2006).

Studies comparing home-based rehabilitation to conventional hospital-based rehabilitation are varied. Results from an Australian randomized clinical trial examining early hospital discharges following an acute hip fracture (i.e., from falling) show similar significant improvements for cases and controls for mobility walking tests, self-reported health index and caregiver burden (Crotty, Whitehead, Miller & Gray, 2003). Home-

based rehabilitation in this study included occupational, physical, social work, speech and therapy aides. However, when a similar study design examined only occupational and physical therapy interventions for post-acute hip fractures, home-based elderly clients showed significantly greater confidence, mobility (e.g., outdoor walking), social activity, self-efficacy and independence in daily care and maintenance activities (Ziden, Frandin & Kreuter, 2008). This study also found that the home-based rehabilitation group spent significantly less time in medical clinics or in respite care (Ziden et al., 2008).

Results from systematic reviews and meta-analysis have also varied or were inconclusive. A recent review (Stolee et al., 2011) compared home-based rehabilitation to inpatient rehabilitation units for older patients diagnosed with a musculoskeletal disorder. Based on 12 studies, the review concluded that clients diagnosed with a musculoskeletal condition and that received home-based rehabilitation had equal or higher gains than inpatient rehabilitation controls in function, cognition and quality of life (Stolee et al., 2011). Similar findings to Stolee's work were also found in a meta-analysis specific to home-based rehabilitation provided by multidisciplinary teams for stroke patients (Langhome et al., 2005). Results indicated fewer adverse events, higher scores for independence on daily care activities and greater satisfaction when compared to patients treated with conventional hospital based rehabilitation (Langhome et al., 2005). Yet in another systematic review on the effectiveness of home-based rehabilitation relative to functional status and hospital admissions, 15 randomized clinical trials found no significant statistical effects (i.e., pooled odds ratios) for home-based rehabilitation on

rehospitalization or improvements in activities of daily living, whereas two studies did show improvement in independent activities of daily living (Elkan et al., 2001).

The Cochrane Collaboration (2009) also conducted a meta-analysis to compare the effects of home-based rehabilitation to hospital and long term (managed) care facilities. After assessing over 300 abstracts, the reviewers concluded there is insufficient evidence to draw a comparison largely due to the complexity and intertwined individual services providing rehabilitation to the elderly (Drahota, Gal, Severs & Dean, 2009).

Effectiveness of Ontario's home care's occupational and physical therapies on clients with musculoskeletal conditions was just recently examined (Cook et al., 2013). Using standardized data collected from 2003-2008 for only long-stay home care clients, measures assessed on admission were compared to the same assessment repeated at 6-12 months afterwards to determine change in functional status, mortality and institutional utilization. The majority of the sample included women with an average age of $\geq$75 years of age. Regardless of baseline scores, clients showed significantly increased odds of functional improvement moving from limited activities of daily living or independent activities or both to a level of independence (Cook et al., 2013). As well, the sample had a decrease in the number of hospital admission or long term care placement and an increased likelihood of being discharged from home care (Cook et al., 2013).

2.6 Summary

The literature and reports reviewed for this study clearly demonstrate that diminishing functional autonomy among community dwelling elderly is an increasing priority and challenge to health care systems (i.e., home care). Elderly individuals with functional decline concomitant with multiple chronic and clinically complex conditions represent a high-need, at-risk and vulnerable segment of our population (Hebert et al., 1997b; Williams et al, 2009).

Functional decline is clearly linked to the elderly being at risk for experiencing a range of adverse events such as acute and chronic illness, falls, disability, increased weight loss, functional dependence and death. Outcomes from these events include increased utilization of hospitals, medical and social resources, community and home care services and premature long term care institutionalization (Hogan et al., 2003; CIHI, 2011; Health Council of Canada, 2012).

Although the etiology of functional decline is complex and dynamic, the literature does suggest that there are opportunities or periods of time whereby prevention and remediation may be effective. That is, if detected early or if interventions are appropriate and provided in a timely manner the [degree] progression of functional decline may be delayed and individuals may be left able to sustain a level of independent function, remain at home (Ferucci et al., 2004) and experience fewer hospital visits. Interventions proposed include multidisciplinary rehabilitation therapy teams, occupational therapy and physiotherapy individually and together, as well as exercise, as a means to restore and/or

maintain functional independence and prevent further progression of frailty. Yet many of the studies indicating equal or greater improvements attributed to home-based rehabilitation target a specific diagnostic category (i.e., musculoskeletal, stroke) and only those who received rehabilitation. While the results from a systematic review and meta-analyses of studies on home-based rehabilitation are varied and inconclusive.

Home-based rehabilitation provided to the elderly across Canada is mainly situated within a publicly funded home care program and system and is recognized as critical to contributing to the transition and cost-saving substitute for non-acute hospital based care (Caplan, 2005; Kushner et al., 2008; Ontario Health Coalition, 2011). Home care provided to the elderly is widely considered as a means of maintaining and preventing further health and functional deficits, supporting the ability to live independently, delaying institutional care and decreasing and substituting for hospital care. (Health Council of Canada, 2012; Kushner et al., 2008).

However, the delivery of home care services varies immensely across and within provinces and this variance is attributed to multiple reasons (e.g., policies, resources, geography, eligibility, and wait times). As such, access to a home care assessment does not ensure the certainty of receiving care (Ontario Health Coalition, 2011; Watkins et al., 2009). For the elderly with chronic conditions and who experience the longest wait times for occupational therapy and physiotherapy, the evidence would suggest that [timely] access to home care is of great concern (Cook et al., 2006).

Yet, one of the most significant health care reform strategies from the past two decades, and potentially the greatest to impact functional autonomy for the elderly, is the migration of rehabilitation services from hospitals to home care. In essence, one's own home is the site of care and can be a rehabilitation health care site. Although there are tremendous contributions made by studies that describe home care elderly clients, many of these have only used data on longer-stay home care clients and/or have focused on a specific diagnostic group (i.e., musculoskeletal). There has been little focus on distilling individual entities of home care rehabilitation to determine the impact on outcomes. For example, there is a gap in the literature when it comes to detailing the actual differences in who receives home-based occupational therapy and physiotherapy rehabilitation and who does not, regardless of diagnosis and length of stay on home care. Moreover, it is unclear from the research literature how these specific home-based therapies contribute to mitigate or reduce the burden on hospital utilization, specifically emergency department encounters and inpatient admissions.

Chapter 3

Methods

This chapter identifies the methods and procedures used to address the study objectives. The study design, data sources, cohort identification, variables and measures will be explained in detail. The methods used in the analyses of the data and how these are applied are described under each objective.

3.1 Research Goal and Objectives

The goals for this thesis are to better understand and describe the referral patterns to home-based rehabilitation and to examine the impact home-based rehabilitation services has on home care clients' utilization of hospital services. The study focused on a subset of home care physiotherapy. The outcome of interest was utilization of hospital emergency departments or inpatient admissions. Three key objectives were proposed that further delineated the research question and structured the study. These included:

1. To discover how those who receive rehabilitation therapies through home care following a hospital discharge differ from those who do not receive rehabilitation.
2. To determine whether receiving rehabilitation or not is associated with returning to the hospital after an admission to home care.

3. To establish if returning to the hospital, once on home care, occurs at the same length of time for clients who received rehabilitation and those that did not.

3.2 Study Design

A retrospective cohort design was used to address the research objectives. Cohort study designs, sometimes referred to as historical cohort or follow-up studies, identify a discrete group of individuals (a cohort) based on a shared characteristic or event at a specific period of time (Portney & Watkins, 2009). The design then follows the cohort at intervals through time to assess the risk of specific outcomes (Portney & Watkins). Retrospective cohort studies identify a cohort after the data are collected and examine information collected over a defined period of time and in relationship to specific outcomes. This approach means that the identified cohort can be split and defined by one group from the cohort identified by a specific exposure and a second group without the same defined specific exposure (Kelsey, Thompson & Evans, 1986; Portney & Watkins, 2009).

In this study, the exposure was classified as: (1) home care clients who received home-based rehabilitation therapy (exposed to) and (2) home care clients who did not receive rehabilitation. The specific outcome of interest was the utilization of hospital services (dependent variable). The outcome was defined as either an emergency department visit or inpatient admission.

The study design relies on routinely collected administrative data recorded for purposes other than the current research. As such, there may be incomplete data and, in some instances, possibly incomparable data for all subjects (Henneckens & Buring, 1987). As well, there is the inability to assert causality. The retrospective cohort design does provide the following advantages (Kelsey, Thompson & Evans, 1986; Portney & Watkins, 2009): it is a practical efficient approach to ensure a cohort of exposed clients is adequate for a meaningful analysis in cases in which a specific exposure may be known to have a low prevalence; it considers and assesses the temporal impact of exposure occurring first and then outcomes, and can simulate the benefits of a longitudinal cohort study; it can produce timely results based on routine data (records) derived from the recent past; and it is cost-effective because it uses administrative datasets. Figure 3.1 illustrates the retrospective cohort design for this study.

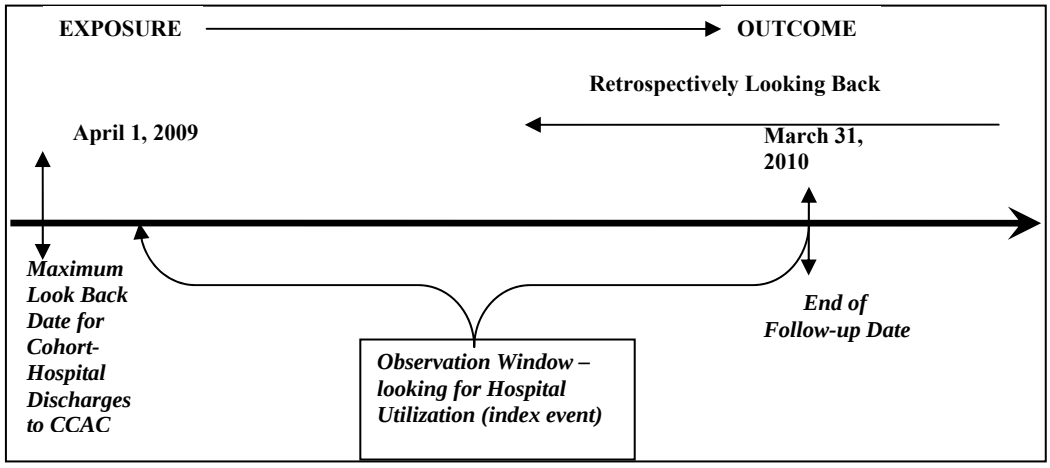

Figure 3.1. **Retrospective cohort study design and time frames**

3.2.1 Sample Selection

3.2.1.1 Cohort Identified

The cohort was identified from consecutive admissions to the South East home care program from discharges at two major hospitals serving the region: the Kingston General Hospital and the Hotel Dieu Hospital. The study period was from April 1, 2009 up to and including March 31, 2010.

Study participants were identified from 2009-2010 South East Community Care Access Centre client database (South East Community Care Access Centre, 2010). The database accessed included 14,558 clients aged ≥ 65 years and close to 45% (> 6,000) who came directly onto home care from a hospital (South East Community Care Access Centre, 2010). Kingston General and Hotel Dieu Hospitals are the largest hospitals and leading centres for complex-acute, specialty and ambulatory care servicing the South East Local Health Integration Network region (South East Local Health Integration Network [LHIN], 2009). These are also research and teaching hospitals affiliated with Queen's University Faculty of Health Sciences (i.e., Schools of Medicine, Nursing and Rehabilitation Therapy). The Kingston General Hospital is a 456-bed hospital, representative of 41% of the region's 1,124 total active acute care beds. The Hotel Dieu Hospital is an ambulatory care centre specializing in clinics, diagnostics, screening or day procedures and rehabilitation and education (e.g., diabetes, pain, cardiac). A major function of Hotel Dieu's ambulatory care is the urgent care centre for less critical emergency problems, and only minimal inpatient beds for mental health—these inpatient

beds existed during the study's time period. The home care admissions were from either hospital's inpatient units or from an outpatient care department (i.e., emergency, day surgery or clinic).

The criteria for inclusion in the study were:

- admission to South East home care program between April 1, 2009 up to and including March 31, 2010
- discharged from an outpatient or inpatient department at Kingston General Hospital or Hotel Dieu Hospital
- were ≥65 years of age
- were considered as new admissions to home care
- were clients residing in a private dwelling or apartment

Clients were excluded from the cohort if they were residing in a managed care environment (e.g., retirement home, long term care home). Clients who were on home care prior to the most recent hospitalization and whose hospital length of stay was < 14 days were not considered a new admission.

The home care database identified 1151 consecutive home care admissions who met the inclusion criteria. A total of 45 cases were omitted due to missing information identified in the course of joining other required home care and hospital variables (datasets) to the master client list. The remaining 1106 cases were then reordered to search for clients who may have had more than one return visit to hospital after their

home care admission. Because the study was interested in identifying and retaining the client's first hospital encounter post-home care admission, all other repeat hospital encounters were excluded—that is to say that clients may have had multiple entries as new home care admissions during the study because they rehospitalized and then discharged from home care and then admitted back on to home care as a new client. The decision rule for this examination, therefore, was to retain the first hospital encounter as indicated by the hospital admission date that came immediately after the home care admission date. Sixty two (62) hospital encounters were removed from the master dataset. The final review of the dataset was for the purpose of excluding any client who was assessed on admission to be end-of-life or palliative—as assessed by case managers using pre-defined criteria stipulated by home care's clinical status types (acute, rehabilitation, maintenance, longer stay, and end-of-life). There were 15 clients identified as end-of-life. The final cohort sample size used for the analyses was 1029. Figure 3.2 shows the process to identify the final cohort.

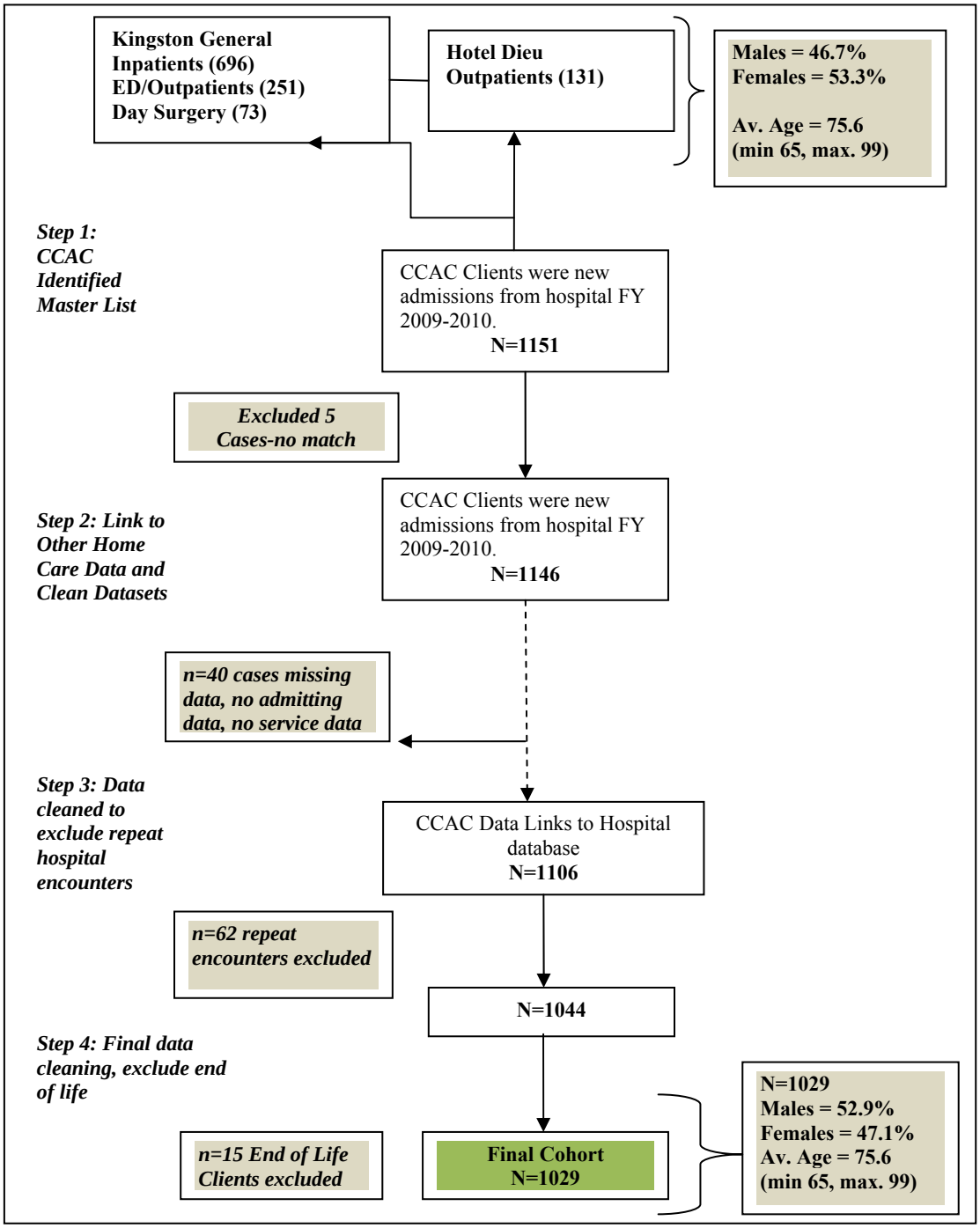

Figure 3.2. **Process to link and clean the data and identify the study cohort sample**

3.2.1.2 Data Collection

In order to address the study objectives, the following lists of variables were used in the analyses. These variables were abstracted from three main administrative databases: 1. home care's Client Health Related Information System (CHRIS); 2. hospital emergency department's National Ambulatory Care Reporting System (NACRS); and 3. hospital inpatient's Discharge Abstract Database (DAD). Table 3.1 identifies the variables that were extracted from these three databases for the study's analyses. The variables operational definition and database source are identified. The variables abstracted and used in the analyses from NACRS and DAD reflect information that related to a client's hospital encounter after their home care admission.

Table 3.1

Variables Extracted from Home Care and Hospital Databases

Variables	Operational Definition	Database Source(s)
Home Care Program		**CHRIS**
Health Insurance Number	Ontario Ministry of Health billing identifier (random)	
Client Number	Unique number for each client [chart number]	
Referral Number	Unique number generated for a new admission & linked to Client Number	
Age	Years	
Date of Birth	dd / mm / yyyy	
Sex	Male / Female	
Admission Date	dd / mm / yyyy	
Discharge Date	dd / mm / yyyy	
Referring Hospital	Kingston General Hospital / Hotel Dieu Hospital	
Referring Department	Emergency, Clinic, Day Surgery, Inpatient	
Assessed Clinical-Service Need (on Admission)	Acute / Rehab / Maintenance / Long Term Supportive / End-of-Life	
Discharge Outcome	Service Plan Complete / Died (Under Home Care) / Died in hospital (<14 days) / Admitted to hospital-Acute care, rehab, chronic / Admitted to Long Term Care / Outpatient service / Client or Family prefers / Transfer to other Home Care Program / Not yet discharged	
Occupational Therapy	Yes / No	
Physiotherapy	Yes / No	
Rehabilitation Visits	Number of Visits by Occupational Therapy; by Physiotherapy	
Nursing Received	Yes / No	
Home Support	Yes / No	
Nursing & Home Support Units	Hours by Home Support ; Hours by Nursing	
Other Therapies/ speech, nutrition, social work	Yes / No & Number of Visits	
Hospital Emergency & Inpatient Departments		**NACRS & DAD**
Health Insurance Number	Ontario Ministry of Health billing identifier (random)	
Date of Birth	dd / mm / yyyy (Verification)	
Admission Date	dd / mm / yyyy	
Discharge Date	dd / mm / yyyy	
Triage Times	Minutes	
Hospital Site	Kingston General Hospital / Hotel Dieu Hospital	
Discharge Outcome	Admitted / Home	
Primary Diagnosis	International Statistical Classification of Diseases and Related Health Problems 10th Edition (ICD-10)	
Rehabilitation – Inpatient (OT / PT)	Yes / No	

The variables extracted from CHRIS, NACRS and DAD were then used to derive new variables also required for the analyses. These are listed in Table 3.2. For example, the variable required to identify the Study Cohort, those who received or did not receive rehabilitation (yes/no), was derived from the individual variables provided in the home care dataset for occupation therapy (yes/no) and physiotherapy (yes/no). In some instances the newly derived variable also produced even a second derivative. For example, determining the length of stay on home care was first derived using clients' home care admission and discharge dates and produced a continuous variable (i.e., number of days). The continuous variable could also be further defined as a categorical variable, for example $\leq$ 60 days / $\geq$61 days.

Table 3.2

New Variables Derived from the Original Database Extraction

Derived Variables	Operational Definition	Variable Source(s)
Home Care Program		**CHRIS**
New Admission	Client and Referral Numbers	Client and Referral Numbers
Age Categories	1) 65-69, 70-74, 75-79, ≥ 80 2) 65-74 (young old), 75-84 Middle Elderly, >85 Older-Old	Age, Date of Birth
Length of Stay	1) Days 2) Categories (0-30, 31-60, 61-90, 91-120, 121-150, 151-180, >181) 3) ≤ 60 Days / ≥61	Admission-Discharge Dates
Referring Hospital Department	Inpatient / Outpatient	Referring Department
Admission Intake Clinical Status	Acute / Non-Acute	Assessed Clinical-Service Need (on Admission)
Discharge Outcome Collapsed	-Service Plan Complete -Other (died, family/preference, admission) -Not yet discharged	Discharge Outcome
Study Cohort	-OT received only -PT received only -OT & PT both received -No Rehabilitation	Rehabilitation Therapies/ OT & then PT
Study Cohort Collapsed	-Yes received rehabilitation -No did not receive	Study Cohort
Time-to-Event	Days (where clients have no discharge, end of study date inserted)	Admission-Discharge Dates
Hospital Emergency & Inpatient Departments		NACRS & DAD
Unique Clients	Client's index hospital encounter	Client and Referral Numbers
Primary Diagnosis	-Joint replacement -Symptoms, signs -Surgery-major -Fractures -Prosthesis complication -Stroke -Heart Surgery -Follow-up	ICD-10 Classification Codes
ED Encounter	Yes / No	HIN/Client and Referral Numbers
Admission	Yes / No	HIN/Client and Referral Numbers
Hospital Encounter – Dichotomous	Yes / No	ED Encounter & Admission / Client and Referral Numbers
Hospital Encounter-Polytomous	None / ED Encounter / Admission	ED Encounter / Admission / Client and Referral Numbers

The CHRIS, NACRS and DAD are administrative database systems used to report information as mandated by Ontario's Ministry of Health and Long Term Care. These databases provide a means by which health status and health system performance can be compared nationally, provincially and regionally. The standardized reporting includes pre-determined utilization, clinical and financial indicators that are completed and submitted on a quarterly basis to the Canadian Institute for Health Information, hereafter referred to as CIHI (CIHI, 2007).

Home care's CHRIS database includes detailed client intake information, eligibility criteria and assessment, care plans, service monitoring and billing (MOHLTC, 2010). The CHRIS includes a limited amount of fixed quantifiable fields such as: Ontario Health Insurance Numbers (HIN), chart and referral identification numbers, demographics (age, sex), process data (admission-discharge dates, times) and resource utilization (specific services). Other client information such as diagnosis, assessment findings (e.g., functional status) or progress and status are documented as clinical notes (text). These clinical notes are not all located within the client's home care file—service providers contracted by CCACs to provide direct care (i.e., occupational and physical therapies) will have a detailed client chart on assessments or progress notes, providing only summaries (text).

Both the NACRS and the DAD record process and health information in standardized fixed fields that are specific to hospital emergency department encounters and to hospital inpatient admissions. For example, NACRS will record the ED triage time, admission

date and level of urgency whereas the DAD data will record an admission date, code for type of admission or surgical procedure. Both NACRS and DAD include patients' Ontario Health Insurance Numbers (HIN), demographics (age, sex, address), primary diagnosis(es) and process of care measurements (admit-discharge date).

3.2.1.3 Linking the Databases

The data extraction and database linking were completed in two distinct steps. The initial extraction of variables from CHRIS, NACRS and DAD transpired between data programmers from home care and Kingston General Hospital—the process as determined by Queen's University Health Sciences Research Ethics Board approval (see Appendix B), and the South East CCAC client confidentiality policy. This process produced multiple databases (i.e., one per CCAC's CHRIS, DAD and NACRS). Each of these individual databases included the client's unique home care Client Number and Referral Identification Number and Health Insurance Number. Clients' Ontario Health Insurance Numbers were encrypted so the researcher could not have access to this information when the databases were transferred. Each programmer retained the Master copies of all databases created for this study in the event verification was required using a client's HIN.

The Kingston General Hospital's Decision Support Department stores and secures the NACRS and DAD for all hospitals in Southeastern Ontario. However, patient level data are encrypted for all regionally based acute care hospitals—access to all 9 SE ON hospitals' data can only contribute to aggregate reporting (e.g., total number of

admissions). The exception to this is the Kingston General and Hotel Dieu Hospitals. The hospital programmer was able to electronically access patient level NACRS and DAD data these two hospitals. Because of this, the focus for the study was contained to the Kingston General and Hotel Dieu Hospitals. Therefore, it was possible to link a home care client master list to these NACRS and DAD patient level information for emergency department visits or inpatient admissions.

Clients' Ontario Health Insurance Number and date of birth were the two main variables used to link and extract the required hospital data. Where any questions or concerns were raised by the hospital programmer, the home care admission date was used to verify or the programmer could confer with the home care programmer as to verification (i.e., client initials, address). Hospital information was requested for two points of time: 1. the immediate hospital encounter preceding the home care admission; and 2. the first return to hospital after the home care admission. Using the home care admission dates, the hospital programmer stipulated a 30 day search preceding the admission and up to and including March 31, 2010 as the search following the home care admission.

Once the data extraction was finalized, the researcher received the individual databases produced from CHRIS, NACRS and DAD. The home care's unique Client Number and Referral Number was retained in each of these databases and therefore allowed the researcher to link the databases and create one Master database file. The final

Master database was examined for missing data, specifically, admitting information, demographics and services and also repeat entries attributed to individual clients.

3.3 Data Analyses

The study applied an analytic strategy using multiple methods. The analyses for this study centred on determining whether there were significant statistical differences between the characteristics of clients who received home-based rehabilitation compared to those who did not; and to delineate those differences and characteristics that affect the utilization of hospital services while on home care. All of the analyses for this study were quantitative. The analyses were performed in a sequential order that built upon the results from the preceding objective. Data manipulation and analyses were performed in SPSS version 20 [SPSS Inc., 20.0 Inc., Chicago Il.]. The method of data analysis is described under each research objective.

3.3.1 Objective One: Descriptive Analyses

Objective 1: To discover how those who receive rehabilitation therapies through home care following a hospital discharge differ from those who do not receive rehabilitation.

Bivariate analysis was used to compare and describe the two groups—those who receive rehabilitation versus those who do not. Standard descriptive measures of central tendency and distribution (mean, standard deviation, median, range) and t-tests and analysis of variance (ANOVA) were calculated for continuous variables. Categorical variables were analyzed using chi-square and one-way multivariate analysis of variance

in order to examine differences in those clients who did or did not receive therapies. The p-value for these statistical significance testing was $p<0.05$.

Multiple logistic regression was used in the final analysis of this objective where the outcome variable was receiving rehabilitation (yes/no). A multiple logistic regression analysis produces a model that estimates the effects of a number of explanatory variables (independent variables) on a dichotomous dependent variable. One of the strengths of this method is that it assumes that the predetermined collection of independent variables to be examined may be of different measurement scales (e.g., discrete, nominal, continuous) (Hosmer & Lemeshow,1989). The logistic regression analysis allows for further examination of the relationships between the independent variables of interest, when considered in relationship to each other, and to determine which client characteristics increased the likelihood (odds ratio) of receiving rehabilitation. This analysis produces a model that indicates which independent variables have a stronger likelihood (odds) of increasing the outcome, i.e., receiving home-based rehabilitation. For example, does the likelihood of receiving home-based rehabilitation increase as age increases on a continuous scale, if age is statistically significant and included in the model. How much difference does being aged 75 to 84 make compared to being 65 to 74 as regards to the likelihood of receiving home-based rehabilitation. A p-value < 0.05 was also used to assess the variables included in the model.

3.3.2 Objective 2: Descriptive Analysis

Objective 2: To discern which home care client characteristics and processes are associated with returning to the hospital.

Bivariate analysis was used to compare and describe the clients that rehospitalized from those that did not. The outcome variable in this analysis is defined as whether or not a hospital encounter occurred (i.e., yes/no). Similar tests of significance detailed in objective one were repeated, specifically: standard descriptive measures of central tendency and distribution (mean, standard deviation, median, range) and t-tests and ANOVA were calculated for continuous variables. Categorical variables were analyzed using chi-square and one-way multivariate analysis of variance in order to examine differences in those clients that did/did not rehospitalize. A p-value < 0.05 was used for statistical significance testing.

3.3.3 Objective 3: Survival Analysis

Objective 3: To establish if returning to the hospital, once on home care, occurs at the same length of time for clients who received rehabilitation and those that did not receive rehabilitation.

The retrospective cohort study design examined a defined period of time April 1, 2009-March 31, 2010. Within this time, clients were admitted onto home care and observed for the occurrence of a hospital encounter up to and including March 31, 2010. However, the actual observation time varied for each individual client depending on their admission date. For example, a client admitted April 1, 2009 and discharged January 1,

2010 was on home care for 9 months during which time a hospital encounter may have occurred or not. In contrast, a client admitted April 1, 2009 and discharged May 1, 2009 will have experienced a much shorter period of time on home care (1 month) during which a hospital encounter may or may not have occurred.

Conventional statistical methods, as described under the previous objectives, do not consider the duration of time and length (variance) of time that passes until a hospital encounter occurs; these methods also do not consider those clients who may not experience a hospital encounter. Survival analysis or time-to-event analysis takes into account the possible different follow-up times that will be affected by clients' admission dates. Time-to-event analysis therefore looks at the total time a client is at risk for a hospital encounter and allows us to compare those clients who received rehabilitation and those that did not (Singer & Willett, 2003).

The event was defined as a hospital encounter (dichotomous yes/no). The time or duration variable was measured in number of days counted from admission to even date or discharge date up to and including March 31, 2010. Some clients will not have a hospital encounter during the observation period and these clients are described as censored in this analysis. Censored refers to the fact that clients cannot be observed to know what has happened and they may or may not have experienced a hospital encounter.

The Kaplan-Meier (KM) procedure was used to estimate the time-to-event, including censored cases. The KM procedure produced the distribution of time-to-

hospital return by defining groups as: received rehabilitation and did not; four categories including no rehabilitation, occupational therapy, physiotherapy or both occupational/physiotherapy; and separately for occupational therapy versus no occupational therapy; and physiotherapy versus no physiotherapy. This analysis produces survival curves allowing for a visual examination of the time-to-event as well as the overall tests of the equality of survival times across the recipients and non-recipients of rehabilitation. In this analysis, non-parametric tests used to compare the difference between the survival curves report the Log Rank and the generalized Wilcoxon test.

Chapter 4

Results

The results are presented in three sections, corresponding to each research objective. The chapter begins first by describing the study cohort in more detail in order to situate the context for the results that will follow as related specifically to the study objectives:

1. To discover how those who receive rehabilitation therapies through home care following a hospital discharge differ from those who do not receive rehabilitation.
2. To discern which study cohort characteristics and home care processes are associated with returning to the hospital.
3. To establish if returning to the hospital, once on home care, occurs at the same length of time for clients who received rehabilitation and those that did not.

4.1 Study Cohort

The study examined the period of time between April 1, 2009 and to March 31, 2010. During this time, a total of 1029 eligible elderly people were admitted consecutively to home care from the two major hospitals serving the SE region, the Kingston General Hospital or the Hotel Dieu Hospital.

The distribution of the 1029 admissions included in this study is detailed in Table 4.1. This summary table indicates those clients that received occupational therapy or physiotherapy, clients that received both occupational therapy or physiotherapy and those that did not receive either of occupational therapy or physiotherapy. From the total sample of 1029, 451 (43.8%) received home-based rehabilitation and 578 (56.2 %) did not. Of those clients that received rehabilitation, 336 (32.7%) received physiotherapy, 182 (17.7%) received occupational therapy and 67 (6.5%) received both. The chi-square test for the distribution of these specific therapies received by no therapy received was significant ($p<0.001$).

Table 4.1

Distribution of Home-Based Occupational Therapy or Physiotherapy

	PT Yes n (total%)	**PT No n (total %)**	**TOTAL n(column %)**	**Significance (2 Tailed) p-value***
OT Yes	67 (6.5)	115 (11.2)	**182 (17.7)**	p<0.001
OT No	269 (26.1)	578 (56.2)	**847 (82.3)**	
TOTAL (row%)	**336 (32.7)**	**693 (67.3)**	**1029 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

4.2 Hospital Admission Prior to Home Care

Hospital stays experienced by the study cohort and that occurred immediately before the home care admissions were examined. This analysis provided a general description of the medical reasons for the hospital encounter and the differences that might be attributed in health status between the rehabilitation groups (yes/no). In this analysis, the NACRS and DAD databases were the primary sources. Data extracted included admission-discharge dates, primary diagnosis and, for inpatients, whether or not occupational or physiotherapy had been received. Data were available for 673 (65.4%) of the total 1029 study sample—a subset. The following results will be presented on the 673 clients for whom hospital data were extracted. Of the 673 clients, 70 (10.4%) were emergency department visits that were then discharged home, 182 (27.0%) went from an emergency department to an inpatient unit and 421 (62.6%) were direct admissions to an inpatient unit.

Significant differences ($p<0.05$) were found in the ANOVA comparing the length of time spent by clients seen either in an emergency department or as an inpatient when comparing clients' specific home care rehabilitation status. Clients who were initially seen in emergency departments (n=252) and who then later received home-based occupational therapy spent longer time in emergency care (average 11 hours) compared to an average 7 hours for clients who either never received any rehabilitation, received only physiotherapy or both therapies ($p=0.006$). Differences were also found in the average number of inpatient days. Of the 603 inpatients, clients who received home-based occupational therapy and physiotherapy had an average stay of 19.1 days compared

to 18.6 days for those who then received occupational therapy alone, 7.4 days for physiotherapy and 9.0 days for no rehabilitation after discharge ($p<0.001$). Table 4.2 details the average lengths of stay for emergency visits and inpatient separations by the clients' home-based rehabilitation status.

Table 4.2

Average Number of Hours and Days in Hospital Prior to Home Care Admissions

Hospital Department	Occupational Therapy	Physio-therapy	Both OT/PT	No Rehab	Significance (2 Tailed) p-value*
ED (n=252)[1]					
Mean[2]	11.2	7.2	7.8	7.3	0.006
±SD	10.2	4.9	9.6	5.9	
Min	1.9	0.3	1.6	0.6	
Max	68.3	30.1	54.2	45.0	
Inpatients (n=603)[1]					
Mean[3]	18.6	7.4	19.1	9.0	$p < 0.001$
±SD	33.7	9.6	18.9	13.6	
Min	1.0	1.0	1.0	1.0	
Max	279.0	88.0	83.0	131.0	

****ANOVA test of significance, $p<0.05$; [1]182 clients seen in ED and then admitted contribute to time spent in both the ED and inpatient units ; [2]Time in hours; [3]Time in Days**

Examining only those admitted to home care from inpatient units (n= 603), 71.3% received rehabilitation during their stay, the majority for physiotherapy (69.8%) and 173 (28.7%) did not receive any. The distribution for inpatient hospital rehabilitation status that preceded home care admissions for those clients for whom primary diagnosis data were available was significantly different overall ($p<0.001$) and is shown in the following contingency table below (Table 4.3).

Table 4.3

Distribution of Inpatient Occupational Therapy or Physiotherapy Received

	PT Yes n (total %)	**PT No n (total %)**	**TOTAL n(column %)**	**Significance (2 Tailed) p-value***
OT Yes	195 (32.3)	9 (1.5)	**204 (33.8)**	p<0.001
OT No	226 (37.5)	173 (28.7)	**399 (66.2)**	
TOTAL (row %)	**421 (69.8)**	**182 (30.2)**	**603 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

Significant differences (p<0.001) were also found between those who received hospital rehabilitation compared to home-based rehabilitation status (see Table 4.4). Those patients that received rehabilitation while in hospital were more likely to receive home-based rehabilitation. Only 154 (35.8%) of the inpatients did not receive any rehabilitation at home. Of those who received inpatient physiotherapy, the majority of these received no follow-up therapy (54.9%); and patients that received both occupational therapy and physiotherapy were primarily followed by physiotherapy at home (55.9%).

Table 4.4

Distribution of Inpatient Rehabilitation Therapies by Home-Based Rehabilitation

Hospital Rehab → / **Home-based Rehab ↓**	**OT n (column %)**	**PT n (column %)**	**Both OT & PT n (column %)**	**TOTAL n (column %)**	**Significance (2 Tailed) p-value***
No Rehab	2 (22.2)	124 (54.9)	28 (14.4)	**154 (35.8)**	p < 0.001
OT	3 (33.3)	24 (10.6)	33 (16.9)	**60 (14.0)**	
PT	1 (11.1)	70 (31.0)	109 (55.9)	**180 (41.9)**	
Both OT & PT	3 (33.3)	8 (3.5)	25 (12.8)	**36 (8.4)**	
TOTAL (row %)	**9 (2.1)**	**226 (52.6)**	**195 (45.3)**	**430 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

The primary diagnoses were examined under ICD-10 headings, sub-headings, numerical coding and by description of procedures. Using these ICD-10 descriptors and coding, frequency counts from the abstracted diagnosis provided eight groupings (categories) and these included: 1. joint replacement, repair, fusion or amputation (i.e., implant prosthesis hip or knee, repair vertebra spine), 2. fracture (i.e., ankle, femur, wrist, hand), 3. stroke (i.e., cerebral infarction or hemorrhage), 4. mechanical complication and infection (i.e., of hip, knee or other prosthesis), 5. heart surgery (i.e., bypass, implant, valve stenosis), 6. surgical procedure (i.e., neoplasm excise, biopsy), 7. symptoms and signs (e.g., dyspnoea, dizziness, malaise, pain, fever, nausea, dehydration) and 8. follow-up treatment (i.e., dressings, convalescence).

The chi-square test of significance was used to examine the distribution of primary diagnostic categories by specific hospital departments and by clients' home-based rehabilitation status. There was an overall significant difference between the categories by the specific hospital department encountered before home care—inpatient or emergency. The p-value reported in Table 4.5 was $p<0.001$ and reflects the chi-square result for the entire contingency table. The majority of inpatients had a primary diagnosis related to surgery and repair requiring joint implants (27.2%), surgical excise (24.1% predominantly of neoplasms) and surgical heart procedures (10.1%). Clients who experienced general sub-acute symptoms and signs (18.6%) and fractures (10.0%) were seen in emergency departments. Table 4.5 shows the distribution for the 673 patients for whom primary diagnoses were available by the hospital departments seen by the client.

Table 4.5

Diagnostic Categories by Hospital Department Encountered Prior to Home Care Admission

Primary Diagnosis Category	ED-Discharge n (column%)	ED to Inpatient n (column%)	Inpatient n (column%)	Total n (column%)	Significance (2 Tailed) p-value*
Joint Repair Replacement, Fusion, Amputation	5 (7.1)	5 (2.7)	173 (41.1)	**183 (27.2)**	$p < 0.001$
Surgical-Major Excise, Biopsy	5 (7.1)	47 (25.8)	110 (26.1)	**162 (24.1)**	
Symptoms, Signs	40 (57.1)	55 (30.2)	30 (7.1)	**125 (18.6)**	
Heart Surgery, Valve, Bypass, Stenosis	0 (0.0)	13 (7.1)	55 (13.1)	**68 (10.1)**	
Fractures	15 (21.4)	42 (23.1)	10 (2.4)	**67 (10.0)**	
Mechanical Complication, Infection	1 (1.4)	3 (1.6)	28 (6.7)	**32 (4.8)**	
Stroke, Aneurysm, Infarction	0 (0.0)	17 (9.3)	6 (1.4)	**23 (3.4)**	
Follow-Up Treatment	4 (5.7)	0 (0.0)	9 (2.1)	**13 (1.9)**	
Total (row %)	**70 (10.4)**	**182 (27.0)**	**421 (62.6)**	**673 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

4.3 Describing Recipients of Home-Based Rehabilitation

Objective 1: To discover how those who receive rehabilitation therapies through home care following a hospital discharge differ from those who do not receive rehabilitation.

The first part of the analysis for objective one was the continued examination of patients' hospital encounter prior to a home care admission. Building upon the data and analysis described above, primary diagnoses were further examined. Specifically, the distributions of diagnoses were examined by clients' home-based rehabilitation status. Overall, the chi-square test showed a significant difference ($p<0.001$) in the diagnoses of the 378 (56.2%) clients that received rehabilitation once home compared to 295 (43.8%) who did not. Table 4.6 and 4.7 provide the distribution of the eight diagnosis groupings by home-based rehabilitation status (4.6 as a dichotomous variable and 4.7 by each specific therapy).

The clients who received rehabilitation were more likely to have conditions related to joint replacement, general symptoms, surgical procedure and fractures. Referring to Table 4.7, of the 242 clients that received physiotherapy, 70.5% were attributed to joint replacement-repair and 43.3% to fractures. In contrast, of the 84 clients that received occupational therapy, 27.2% were diagnosed with symptoms and signs and 26.1% with stroke or infarction. Clients that received both therapies had diagnoses predominantly within the groups for fractures (25.4%), stroke or infarction (17.4%) and

symptoms and signs (10.4%). Clients with no rehabilitation had primarily medical and acute diagnosis (i.e., 70.6 % heart surgery, 63.6% surgery-cancer).

Table 4.6

Hospital Discharge Diagnoses Categories by Home-Based Rehabilitation

Primary Diagnosis Category	Rehab n (column %)	No Rehab n (column %)	Total n(column %)	Significance (2 Tailed) p-value*
Joint Repair Replacement	136 (36.0)	47 (15.9)	**183 (27.2)**	p < 0.001
Surgical-Major Excise	59 (15.6)	103 (34.9)	**162 (24.1)**	
Symptoms, Signs	70 (18.5)	55 (18.6)	**125 (18.6)**	
Heart Surgery	20 (5.3)	48 (16.3)	**68 (10.1)**	
Fractures	57 (15.1)	10 (3.4)	**67 (10.0)**	
Mechanical Complication, Infection	19 (5.0)	13 (4.4)	**32 (4.8)**	
Stroke, Infarction	17 (4.5)	6 (2.0)	**23 (3.4)**	
Follow-Up Treatment	0 (0.0)	13 (4.4)	**13 (1.9)**	
Total (row%)	378 (56.2)	295 (43.8)	**673 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

Table 4.7

Diagnoses Categories by Rehabilitation Defined as Four Categories (n=673)

Primary Diagnosis Category	OT n (row%)	PT n (row%)	Both OT/ PT n (row%)	No OT/PT n (row%)	Total (column %)	Significance (2 Tailed) p-value*
Joint Repair Replacement	0 (0.0)	129 (70.5)	7 (3.8)	47 (25.7)	**183 (27.2)**	p < 0.001
Surgical-Major Excise	27 (16.7)	27 (16.7)	5 (3.1)	103 (63.6)	**162 (24.1)**	
Symptoms, Signs	34 (27.2)	23 (18.4)	13 (10.4)	55 (44.0)	**125 (18.6)**	
Heart Surgery	5 (7.4)	12 (17.6)	3 (4.4)	48 (70.6)	**68 (10.1)**	
Fractures	11 (16.4)	29 (43.3)	17 (25.4)	10 (14.9)	**67 (10.0)**	
Mechanical Complication, Infection	1 (3.1)	15 (46.9)	3 (9.4)	13 (40.6)	**32 (4.8)**	
Stroke, Infarction	6 (26.1)	7 (30.4)	4 (17.4)	6 (26.1)	**23 (3.4)**	
Follow-Up Treatment	0	0	0	13 (100.0)	**13 (1.9)**	
Total (row %)	**84 (12.5)**	**242 (36.0)**	**52 (7.7)**	**295 (43.8)**	**673 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

4.3.1 Study Cohort Described

Significant differences in age, sex and hospital referring department were found ($p<0.001$) between the total study cohort (N=1029) as defined by exposure to receiving home-based rehabilitation compared to those who did not (Table 4.8). Rehabilitation recipients were older than non-recipients (mean age of 77.0 versus 74.4 years) and were more likely to be female (55.7% versus 44.3%). The recipients were also more likely to come from an inpatient unit (78.5%) whereas non-recipients were more likely to be admitted from an outpatient department (53.1% versus 21.5%).

Table 4.8

Demographic Characteristics of the Study Cohort (N=1029) by Rehabilitation Status

Demographic Variables		**Rehab n (column %)**	**No Rehab n (column %)**	**Significance (2 Tailed) p-value***
Referring Hospital Department[a]	Outpatient Inpatient	97 (21.5%) 354 (78.5%)	307 (53.1%) 271 (46.9%)	p<0.001
Sex[a]	Male Female	200 (44.3%) 251 (55.7%)	344 (59.5%) 234 (40.5%)	p<0.001
Age (years)[b]	Mean ±SD	77.0 7.0	74.4 6.3	p<0.001

***Test of significance p<0.05**
[a] Chi-Square test for a contingency table, significance p<0.05
[b] t-test of significance, p<0.05

The average number of therapy visits slightly differed but not significantly (p = 0.07). The average number of visits by occupational therapists was 3 (SD ±2.5, min 1- max 22) and 5 by physiotherapists (SD ±3.0 min 1- max 24). For the clients who received both occupational and physical therapies the average visits, correspondingly, was 4 visits (SD ±2.7 min 1 max 16) and 6 visits (SD ±4.2, min1 - max 16). Yet, there was a

significant difference in the average time (days) calculated between the referral date requesting these therapies to the actual first home visit (see Table 4.9). The average time period from referral to first visit was longer for physiotherapy (11.0 days) compared to 8.5 days for occupational (p=0.002). Occupational therapy, however, had referrals requested after a longer period of time from admission compared to physiotherapy (13.3 days versus 7.7). Overall, occupational therapists' first visit was 3 weeks from admission and physiotherapists 2.5 weeks.

Table 4.9

Time to Receive Home Care Rehabilitation

Time Interval (Days)	Occupational Therapy (n=177)	Physiotherapy (n=366)	Significance (2 Tailed) p-value*
Home Care Admit Date Rehab Referral			
Mean	13.3	6.7	p = 0.008
±SD	34.1	22.0	
Min	0	1	
Max	258	181	
Rehab Referral to Rehab First Visit			
Mean	8.5	11.0	p = 0.002
±SD	7.8	8.8	
Min	0	0	
Max	42	57	
Home Care Admit Date to Rehab First Visit			
Mean	21.9	17.6	
±SD	34.4	24.0	p = 0.10
Min	1	0	
Max	259	189	

***t-test of significance, p<0.05**

There were also significant differences in the types and amounts of other home care services received, as detailed in Table 4.10. Clients receiving rehabilitation were more likely to receive home making support but less likely to receive nursing care. Of the total 451 clients receiving rehabilitation, 30.4% had home making support services (i.e., Personal Support Worker) where only 9.3% of those not receiving therapy had home making. The recipients received close to 3 times the average amount of home making hours (165.6 hours versus 58.5); and the support was largely provided to those who had both therapies (65.7%) and occupational therapy alone (45.2%).

In contrast, a very large proportion of the clients who did not receive rehabilitation were provided nursing care (96.4%). Nursing care was received by 61.2% of clients with both occupational therapy and physiotherapy and by 54.6% of clients with only physiotherapy. Despite these differences, both rehabilitation and non- rehabilitation groups were provided close to the same average amount of nursing time (21.6 and 19.1 hours).

Table 4.10

Home Care Services by Rehabilitation Status

Services Received Variables		Rehab n (column%)	No Rehab n (column%)	Significance (2 Tailed) p-value*
Home Making Services	Yes [a]	137 (30.4)	54 (9.3)	p<0.001
	(n=191) [b] Mean (hours)[c] ±SD	 165.6 226.42	 58.5 110.16	0.001
Nursing Services	Yes [a]	242 (53.7)	557 (96.4)	p<0.001
	(n=799) [b] Mean (hours) [c] ±SD	 21.6 56.12	 19.1 42.25	0.488

***Test of significance p<0.05**
[a] Chi-Square test for a contingency table, significance p<0.05
[b] t-test of significance, p<0.05
[c] Hours calculated from total sum of time provided to a home care client during their admission

Returning to the hospital was examined between and within the client groups – received rehabilitation and did not receive rehabilitation. There were 241 (23.4%) of the total sample that returned to the hospital. Slightly over half of the 241 clients that returned to hospital did not receive any rehabilitation (51.5%). Of the 451 clients that were a part of the cohort that received rehabilitation, 117 (25.9%) experienced a hospital encounter compared to 21.5% from the 578 clients that did not receive rehabilitation. There was no significant difference in hospital encounters between the groups.

There were, however, significant differences in the discharge outcomes and lengths of stay between the two groups (chi-square, p<0.001). During the observation period 943 (91.6%) of the 1029 total sample were discharged from home care. Eighty six clients (8.4%) remained on home care when the study concluded, March 31, 2010. Of

the 943 clients discharged during the study, 402 (42.6%) had received rehabilitation therapy and 541 (57.4%) had not. The majority of home care discharge statuses in both groups indicated clients had met their goals—completed their care plans (69.2% and 81.7%). Discharge dispositions defined under "Other" showed rehabilitation clients compared to clients without to have higher occurrences specific to: deceased (9.0 versus 6.3) or transfer (other care institution) (7.2 versus 3.5).

Clients' length of stay patterns were examined in two different ways as shown in Table 4.11. The first analysis considered the overall number of days a client was on home care calculated from admission date to discharge date. The second measured the clients' duration of stay on home care defined as either a short stay compared to a longer stay, or ≤60 days versus ≥61 days. The overall average length of stay (days) for rehabilitation clients was significantly longer (98 versus 86). A significantly larger proportion of rehabilitation clients stayed beyond 61 days (64.5% versus 45.0%). Both measures used to describe clients' length of stay were statistically significant ($p<0.001$).

Table 4.11

Effect of Rehabilitation Status on Outcomes

Discharge Outcome Variables		**Rehab n (column%)**	**No Rehab n (column%)**	**Significance (2 Tailed) p-value**
Hospital Encounter During Home Care [a]	Yes	117 (25.9)	124 (21.5)	0.10
Home Care Discharge Outcome [a]	- Goals Achieved - Deceased, Transferred - No Discharge	312 (69.2) 90 (20.0) 49 (10.9)	472 (81.7) 69 (11.9) 37 (6.4)	p<0.001
Comparison of Length of Stay by Short vs Long [a]	-Short Stay ≤60 days -Longer Stay ≥61 days	160 (35.5) 291 (64.5)	318 (55.0) 260 (45.0)	p<0.001
Length of Home Care Stay [b]	Mean (Days) ±SD	98.3 83.5	85.8 101.6	0.04

[a] Chi-Square test for a contingency table, significance p<0.05
[b] t-test of significance, p<0.05

4.3.2 Multiple Logistic Regression Modeling

Logistic regression was used to assess the odds of receiving rehabilitation based on client demographics and service characteristics. The logistic regression analysis estimated the odds ratios for each of the client characteristics the model fit, as well as the significance and variation explained by the model.

Two separate logistic regressions were computed. The first analysis considered the client characteristics of sex and age and admission-discharge process variables, specifically the hospital department a client was discharged from and comparison categories for length of stay. The total sample was considered in the regression (N=1029). The most significant predictor for receiving rehabilitation was coming from an inpatient unit. Clients coming onto home care from a hospital inpatient unit had 5.3 times the odds of receiving home-based therapy compared to those clients who were referred from an outpatient department. Clients who were on home care longer than 61 days were 2.5 times more likely to receive rehabilitation than shorter stay clients ($\leq$ 60 days) and females also had greater odds of 1.8 times for receiving rehabilitation compared to males. The model also indicated that for every one year of increase in age (e.g., 65 to 66 years of age), the probability of receiving home-based rehabilitation increased ($p<0.001$). The final model predicted 26.1% of the variance when considering these independent variables together. Table 4.12 shows the variables included in the multiple logistic regression modeling.

Table 4.12

Multiple Logistic Regression Modeling Client Characteristics on Rehabilitation Status

Client and Process Characteristic Variables[a]	B	Odds Ratio (OR)	95% C.I. for OR		Significance (2 Tailed) p-value*
			Lower	Upper	
Referring Hospital Dept$_{(Inpatient)}$	1.7	5.3	3.9	7.1	<0.001
Comparison of Length of Stay by Short vs Long $_{(longer\ stay)}$	0.9	2.5	1.9	3.3	<0.001
Sex$_{(female)}$	0.6	1.8	1.4	2.3	<0.001
Age	0.1	1.1	1.0	1.1	<0.001

[a]Sample size N=1029
***Significance p<0.05**

Next, variables that described different support and nursing services were added to the logistic regression. Specific variables included homemaking service and nursing units of care (hours) and client's admission intake clinical assessment (acute/non-acute). The total sample size (N=1029) contributed to the model.

The final model is shown in Table 4.13. The variables included were the referring hospital department, assessed clinical and service needs (acute/non), amount of home making care, sex and age. In this model, the odds of receiving rehabilitation slightly increased from the previous model for clients admitted from an inpatient unit, from OR=5.3 to OR=6.5. Clients assessed as having non-acute clinical and service needs had greater odds of 5.6 for receiving rehabilitation than those assessed as acute. Clients remaining on home care > 60 days (longer stay) clients were also more likely to receive rehabilitation (OR=1.4). This odds ratio had decreased slightly from the first model

(OR=2.5) when the other variables were added to the model. The amount of nursing care was not significant and excluded from the model. Home making hours (see shaded row in Table 4.13), although significant, indicates an even odds (OR=1.0) when considered with the other variables. This variable was retained in the model after removing it to determine if it affected the other covariates' odds ratios. There was no effect on the covariates or the overall variance explained by the model. The prediction of variance between the independent variables included in the model and the dependent variable, receiving therapy or not, was 41.1%.

Table 4.13

Final Multiple Logistic Regression Model of Client Characteristics Associated with Rehabilitation Status

Client and Process Characteristic Variables[a]	**B**	**Odds Ratio (OR)**	**95% C.I. for OR**		**Significance (2 Tailed) p-value***
			Lower	**Upper**	
Referring Hospital Dept$_{(Inpatient)}$	1.9	6.5	4.7	9.2	<0.001
Admission Intake Clinical Status $_{(non\text{-}acute)}$	1.7	5.6	4.1	7.8	<0.001
Sex$_{(female)}$	0.4	1.5	1.1	2.1	0.01
Comparison of Length of Stay by Short vs Long $_{(longer\ stay)}$	0.3	1.4	1.0	1.9	0.05
Age	0.6	1.1	1.0	1.1	<0.001
Home Making Time$_{(hours)}$	0.01	1.006	1.003	1.010	<0.001

[a]Sample size N=1029
***Significance p<0.05**

4.4 Home-Based Rehabilitation Associated with Hospital Utilization

Objective 2: To discern which home care client characteristics and processes are associated with returning to the hospital.

There were 241 (23.4%) clients from the total cohort who experienced a hospital encounter at some point in time after their home care admission. A hospital encounter was defined as either a visit to the emergency department or an inpatient admission. Of the total 241 clients who went to hospital, 117 (48.5%) received home-based rehabilitation and 124 (51.5%) did not ($p = 0.10$). Table 4.14 provides the distribution of hospital encounters by rehab status. There was no overall statistical significance at $p<0.05$ found in the distribution between rehabilitation therapies (yes/no) and Rehospitalization (yes/no).

Table 4.14

Distribution of Hospital Encounters during Home Care by Rehabilitation Status

Rehab Status	**Hospital Encounter n (total %)**	**No Hospital Encounter n (total %)**	**Total n (column%)**	**Significance (2 Tailed) p-value***
Yes Rehab	117 (11.4)	334 (32.5)	**451 (43.8)**	0.10
No Rehab	124 (12.1)	454 (44.1)	**578 (56.2)**	
Total (row%)	**241 (23.4)**	**788 (76.6)**	**1029 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

4.4.1 Rehospitalization Described

Of the 241 clients who returned to hospital, 128 (53.1%) went to an emergency department and then were discharged home, 79 (32.8%) were admitted to hospital from the emergency department and 34 (14.1%) were direct admissions. Comparing across the four categories describing clients' rehabilitation status, the majority who returned to hospital had not received rehab (51.5%) compared to 22.0% who received physiotherapy, 17.8% occupational therapy and 8.7% both therapies. The chi-square test of significance of clients returning to hospital by rehabilitation status was not significant ($p=0.10$).

A significant statistical difference from the chi-square testing ($p<0.001$) was found when comparing the primary diagnoses for these 241 clients to the specific hospital department attended. The individual ICD-10 index codes and sub-codes were collated using similar groupings used to describe home care clients' initial hospital encounter (preceding home care admission) and these included: 1. joint replacement, repair, injury; 2. fractures; 3. stroke; 4. mechanical complication and infection (i.e., of prosthesis or device); 5. heart surgery and symptoms; 6. surgical procedure (i.e., neoplasm excise, biopsy, general invasive procedure); 7. symptoms and signs (i.e., general); and 8. follow-up treatment. A ninth (9) category, "acute symptoms, conditions and episodes", was added based on an examination of frequencies for the primary diagnosis. The ninth category was identified from emergency department visits for conditions such as acute renal failure, intestinal obstruction, post-surgical complication(s) and shingles.

Clients that returned to emergency departments presented with general symptoms and signs (40.6%) such as: pain, fever, dehydration, dizziness and giddiness, dyspnoea, pneumonia, nausea, constipation, poisoning by opioids, delirium and depression. Other clients who attended emergency but then admitted had diagnoses and conditions primarily related to acute renal failure, intestinal obstruction, post-surgical complications and COPD; as well as general symptoms and signs and heart (e.g., angina, ventricular failure, congestive heart failure). Direct hospital admissions were associated with surgical procedures (i.e., neoplasms). Table 4.15 details the distribution of primary diagnoses.

Table 4.15

Primary Diagnosis Determined During the Rehospitalization

Primary Diagnosis Category	Emergency Department n (column%)	ED to Inpatient n (column%)	Inpatient n (column%)	Total (column%)	Significance (2 Tailed) p-value*
Symptoms, Signs	52 (40.6)	21 (26.6)	2 (5.9)	**75 (31.1)**	$p < 0.001$
Acute Symptom, Condition, Episodes	13 (10.2)	34 (43.0)	0 (0.0)	**47 (19.5)**	
Joint Repair Replacement, Injury	21 (16.4)	2 (2.5)	2 (5.9)	**25 (10.4)**	
Heart Symptoms, Surgery	6 (4.7)	10 (12.7)	4 (11.8)	**20 (8.3)**	
Surgical or Treatment	0 (0.0)	0 (0.0)	20 (58.8)	**20 (8.3)**	
Stroke	10 (7.8)	5 (6.3)	2 (5.9)	**17 (7.1)**	
Mechanical Complication, Infection	10 (7.8)	5 (6.3)	1 (2.9)	**16 (6.6)**	
Follow-Up Treatment	9 (7.0)	1 (1.3)	2 (5.9)	**12 (5.0)**	
Fractures	7 (5.5)	1 (1.3)	1 (2.9)	**9 (3.7)**	
Total (row%)	**128 (53.1)**	**79 (32.8)**	**34 (14.1)**	**241 (100.0)**	

***Chi-Square test for a contingency table, significance p<0.05**

4.4.2 Rehabilitation Status and Client Characteristics

This analysis sought to discover whether receiving home-based rehabilitation had an impact on the likelihood of a client experiencing a hospital encounter after their admission to home care. Bivariate statistical tests of significance (differences) were performed using chi-square for categorical variables and t-tests and ANOVAs for continuous variables. These tests were conducted as part of informing the multiple logistic regression analysis.

Table 4.16 and 4.17 show the significant differences from the chi-square tests ($p<0.05$) found between a number of client characteristics and the reoccurrence of a hospital encounter. The clients who returned to hospital were slightly older with an average age of 77 ($p=0.006$). This age group ≥ 75 represented 57.7% of the clients that went to hospital. Clients that went back to hospital had originally been primarily admitted onto home care from an inpatient unit (52.7%) and who were assessed for clinical status and service needs as non-acute (54.8%). Of the two rehabilitation therapies, only occupational therapy was significantly associated with returning to the hospital ($p<0.001$).

Results from t-test analysis indicated significant differences ($p<0.05$) between rehospitalizing (yes/no) and clients' age, length of stay on home care, total number of services received and units of service provided by home making and nursing. Specifically, clients who went to the hospital after their home care admission

experienced, on average, more home making and nursing services than those who did not re-attend (Table 4.17).

Table 4.16

Client Characteristics Associated with Rehospitalization

Client Characteristics	**Categories**	**Hospital Encounter (N=241) n (column%)**	**No Hospital Encounter (N=788) n (column%)**	**Significance (2 Tailed) p-value***
Referring Hospital Dept	Inpatient Outpatient	127 (52.7) 114 (47.3)	498 (63.2) 290 (36.8)	0.004
Admission Intake Clinical Status	Acute Non-Acute	109 (45.2) 132 (54.8)	421 (53.4) 367 (46.6)	0.03
OT Received	Yes	43 (17.8)	72 (9.1)	p<0.001
Home Making Service	Yes	72 (29.9)	119 (15.1)	p<0.001
Comparison of Length of Stay by Short vs Long	≤60Days ≥61 Days	69 (28.6) 172 (71.4)	409 (51.9) 379 (48.1)	p<0.001
Sex	Male Female	131 (54.4) 110 (45.6)	413 (52.4) 375 (45.6)	0.61
PT Only	Yes	53 (22.0)	216 (27.4)	0.10
Nursing	Yes	193 (80.1)	48 (19.9)	0.33

***Chi-Square test for a contingency table, significance p<0.05**

Table 4.17

Age and Service Variables Associated with Rehospitalization

Service & Units		**Hospital Encounter**	**No Hospital Encounter**	**Significance (2 Tailed) p-value***
	N=1029	**n=241**	**n=788**	
Age (years)	Mean ±SD	76.6 7.0	75.2 6.6	0.01
Home Making Service (hours)	Mean ±SD	37.2 112.2	21.4 99.8	0.04
Nursing Service (hours)	Mean ±SD	32.1 56.3	15.9 42.8	p<0.001
Length of Stay	Mean ±SD	134.2 111.9	78.1 84.4	p<0.001
OT Visits-Number	Mean ±SD	3.3 2.6	3.1 2.6	0.58
PT Visits-Number	Mean ±SD	5.6 4.5	5.6 2.8	0.92

***t-test for the significance of the difference, p<0.05**

Clients that received rehabilitation and returned to hospital experienced over 3 weeks before the referral for rehabilitation was issued (based on a 5 day working week); and one month from admission until the first visit was made by a therapist. These waiting periods were significantly different between clients that returned to hospital and that did not ($p<0.001$). Wait times from admission and referral are detailed in Table 4.18.

Table 4.18

Wait Times for Home-Based Rehabilitation by Rehospitalization

Time Intervals (Days)		Hospital Encounter	No Hospital Encounter	Significance (2 Tailed) p-value*
	N=446	**n=116**	**n=330**	
Home Care Admit Date-Rehab Referral	Mean ±SD Min Max	17.7 39.4 1 258	3.7 18.1 1 181	p<0.001
Home Care Admit Date to Rehab First Visit	Mean ±SD Min Max	28.0 39.9 1 259	13.2 19.8 1 189	p<0.001
Rehab Referral to Rehab First Visit	Mean ±SD Min Max	10.3 9.6 1 47	9.6 7.5 1 57	0.43

***t-test for the significance of the difference, p<0.05**

4.5 Time-to-Event Analysis

Objective 3: To establish if returning to the hospital, once on home care, occurs at the same length of time for clients who received rehabilitation and those that did not.

Survival analysis was used to explore whether those who received therapy had a longer period of time lapse before a hospital event occurred. The survival analysis involved modeling time to the occurrence of a specifically defined event. The event of interest in this study was an index hospital encounter, emergency department or admission. The results presented in this section are based on examining the differences in the actual curves produced by the Kaplan-Meier survival function analysis.

The sample (N=1029) was followed until a hospital encounter occurred (emergency department or inpatient admission) or until the study ended (March 31, 2010), whichever happened first. However, within this time period there would be incomplete information about some clients as to time and occurrence of event. Specifically, there were clients that would either/or: 1. be admitted to home care at varying admission dates; 2. never experience a hospital encounter; 3. remain on home care past March 31; 4. not be observed for the complete study time frame. To control for these variances within the cohort and in order to consider the entire cohort sample, survival analysis applies a mechanism that is referred to as censoring, or censoring the data. In this study, random censoring is applied as it considers the time period of observation to be fixed and entrance into the study time period occurs at different time points (April 1, 2009-March31, 2010), some of the cohort will experience the event

where others will not and some will leave the study where others may remain active beyond the study end point (Lam, n.d.; Singer & Willett, 200).

4.5.1 Describing the Event

Objectives of the survival analysis were to:

1. assess the time to a hospital encounter for a group of individuals who are admitted to home care;
2. compare time-to-event between clients who received home-based rehabilitation versus those who do not; and
3. estimate the effect of rehabilitation on time-to-event.

The time-to-event (or survival time) was measured from the date of a client's home care admission. Therefore, clients entered the study on different dates—that is, at different calendar admission dates within the observation period April 1, 2009-March 31, 2010. The time-to-event analysis considered clients that were:

- admitted and experienced a hospital encounter;
- admitted and discharged from the program, without experiencing a hospital encounter; and
- admitted and remained on the home care program after March 31, 2010 and to that date had not experienced a hospital encounter.

There were 241 (23.4%) clients who experienced a hospital encounter (ED or admission) out of the total sample of 1029. Of these rehospitalizations, 128 (53.1%) were visits to the Emergency Department and 113 (46.9%) were hospital admissions. In table 4.14, the differences in average number of days before an emergency visit or hospital admission occurred for each of the rehabilitation and non-rehab groups is shown in Table 4.19. The t-test for the significance of difference between groups was significant ($p<0.001$). Those who received rehab experienced on average a longer period of time to an emergency visit (42.4 days versus 38.6) as well as to a hospital admission (77.6 versus 51.1).

Table 4.19

Average Number of Days to Hospital Encounter by Rehabilitation

Hospital Encounter Type		**Yes Rehab**	**No Rehab**	**Significance (2 Tailed) p-value***
Emergency Department (n=128)	Mean ±SD Min. Max. n	40.5 47.9 1 218 61	39.6 52.1 1 228 67	p<0.001
Admission (n=113)	Mean ±SD Min. Max. n	57.0 77.0 1 324 56	44.2 43.3 2 143 57	

***t-test for the significance of the difference, p<0.05**

4.5.2 Survival Analysis for Rehabilitation Defined Yes/No

The Kaplan-Meier survival function was used to compare time-to-event (hospital encounter) for clients who received home-based rehabilitation and those who did not. The survival function estimates the probability of an event occurring beyond a specified time. The results comparing tests of equality of time-to-event showed no statistically significant difference when the comparison considers rehabilitation status as a dichotomous variable, yes/no (Log Rank p=0.65 / Wilcoxon p=0.49). It indicates that the probability of experiencing a hospital encounter (event) at any time during the observation period is not significantly different when clients were grouped as receiving rehab and those who did not. The survival curves for time to hospital encounter comparing clients receiving/not home-based rehabilitation is shown in Figure 4.1.

Referring to Figure 4.1, it is clear from this comparison that the survival curves cross and thereby indicating potential non-proportional hazards. Specifically the crossing survival curves suggest that the survival probability of one group is better than the other group only at a shorter time span and that the relation is reversed for a longer time span. This finding precludes any further analysis, namely Cox Regression modeling, which would consider multiple covariates at the same time and the effect of these on time-to-event.

Despite this, the survival curves (see Figure 4.1) provide the initial descriptive and visual representation of the time-to-event (hospital encounter: ED or admission) from which to consider other survival analysis functions. For example, the majority of events

(30%) occurred within the first 3 months of admission to home care. As shown in Figure 4.1, the survival curves run parallel and somewhat overlap during these initial 3 months and are similar for those who did versus did not receive therapy. The time-to-hospital encounter appears to change its pattern for the two client groups within 3 to 8 months (or ≥90 days and ≤240 days) before crossing. Within this time frame (91-230 days), the clients who did not receive rehab experienced more hospital encounters within a shorter period of time (steeper curve). However, the clients who received rehab experience a longer span of time before a hospital encounter occurs but continue to experience encounters up to ~330th day.

Clients in the study who were included in the survival analysis and observed for the same period of time but did not experience an event are noted in the key and figure as No Rehabilitation Censored, Yes Rehabilitation Censored.

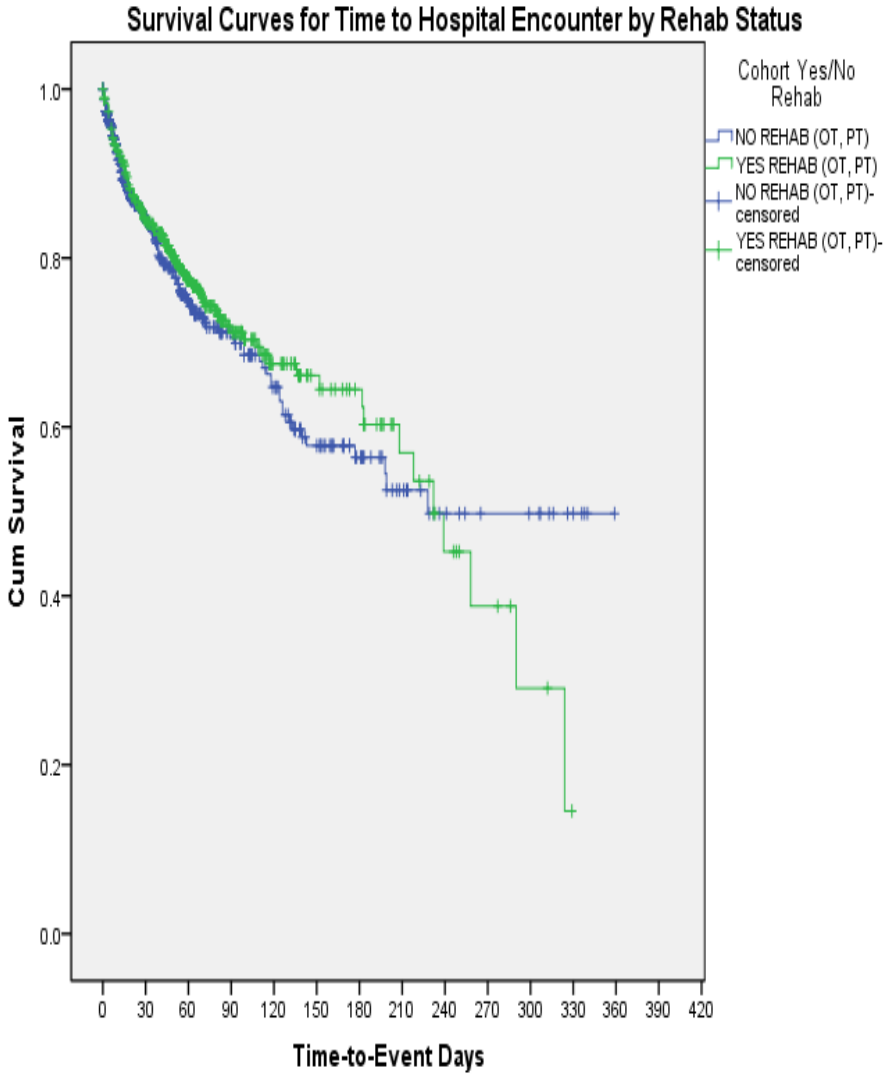

Figure 4.1. **Survival curves for time to hospital encounter comparing home clients receiving rehabilitation to those who did not**

Based on this initial description, there was cause to attempt to increase the visual clarity in the survival curves, specifically for the segment of time after 90 days (middle-late). Therefore, the data were analyzed using the Kaplan-Meier cumulative hazard function. The distribution for these curves can be viewed using survival functions or cumulative hazard functions depending on which produce visually clearer curves. Similar to results from the survival curve function, the cumulative hazards demonstrate potential crossed hazard functions as well. The Figure produced from this analysis is included in Appendix C. The differences between the curves were tested also using the Wilcoxon and Tarone-Ware tests. These tests and approach give more weight to earlier differences. The results from the tests were again not significant, p-value <0.05 (Wilcoxon=0.49 and Tarone-Ware=0.47).

The Kaplan-Meier survival analysis also considered and adjusted for clients' characteristics known to act as confounding variables—that is, having a +/- relationship to both the independent variable (rehabilitation therapy/no rehabilitation therapy) and outcome (rehospitalization). These included adjusting for age and sex. Despite stratifying for age and sex individually or when considered as a composite variable (age + sex), the survival curves showed no significant differences ($p<0.05$) in the time-to-rehospitalization and the curves continued to cross. This suggests that the existence of any confounding effect from age or sex is unlikely. The cumulative hazard function curves produced from stratifying for example by age (young old 65 -74 years, middle-elderly 75-84 years, and old elderly ≥85 years) are shown in Appendix D.

4.5.3 Survival Analysis for Specific Rehabilitation Therapies

Next, the Kaplan-Meier survival analysis function was used to examine the distribution of time-to-event (return to hospital) comparing clients' rehabilitation status in three distinct ways. First, the survival analysis considered rehabilitation by four categories that distinguish the cohort and that is, no rehab, occupational therapy, physiotherapy or both occupational and physical therapies. Operationalizing rehabilitation in this manner would compare and produce four survival curves. The second and third survival analyses examined occupational therapy and physiotherapy as separate dichotomous variables—occupational therapy (yes/no) and physiotherapy (yes/no). The survival analysis for each of these individual variables would produce two curves that could be compared.

The rationale for examining the Kaplan-Meier survival analysis function using these definitions was again to determine if increased visual clarity could be observed between the curves. Selecting rehabilitation as four categories and for occupational therapy as dichotomous was based on chi-square square tests of significance observed in Objective 2 (Table 4.16). Both of these variables were significant ($p<0.001$). Although the chi-square for physiotherapy was not significant ($p=0.31$), it was included in this analysis based on conceptual rationale and the aim of the study objectives.

4.5.3.1 Rehabilitation Defined by Four Categories

In the first survival analysis, the cohorts' rehabilitation status was considered as the four categories. The results comparing tests of equality of time-to-event produced statistically significant differences when comparing the four curves. (Log Rank p=0.02 / Wilcoxon p=0.002). Figure 4.2 illustrates the four survival curves from this analysis.

The slopes of the curves from this analysis appear to be similar to the two curves produced when rehabilitation was considered as a dichotomous and collapsed variable (yes/no). However, there is more clarity in distinguishing the time-to-rehospitalize for each individual rehabilitation group. Referring to Figure 4.2, it again shows the majority of events occur within the first 3 months after admission to home care. The four survival curves run parallel and farther apart for almost 6 months but then cross in-or-around 7 months (210 days).

Figure 4.2 however does clearly show that clients who were receiving only occupational therapy (green line) experienced the shortest survival time—steepest curve caused by most events occurring within the first 3-4 months from admission. In contrast, clients that received only physiotherapy (yellow line) experienced the longest survival time—gradual sloping curve up to 5-6 months and then a sharper decline.

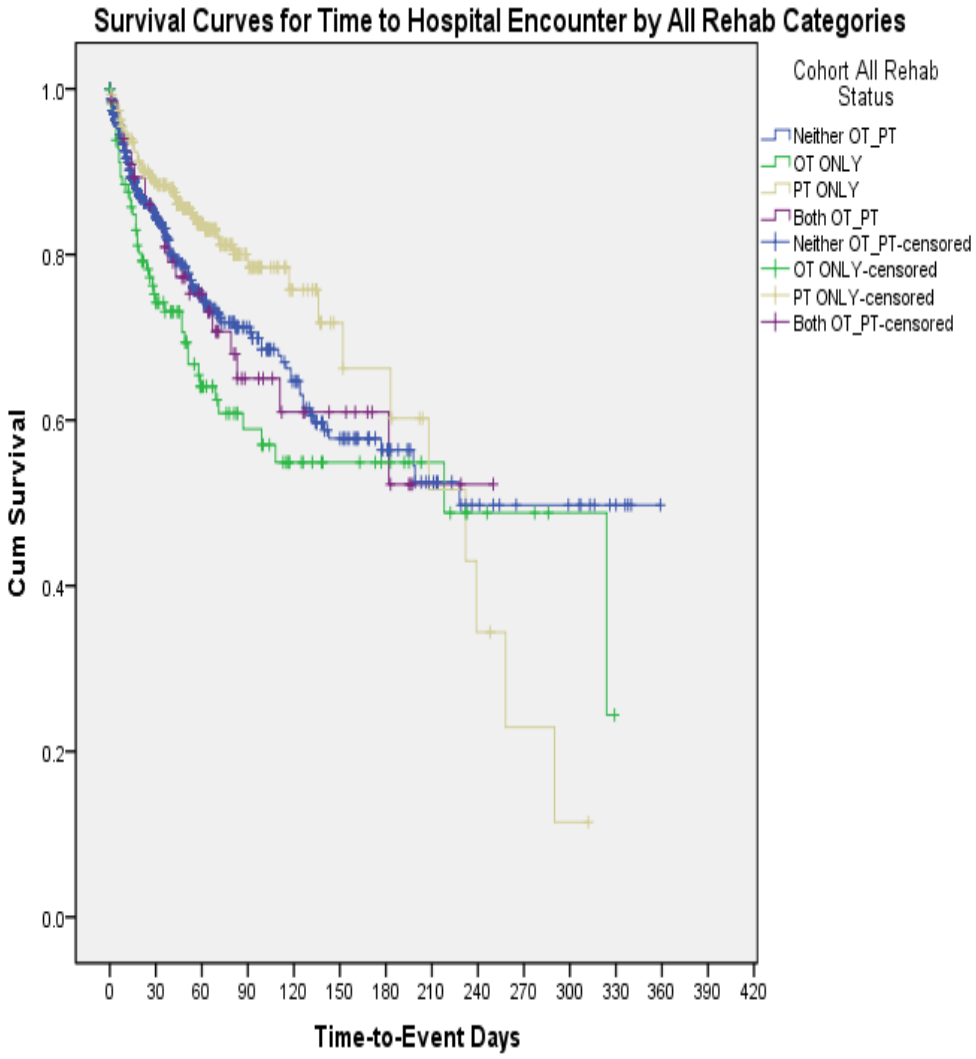

Figure 4.2. **Kaplan-Meier survival curves for time to hospital encounter comparing home care clients described by four categories of home-based rehabilitation**

The four Kaplan-Meier survival curves described in Figure 4.2 were then analyzed adjusting for clients' primary diagnosis that was identified at the time of the hospital discharge preceding the home care admission. Adjusting for the primary diagnosis was done to determine if the frequency and time of events differed when controlling for diagnosis (medical conditions) between the four groups that defined rehabilitation status. Primary diagnoses were collapsed into two categories in order to stratify the survival analysis. The diagnoses were collapsed into: 1. orthopaedic (joint repair or replacement, fractures and mechanical complication or related infection); and 2. medical (surgical, heart, stroke, symptoms and signs). Visually the curves showed that clients receiving occupational therapy and admitted to home care with a medical condition had the shortest survival time (i.e., curve sloping sharply within the first three months). In contrast, clients with a medical diagnosis and receiving no rehabilitation or physical therapy had the longest survival times. Clients diagnosed with orthopaedic conditions and receiving occupational therapy, either therapies or no therapy rehospitalized earlier (i.e., within two months from admission) than similarly diagnosed clients who had physiotherapy.

The survival analysis function found no overall (pooled) significant differences when testing for significance $p<0.05$ between the four curves and stratified by orthopaedic and medical (Log Rank p=0.21 / Wilcoxon p=0.08). There was also no significant differences ($p<0.05$) when comparing the four curves within each individual strata. Tests of significance for orthopaedic I indicated Log Rank p=0.91 / Wilcoxon p=0.66; and for medical conditions Log Rank p=0.17 / Wilcoxon p=0.11.

4.5.3.2 Occupational Therapy and Physiotherapy

Kaplan-Meier survival function was also used to analyze occupational therapy (yes/no), and physiotherapy (yes/no), (see Figure 4.3). First, for the survival analysis examining occupational therapy, the two curves did indicate an overall significant difference measured by the Log Rank (p=0.02) and the Wilcoxon (p=0.01). The curve for those who received occupational therapy shows a much steeper slope again within the first three months, with then longer period of survival time to the few subsequent events. In contrast, those who did not have occupational therapy experience more of the events after six months and within shorter time periods.

The Kaplan-Meier survival analysis for physiotherapy also indicated significant difference in the two curves (Log Rank p=0.03 / Wilcoxon p=0.01). Referring to Figure 4.3, the occurrence of events is more prominent for those without physiotherapy up to ~8^{th} month and then plateaus. However, clients with physiotherapy experience majority of events between 3-10 months before ceasing—that is a more rapid descent caused by a

number of events occurring within shorter time spans. These curves are also shown in Figure 4.3.

The survival curves produced from examining occupational therapy and physiotherapy separately did clearly show greater distinction (separation) between the curves and that the curves do run parallel over a longer period of time compared to when rehabilitation was dichotomous (yes/no) or defined as four categories. Yet, the curves for occupational therapy and physiotherapy do eventually cross at multiple points. For this reason, further analysis using Cox modeling to consider other covariates was not applied.

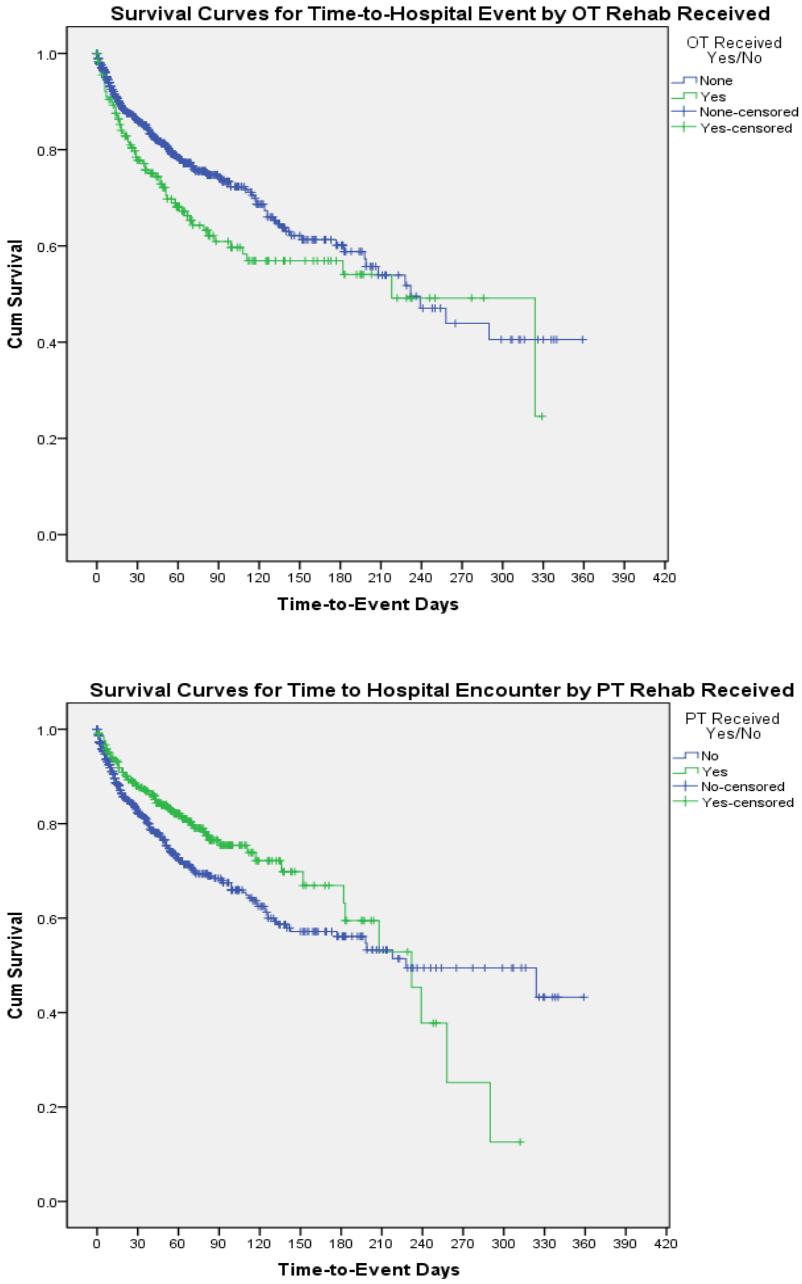

Figure 4.3. **Kaplan-Meier survival curves for time to hospital encounter comparing occupational and physical therapies separately**

Chapter 5

Discussion and Conclusion

5.1 Summary of Findings

The aim of this study was to understand the difference between those home care clients who received rehabilitation therapies and those who did not. The study focused on home-based occupational therapy and physiotherapy. The retrospective cohort study design and use of administrative data allowed for an examination: first, of the characteristics that differentiated community dwelling clients who received Ontario publically funded home-based occupational and physical therapies from those that did not; and second, of the effects of rehabilitation on the likelihood of returning to hospital once on home care. The analyses were applied in a systematic fashion in order to: 1. describe the recipients of occupational therapy and physiotherapy home-based rehabilitation using a subset of clients ≥ 65 years of age admitted to an Ontario home care program from a hospital department; 2. describe the home care clients' characteristics and process variables that differentiate those that returned to the hospital from those that did not; and 3. determine, when a hospital encounter did occur, was there a difference in the time-to-event between those who received rehabilitation and those that did not receive rehabilitation.

Three main results can be derived from this study:

1. The clients that received home-based rehabilitation were more likely to be older, female and referred from inpatient units. These clients were also more likely to receive home making support but less likely to receive nursing care than clients who had no rehabilitation therapies. Recipients experienced longer lengths of stay on home care than non-recipients. When predictor variables were considered together to see the effect on the likelihood of receiving rehabilitation, the odds were greatest for clients who were: referred to home care from an inpatient unit; assessed as non-acute for clinical and service needs; female; and longer stay clients (>60 days). Odds also increased for incremental changes to age.

2. Clients that returned to hospital represented close to one quarter (23.4%) of the entire cohort. Over half of the rehospitalizations had not received any home-based therapy. The majority of the encounters were to emergency departments for (sub-acute) general symptoms and signs. Those admitted were diagnosed in emergency with either acute medical conditions or symptoms that required further investigations and/or procedures, while other admissions were for surgeries (e.g., cancer, cardiac). Clients that had a hospital encounter were significantly more exposed to occupational therapy.

3. There was a significant difference in the time-to-rehospitalization (event) between recipients of occupational therapy, physiotherapy and both therapies and no rehabilitation. The majority of hospital encounters for all four categories occurred within the first six months after a home care admission. Clients receiving occupational therapy, both occupational therapy and physiotherapy and no therapy returned to hospital within the first three months. Clients that received only physiotherapy had the longest survival time. Those receiving only occupational therapy had the shortest survival time to rehospitalization after admission.

The remainder of this chapter will explain these main findings in more detail and as these relate to the literature reviewed for this study. The chapter will conclude with discussing the implications of the findings to home-based rehabilitation therapies focused on in this study, as well as to policy. The limitations of the study and opportunities for future research will also be identified.

5.2 Home-Based Rehabilitation

In the recent evolution and reform of Ontario's publically funded home care program, occupational therapy and physiotherapy have been characterized as "bundled under the heading therapy" (Landry, Cott, Deber, Cameron and Zack, 2009, p.21). Within this "bundle" are speech language pathology, social work and nutrition (Landry, et al., 2009, p.21). However, this conceptualization has meant that there are few reports or studies that detail and delineate the characteristics (e.g., service provider, clients) of those who receive home-based occupational therapy and physiotherapy or on the relationship (clinical and/or process) these therapies may have to outcomes such as hospital utilization (Drahota et al., 2009; Elkan et al., 2000).

The aim of this study was to investigate the effect specifically of home care's occupational and physical therapies on hospital discharges of elderly people, each with distinct acute and sub-acute diagnosis. This study was designed to purposefully remove occupational therapy and physiotherapy from the *home care therapy bundle* and systematically examine and describe the differences between those who receive these therapies and those who do not. Moreover, the study's analytic strategy examined if these specific therapies provided a temporal effect on clients return to hospital—that is, clients receiving one or both therapies would experience a longer survival time before rehospitalization compared to those with no rehabilitation.

5.2.1 Study Cohort and Context

Using administrative health service data, this study identified a subset of home care clients within South East Ontario. The design and concentration within this region was substantiated by an Ontario Health Quality Report measuring multiple home care indicators, of which specific ones pertained to accessing occupational therapy and physiotherapy. The South East region reported the highest provincial average (84.9%) for clients identified as benefiting from rehabilitation but not receiving any occupational and physical therapies or exercise therapy (Ontario Health Quality Council, 2009)—the overall provincial average was 77.6%.

The study cohort represented 56.0% of all new home care admissions, ≥ 65 years of age, from patients discharged from the Kingston General and Hotel Dieu Hospitals during 2009-2010; and 24.3% from all hospitals across the South East region, also for the same age and time period (South East CCAC Decision Support, 2013). Females made up less than 50% of the cohort, although provincial and national data report more females are likely to receive home care (CIHI, 2011).

Of the total occupational therapy and physiotherapy visits provided by the South East CCAC during 2009-2010, the study cohort included 5.4% and 11.6%, respectively. The proportion of occupational therapy visits appear to be similar to provincial and national estimates (2.0%-8.0%), but the visits by physiotherapy in the study were much higher (Health Council of Canada, 2012). When therapy visits from this study were then compared to all of the home-based therapies provided through home care (i.e., speech

language, social work, dietician), occupational therapy reflected 47.5% and physiotherapy 72% of 22,466 total visits made across the region.

The results from grouping the hospital diagnoses prior to home care, although only available for 65% of the sample (subset), fall within the top 10 acute hospital conditions identified nationally. These include primarily joint replacement, heart failure, stroke, cancer and general symptom and signs (CIHI, 2011; Health Council of Canada, 2012). The diagnoses available for a proportion of the study sample describe a composite of clients in which some had very acute incidents associated with disease or deteriorating chronic condition(s) (e.g., heart), whereas others had more sub-acute atypical decline and episodes from an existing condition or new disease (i.e., Parkinson's Disease versus cancer) (Hebert, 1997; Kamaruzzaman, 2010).

The results from this study's subset indicated longer inpatient stays (10 days) compared to the provincial average (7 days) (MOHLTC, 2010). Long hospital stays experienced prior to an admission to home care (for emergency and inpatient) were, on average, two times longer for clients that eventually received occupational therapy compared to physiotherapy and those with no therapy. This finding suggests that the elderly people that received home-based occupational rehabilitation had more complex and involved problems and conditions that contributed to a longer hospital stay, and that these clients required continued follow-up for issues more likely addressed by the expertise of an occupational therapist (e.g., activities of daily living, safety, functional decline).

Other studies and reports that describe Ontario's home care clients and the impact of home-based rehabilitation have also used a subset of home care data but these studies have only included longer-stay home care clients (Armstrong et al., 2013; Cook et al., 2013; Health Council of Canada, 2012). When looking at the impact of Ontario's home-based occupational and physical therapies, the studies examined only those clients that received either one or both therapies, compared to exposed not exposed (Armstrong et al., 2013; Cook et al., 2013). System and meta analysis conducted on the effectiveness of home-based rehabilitation have also targeted a specific diagnostic group (e.g., fractures, stroke, musculoskeletal), and, in many cases, compared it to conventional hospital rehabilitation programs (Langhome et al., 2005; Stolee et al., 2011; Ziden et al., 2008). In addition, these analysis have often included all therapies or a combination of therapies (i.e., occupational, physical, social work, speech, therapy aides) (Crotty eta l., 2003; Petridou et al., 2009; Robertson et al., 2009). This study includes all consecutive hospital discharges of elderly patients admitted to a home care program over the course of one year and it includes varied clinical diagnosis and compares those who were exposed versus not exposed specifically to occupational and physical therapies.

5.2.2 Clients Receiving Home-based Rehabilitation

The results do suggest that there were differences in client characteristics distinguishing those who received rehabilitation compared to those who did not. By using both bivariate and multivariate analysis, the results identified key variables that explain the likelihood of receiving home-based rehabilitation. Those with the highest odds of receiving rehabilitation were admitted from an inpatient unit to home care, assessed as non-acute at the time of hospital discharge and female. The likelihood of receiving rehabilitation also increased for every 1 year increment of age. Similar indicators (i.e.., age, non-acute chronic conditions and hospitalizations) have also been identified in the literature to have concurrent and valid association with functional decline, disability and frailty (Fried, 2001; Gill et al., 2006).

The significance of these findings suggest two possibilities: that clients who receive rehabilitation are older females, experience sub-acute and complex issues and have a greater need for home making to assist with activities of daily living (e.g., bathing, dressing, meal preparation); and, second, that these clients require primarily the expertise of an occupational therapist to determine the complex interactions between the bio-psycho-environmental interactions, while some may require the addition of physiotherapy for mobility restoration (Armstrong et al., 2013; CHCA, 2011). The likelihood of these possibilities is further supported by the results from the bivariate analysis showing that rehabilitation recipients were provided with three times the amount of home making service than those who had no rehabilitation, and a minimal amount of nursing. In this

study, home making was more often provided to clients who received occupational therapy only or both occupational therapy and physiotherapy. This corresponds to the national and provincial data that reports 50%-69% of elderly home care clients are receiving assistance for activities of daily living compared to 15%-26% for nursing care (CIHI, 2007; Health Council of Canada, 2012; Ontario Home Care Association, 2010).

5.2.2.1 Home-based Rehabilitation Impacts Hospital Utilization

Almost one quarter of the cohort (23.4%) returned to the hospital. Over half of those who returned attended the emergency department with general symptoms and signs or post joint replacement mechanical complications and infections. These clients were later discharged home. Clients admitted to inpatient units from emergency presented with either sub-acute symptoms or acute episodes from an existing condition (i.e., COPD, acute renal failure), whereas other admissions (assumed to be direct admissions) were associated with a surgical procedure (i.e., neoplasms).

Of the clients returning to hospital, slightly over half (51.5%) had not received home-based rehabilitation. Of those who had rehabilitation and returned to hospital, a larger proportion received physiotherapy compared to occupational therapy. However, within rehabilitation comparison indicates that clients within occupational therapy had the highest rate of return (37.4%), then both occupational/physical (31.3%), no rehabilitation (21.5%) and lastly physiotherapy (19.7%).

The fact that more clients receiving occupational therapy returned to hospital may be attributed to multiple clinical and process reasons. It may be suggested that these are

clients with more complex etiology and conditions and who may be experiencing functional decline and loss of autonomy for daily activities (Bergman et al., 2004); and experience longer-stays (> 2 months) on home care. The longer-stay also suggests that these may be community dwelling elderly that are either pre-frail or extremely close to transitioning to being frail, as was suggested by Gill et al., (2006) measuring functional decline as a dynamic process and transitions over time in community dwelling elderly.

The clients referred to occupational therapy also experienced the longest wait time compared to physiotherapy clients in this study. The average waiting period from a home care admission to an occupational therapist's first visit was slightly over 4 weeks. Although these specific wait time results exceed that which was reported for Ontario's CCAC occupational therapy (Cott et al., 2006), these results in relation to the hospital discharge diagnosis for these specific clients do suggest that longer wait times are experienced by those with sub-acute and chronic conditions (Cott et al., 2006; CIHI, 2012). Many of these sub-acute and chronic conditions are known to increase with age and to influence increased functional and physical decline and hospital utilization—e.g., complex, multiple conditions such as cardiovascular and pulmonary or stroke or musculoskeletal or general signs and symptoms (Aminzadeh & Dalziel, 2002; Bronskill et al., 2011; Moons, Arnauts & Delooz, 2003).

5.3 Temporal Effect of Rehab on Hospital Event

The aim of this objective and application of survival analysis was to determine if, when there was a hospital event (return), did receiving rehabilitation impact the length of time that passed before it occurred—that is, did receiving rehabilitation mitigate (delay) the time-to-event? When rehabilitation was defined as a dichotomous variable (yes/no) there was no statistical significant difference between the survival curves—the probability of experiencing a hospital encounter at any time during the observation period was the same regardless of rehabilitation status.

However, when rehabilitation status was defined by four categories (none, occupational therapy, physiotherapy and both therapies) the survival curves did show a statistical difference resulting from the time at which events occurred for each individual category across the observation period—that is distinct patterns can be clearly observed when visually comparing the four curves (see Chapter 4, Figure 4.2). Overall, the majority of events occurred within the first six months after home care admissions. Returning to the hospital within this time period is similar to what has been reported in other national and international studies (Aminzadeh & Dalziel, 2002; McCusker et al., 2009). However, within the first three months, clients that had received occupational therapy returned to hospital at earlier time points (~45%) followed by those who received both therapies (~35%) and no rehabilitation (~30%). Only ~20% of clients with physiotherapy account for events in this same time period. More precisely, clients with occupational therapy experience the returns to hospital over the shortest span of time

after admission whereas those with physiotherapy appear to have more events but these occur over longer spans of time from admission and events also continue farther along the continuum.

These overall results from the survival analysis do not suggest that rehabilitation has mitigated the rate of time for returning to hospital when the four curves are compared. Although there is a delayed return of clients receiving physiotherapy at the onset, this may be due to in part to the intervention or to the types of clients more likely to be referred (i.e., joint replacement) or to the shorter wait times and more frequent visits or to a combination of some or all of these factors. This is in contrast to clients receiving occupational therapy who return to hospital at earlier time points after admission. The implications drawn from this finding reflect and build upon the previous description of clients who are more likely to receive occupational therapy and utilize hospital services—these are older females with involved conditions and require more complex care and support for activities of daily living. The time-to-event for the occupational therapy group may also be influenced by the extensive waiting period from admission to a therapist's first visit. In this study, the average wait time for occupational therapy was 21.9 days, which is, in effect, slightly over 4 weeks when calculated by a standard regular working week for home-based rehabilitation allied health professionals (i.e., Monday-Friday). This wait time is of significance when contrasted to the fact that the average time to readmission for those who received occupational therapy was 40 days (median 19 ,±SD

59.5, min=1 max=324).; and the average number of days to rehospitalization for females within this same group was 36 days (median18 ,±SD 64.7, min=1 max=324).

5.4 Implications for Occupational Therapy and Physiotherapy

There are implications suggested by the study results for both occupational therapy and physiotherapy. In large part, these inferences are attributed to the unique client characteristics and system factors that differentiate those who received home-based rehabilitation and those who did not. Again, these findings are highlighted by the fact that this study included all consecutive home care admissions of elderly clients discharged from hospital comparing exposure to rehabilitation regardless of diagnosis versus other studies that have included only long-stay home care clients and/or a specific diagnosis (Armstrong et al., 2013; Cook et al., 2013; Stolee et al., 2011).

For physiotherapy, the implications from the results varied across the objectives. When physiotherapy is considered as one of many covariates in the multivariate analysis, it is not significantly associated with explaining the returns to hospital. However, when physiotherapy is considered in the survival analysis, first as one of four categories to define home-based rehabilitation and second as a dichotomous variable (yes physiotherapy, no physiotherapy), the curves do show a significant difference in both instances. That is, the hospital returns (events) for the clients who received physiotherapy happened over a more gradual period of time over the first 0-4 months compared to occupational therapy, both therapies or no therapies. This suggests two possibilities: 1. physiotherapy does have a mitigating effect in delaying returns to hospital; and/or 2.

clients referred to physiotherapy were the younger elderly (65-74) who were discharged from hospital with post-acute conditions related to mobility (i.e., joint replacement) and may have been more physically and functionally stable prior to home care.

For occupational therapy, the implications from the results were more consistent, compared to physiotherapy. There is a significant association in the bivariate and multivariate analysis when receiving occupational therapy is examined to the outcome of returning to the hospital.

Occupational therapy is further observed to have a distinctive pattern shown in the survival analysis curves, whether occupational therapy is considered as one of the four categories defining rehabilitation status or as a dichotomous variable (yes/no). The time-to-event for this group occurs over the shortest span of time after admission and within the first three months—the slope is steep and the proportion for cumulative survival has the largest decrease compared to physiotherapy or both or none. It may be suggested that the steepness of this curve and shorter span of time-to-event may in fact be affected by the longer period of time clients waited to receive occupational therapy (i.e., slightly over 4 weeks or 1 month from admission). The combination of these consecutive findings suggest that the elderly that received home-based occupational rehabilitation were older, female, with more complex medical and chronic conditions requiring the intervention of occupational therapy (i.e., activities of daily living) and experienced longer home care stays beyond two months.

The suggestions for both therapies correspond with the literature cited earlier on functional decline and frailty and that this change is a dynamic process in community dwelling elderly (Gill et al., 2006; Hebert et al., 1997a). The clients receiving physiotherapy may reflect the pre-frail (pre-functional decline) that if identified early and targeted with specific interventions may in fact restore, maintain or reduce the progression of functional decline and decreased mobility. Whereas, those receiving occupational therapy are in the process of transitioning from pre-frail to frail or are already frail and are progressing in loss of functional independence and mobility (Ferucci et al., 2004; Fried 2001; Gill et al., 2006; Hebert et al., 1997a & 1997b).

Such targeted interventions for community dwelling elderly at risk are frequently associated with falls. For example, preventing falls in community residing elderly compared multifactorial intervention strategies (of which occupational and physical therapies were key entities) to exercise alone in two meta-analysis. Based on these comprehensive reviews and analyses of randomized clinical trials, both exercise and multifactorial strategies indicated significant association in decreasing falls, especially for those < 80 years of age. Most effective was a single intervention (versus multiple approaches provided to a patient) and those provided for a short duration (i.e., 6 weeks-9 months) (Petridou et al., 2009; Robertson et al., 2009). Community exercise programs have also been associated with limiting the effects of chronic illness which will inevitably avoid or delay illness and disability and the demand for acute or longer term care (Williams et al., 2009).

Two systematic reviews and meta-analysis have also shown the effectiveness of home-based rehabilitation on elderly living in the community. The more recent review (Stolee et al., 2011) compared home-based rehabilitation to inpatient rehabilitation units for older patients diagnosed with a musculoskeletal disorder. Based on 12 studies reviewed that measured functional, mental and quality of life outcomes, home-based rehabilitation clients showed equal or increased gains in all three when compared to the inpatients. The second analysis looked at home-based rehabilitation's effectiveness relative to functional status and admissions to hospital in 15 randomized clinical trials (Elkan et al., 2001). None of the studies reviewed found significant statistical effects (i.e., pooled odds ratios) for home-based rehabilitation on hospitalization or improvements in activities of daily living, whereas two studies did show improvement in independent activities of daily living.

The Cochrane Collaboration (2009) attempted a systematic review of the literature to compare the effects of home-based rehabilitation to hospital and long term (managed) care facilities. After assessing over 300 abstracts, the reviewers indicated there was insufficient evidence to compare the effects of home-based rehabilitation to the others. The complexity and intertwined individual services to providing rehabilitation to the elderly was attributed to these results. The recommendation was for more rigorous future studies and that there be an attempt to detail a component(s) of rehabilitation (e.g., patient characteristics, rehabilitation type, environment etc.) (Drahota, Gal, Severs & Dean, 2009). This finding by the Cochrane Collaboration is critical when considering

the previous systematic reviews cited above. The cited systematic and meta-analyses were not able to attribute the effectiveness, or lack of, from many of the studies analyzed, to a specific rehabilitation therapy discipline, process (e.g., time to intervention) or delineate explicitly and in any standardized way the elderly clients as stable, pre-frail, frail or at risk. Many of the studies reviewed and contrasted varied in methodological design, types of interventions, measures and clinical case mix groups.

5.5 Implications for Policy

Home care is rapidly growing in the overall demand, acuity and complexity of clients and costs. The estimated one million clients served annually by Canada's publically funded home care system reflect a doubling of volume served over the last 15 years (CHCA, 2011; Health Council of Canada, 2012). It is further estimated that 500,000 access some form of private home care support (CHCA, 2011). The majority (70-82%) of clients is over the age of 65, many of whom require long-term supportive or maintenance care related to functional decline (CIHI, 2011; Health Council of Canada, 2012).

Despite these data, a large proportion of home care services are provided to intensive post-acute and short term care patients, resulting in fewer resources provided to those with complex and chronic needs (Hollander, Chappell, Prince & Shapiro, 2007; Ontario Association of CCAC, 2007; Watkins et al., 2009). The delivery of home care in this regard is highly attributed to the pressures placed on hospitals to minimize inpatient lengths of stays thus increasing the acuity of admissions to home care—a process

described as discharging hospital patients "quicker and sicker" (Watkins et al., 2009, p.12). It may be suggested that this home care process further marginalizes the elderly in need of home care and home-based rehabilitation and consequentially force the elderly to seek access to home care through the hospital. This may also contribute to the wait times for occupational and physiotherapy experienced by the elderly, as was demonstrated in this study and in the literature—average of 15 days for occupational therapy and 29 for physiotherapy (Cook et al., 2006).

Policy, pilot programs and enhanced health information tools have been put forward in Ontario over the last five years to address the complexity of providing home care, to alleviate the pressures on hospital care identified with the elderly and to inform accountability. These initiatives are aimed at increasing financial support and efficiency to home care as a means of increasing client volumes while maintaining quality care. These initiatives, therefore, have purposefully targeted high needs clients with complex conditions and who require a hybrid of medical, rehabilitative and supportive care and who are recognized as disproportionately high-end users of health care services, namely hospitals (e.g., Aging at Home Strategy, Virtual Ward-Hospital in the Home) (MOHLTC, 2007; Walker, D., 2011). Despite these efforts, ~80% of the expenditures for longer term home care remain earmarked for home making (direct supportive care) and ~20% for professional services (Hollander et al., 2007).

For example, Ontario's home care system is currently introducing a new assessment process and form as a means of assessing and flagging all clients (vulnerable

populations, i.e., elderly) at the time of intake, whether the admission is from the hospital or community. The Inter-Resident Assessment Instrument Contact Assessment (Inter-RAI CA) is a brief standardized clinical assessment that will inform pre-set algorithms designed to determine a clients need and referral to home care services, specifically rehabilitation (CIHI, 2010). The new Inter-RAI CA builds upon the existing RAI-HC assessment that Ontario home care was mandated to complete (2002-current) but only on all long-stay clients—that is, clients that experience a length of stay on home care ≥60 days are assessed one time a year with RAI-HC or if there is a change in status.

The goal of the Inter-RAI CA, however, is to screen all clients at the time of the initial assessment and to identify those at risk for adverse events, provide real-time referrals (i.e., rehabilitation) and care planning, prevent hospital admissions and emergency department visits and provide standardized data to compare home care across Ontario's 14 health regions (CIHI, 2010). The assessment emphasizes functional limitations, recent decline and need rather than diagnosis(es), and these elements are similar to the original RAI-HC.

Although the new standardized Inter-RAI CA may address the issue of early identification of at-risk elderly and prompt and earlier referrals to rehabilitation services, there remains a lack of understanding on how such tools affect client care (Egan et al., 2009) or impact other health systems. There still remain other system-based factors, other than clients' need and/or functional status, which will influence the decision to refer to rehabilitation services. For example, regional funding and priorities (Local Health

Integration Networks), geographic population distribution and available human resources, specifically for occupational and physical therapies, will all impact whether or not a client receives rehabilitation. The current study suggests also that the *time* or *timing* of when an elderly client receives namely occupational therapy is critical to the client's likelihood of rehospitalization and overall length of stay on home care. This finding is highly dependent upon the availability of therapists (supply and demand), and as such may require a further examination as to where (locale) occupational therapy is most effectively delivered.

Formally recognizing the importance and detailing the uniqueness of home care's longer term complex needs clients is suggested as a means from which specialty home care or new models of home care may result and best practice rehabilitation care pathways designed (Hollander et al., 2007; Walker, 2011). The results from this study would suggest that extracting and describing the characteristics of home care's elderly clients' trajectory from hospital to home care to occupational therapy and/or to physiotherapy to rehospitalization requires in-depth and systematic analysis. It is posited that by examining the interface between each of these routes, as well as the inherent processes (e.g., temporal effect), variables that are causal, preventable and modifiable can be identified and interventions targeted appropriately (Lindquist & Baker, 2011).

5.6 Limitations

There are limitations that must be addressed when considering the results from this study.

5.6.1 Administrative Data

The study design relied on administrative data from two primary health service providers, the South East CCAC and the Kingston General Hospital Decision Support. Although the databases accessed for the study are standardized and government mandated, these indicators were designed and routinely collected for the purposes other than the current research—that is the original intent in developing the database indicators were for decision-making and performance. As such, there may be incomplete data and, in some instances, possibly incomparable data for the entire sample (Henneckens & Buring, 1987).

The use of administrative data therefore limited the selection variables available from each individual database. There may be unmeasured covariables that account for differences in who receives rehabilitation and who doesn't and its impact on hospital utilization. A recent retrospective cohort study on factors predicting patient use of emergency departments and using administrative data considered this same limitation describing it as "residual confounding from unmeasured or inaccurately measured variables" (McCusker et al., 2012, p. 8). For example, neither the home care nor hospital databases included discrete indicators to describe clients' education, ethnicity or level of education or whether or not clients had a primary care physician, family/caregiver or

private support at home. Managers from the South East CCAC who facilitated the data access indicated that some of this descriptive information may be/is documented by case managers on clients' charts (notes); and/or available in a more systematic database format only for the longer stay home care clients.

There was also restricted access to certain indicators originally identified for the study. For example, home care did not permit the extraction of postal codes citing reasons concerning client confidentiality—the potential to collate postal codes to other client information and identify an individual client. Postal codes have been used to impute income within geographic census regions as well as distinguishing between urban and rural. Socio-economic-demographic and cultural indicators may contribute to further delineate those who receive publically funded rehabilitation from those who do not.

Finally, the NACRS and DAD databases provided information only for clients who returned to either the Kingston General or Hotel Dieu hospitals. There is no standardized tracking process or indicators to determine if/when clients attend different hospitals (MOHLTC, 2010). It is not known if clients in this study returned to other hospitals within the region. The study data provided valid information and results in so far as it reflects these two hospitals, but these may not be generalizable. Advancing this study to studying impact of rehabilitation and returns to hospitals should be conducted in multiple sites to enable the tracking of all hospitalizations and examine the differences (Lindquist & Baker, 2011).

5.6.2 Health Status Indicators

A second limitation was the lack of health information specific to diagnosis, co-morbidities, functional status and adverse events. Home care databases did/do not include diagnoses in any easily accessible abstracted classification or coding format. Documentation of diagnoses and/or reason for a home care referral or any admission assessment information (i.e., function, cognition, acuity, comorbidities) was available only in clinical chart notes. As such, the NACRS and DAD databases were used to identify clients' primary diagnosis (ICD-10 code) as it pertained to the pre and post hospitalization to the home care admission. These ICD-10 codes describe only a subset of clients' hospital encounter prior to home care and all of the home care clients (n=241) who returned to hospital.

These diagnoses alone cannot be assumed as the only cause (causality) for home care admissions, services received or hospital return. A main proxy measure was used to describe the clients' clinical status on admission (acute, non-acute) as based on home care's assessment using twelve domains (Appendix B). However, diagnoses that affected hospital encounters and home care admission for the entire sample and/or the cumulative number of relevant co-morbidities would have contributed further to the analyses. Also, the identification of an adverse event(s) and resultant outcome is not a standardized indicator within home care's database or the hospital's. The lack of these data prohibits a deeper understanding and ability to distinguish home base rehabilitation's role to mitigate

such events, in addition to describing the rates, causes and consequences at multiple levels (e.g., system).

5.6.3 Internal Validity

The main aim for using multivariate analytic methodology in this observational retrospective cohort study was to improve internal validity. In general, internal validity centres on the relationship between cause and effect. Specifically, it is the extent whereby the observed difference in the outcomes between two comparison groups can be explained by the intervention and not by other factors (Portney & Watkins, 2009). Although using administration data can ensure accurate standardized measurement of explanatory variables for this study design, it does not always mean that all such variables were available and/or complete to ensure comparability across the entire sample. Therefore, there a two threats to internal validity in this retrospective cohort study.

Major confounders were controlled for by multivariate regression and stratified survival analysis. Nevertheless, in cohort studies, systematic factors that determine whether a person receives the intervention (i.e., home-based rehabilitation) could result in the groups differing in factors related to the outcome (rehospitalization). This may be either because clients were preferentially selected to receive one form of rehabilitation versus none or because of choices that the individual client made. As an example in this study, selection of clients exposed to home-based rehabilitation versus clients unexposed is related to the case manager's assessment and decision and/or a client's preference.

These baseline differences could confound the assessment of the effect of the intervention—rehabilitation yes/no or specific type of rehabilitation—on hospital utilization. The administrative database therefore is subject to residual confounding effect. The only way to overcome such problem of confounding is a randomized trial, which is neither feasible nor ethical for the research question and population.

The second issue, similar to all observational studies, is the possibility of selection bias. Since the population was limited only to those in our databases, there is no guarantee that the study sample is similar to the target population (Canadian older adults). The potential differences might impact the relationship of interest and introduce selection bias.

The other source of selection bias is confounding by indication or indication bias (Porta, 2001). Confounding by indication is a bias that is based on the fact that at baseline the two comparison groups lack similarity in prognostic factors and these dissimilarities are potential influences on determining treatment or intervention decisions and also on outcome (Porta, 2001; Portney & Watkins, 2009). In this study, for example, clients that had a hospital encounter were significantly more exposed to occupational home-based rehabilitation (17.8% of encountered versus 9.1% of non-encountered, $p<0.001$, table 4.16). This can be a true finding or a biased estimate due to confounding by indication. Factors such as discharge hospital diagnosis, type of disease and age may be associated with determining (or triggering) whether a client receives a specific rehabilitation

therapy, and concurrently these same factors may also be associated with a higher probability of returning to hospital (Porta, 2001; Portney & Watkins, 2009).

5.6.4 External Validity

The final limitation pertains to the external validity (generalizability) of the study results, that is, would the findings from this study hold true for other elderly populations discharged from hospitals in Ontario and admitted to home care. The study sample represents only a subset of home care clients who were discharged from two hospitals located within one region of Ontario and within a mid-size urban city. This specific provincial region, as defined by the Ontario Ministry of Health's Local Health Integration Networks, has the largest proportion of people ≥ 65 years of age in the province of which 44% reside in rural communities with populations of <10,000 (Health Systems Intelligence Project, 2006). In addition, the hospitals included in this study represent the region's main tertiary and clinical hospitals that are affiliated teaching (academic) and research hospitals. A more representative sample of elderly patients discharged from various types and sizes of hospitals and admitted to home care programs across Ontario would increase the rigor and generalizability the study results.

In addition, this study limited the sample and observation period to one year—the original intent was to examine two years but the sample size from 2008-2009 was questionable (N=460) when compared to 2009-2010 and hospital discharge data. Identifying and following a cohort over a longer period of time, especially as it relates to

survival time, may contribute more to understanding the effect of rehabilitation and hospital utilization patterns.

5.7 Future Research

Ontario's publically funded home care is complex in its conceptualization and in its delivery. Many of the studies and reports on home care have used administrative databases to examine variables or indicators associated with client/patient characteristics, clinical and medical status and utilization of health services. Several of these provincial and national studies include only the elderly home care clients who are on home care for lengthy extended periods of time (i.e., > 60 days). The findings from this study cohort suggest that there is a need to include all elderly clients, regardless of length of stay on home care, in order to accurately distinguish the association between client characteristics, interventions and outcomes. This is of particular importance when we consider the results from the survival analysis and the descriptive bivariate analysis on times from admission to first visit by a therapist.

It is suggested that if associations are to be made between variables linked to outcomes such as hospital readmissions, administrative databases cannot provide this level of detail. Rather, primary data collection is needed by means of identifying significant variables and then systematically evaluating whether they are causal and modifiable, and if both of these, determine targeted interventions (Lindquest & Baker, 2011). In the case of Ontario's home care, this is required but it is also challenging. It is required because many of the descriptive information on clients' initial admission

functional status and diagnosis are in note form on a client's chart. It is difficult when trying to ascertain the clients' charts and this information due to the lack of standards of what information is recorded and because there may be a number of charts retained separate to CCACs by the multiple service providers involved in care.

Research on home-based rehabilitation has been described as inherently difficult (Drahota et al., 2009). A great deal of this difficulty is from how therapies have been "bundled under a heading therapy" (Landry et al., 2009, p.21). This has resulted in a lack of knowledge as to the effect each individual therapy provided through home care may have on referral paths, best practice strategies or on outcomes. It is suggested that future studies on home-based rehabilitation need to detail components and make clearer comparisons for example: type of therapy (e.g., occupational, physical, speech etc.), specific patient characteristics, diagnostic groups or care environment (Drahota et al., 2009).

Studies that seek to examine risk factors, interventions and outcomes need to be conducted with a standard methodological design and across multiple sites. The methodological approach is paramount to tracking clients across multiple hospital systems, for identifying standardized measures and for comparison. The inclusion of multiple sites should provide a cross-sectional representation of urban, mid-size and rural, ethnicity, social-economic indicators and types and sizes of hospital (e.g., teaching hospital versus community).

5.8 Conclusion

This study sets apart and focuses on occupational therapy and physiotherapy as a part of Ontario's home care program and delivery of home-based rehabilitation. Clients included in the study were over the age of 65, admitted to home care from hospital discharges during 2009-2010 and reflected distinct diagnosis. The retrospective cohort study design, utilization of administrative databases and multiple analytical methods attempted to systematically discern the characteristics of those clients who received home-based rehabilitation from those who did not. The outcome of interest was hospital utilization, which were defined as clients that returned to hospital while on home care.

The results from the study suggest that there are distinct characteristics significantly associated with certain elderly home care clients increased likelihood for receiving home base occupational therapy and physiotherapy. These included clients who were older, females, referred to home care from an inpatient unit, assessed as non-acute for clinical and service needs and required more home making support and assistance with activities of daily living.

Close to one quarter of the sample returned to hospital after their home care admission. The majority returning to hospital did not receive home-based rehabilitation. The emergency department accounted for the majority of return visits. Clients who received occupational therapy had a shorter survival time (returned to hospital at earlier time points), within the first three months from admission, compared to clients who received physiotherapy, both occupational therapy and physiotherapy and no

rehabilitation. The survival time for the clients who received physiotherapy was greater over the first 0-4 months.

Despite the many complexities attributed to today's delivery of home-based rehabilitation in Ontario, the need to understand and discriminate who receives occupational therapy and physiotherapy is essential to understanding which component contributes to improved outcomes. More importantly, it is vital to supporting the care of community dwelling elderly, to designing or redesigning models and best rehabilitation care and intervention pathways and to enhancing the efficacy of the continuum of care.

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Appendix A

Service Recipient Categorization Guide

Twelve domains used to determine a client's clinical and service needs. The results from these assessments were used in the study as a dichotomous measure, Acute and Non-Acute. The following table was provided by the South East Community Care Agency Management, February 2010.

SERVICE RECIPIENT CATEGORIZATION GUIDE					
	91 - Acute	92- Rehabilitation	93 - Maintenance	94 - LT Supportive	95 - End of Life
Service Goal	To address the client's need for **short term** education, care or support as a result of illness, disability or injury	To **optimize** the client's functional status within limits of their disability and to facilitate social integration and independence	To **maintain** the clients independence by preventing/minimizing the premature decline in health and/or functional status.	To **delay** institutionalization by providing supportive care, and relief of symptoms to preserve the client's level of function and autonomy.	To **alleviate** distressing symptons to achieve the best quality of life by providing complex support in the last stages of their illness.
Individual"s Condition	With a **clearly identified** and predictable outcome or recovery.	With **decreasing short** term activity limitations and participative restrictions.	With **chronic but stable** self care deficit that requires ongoing need for assistance with ADL.	With noticeable, **progressive decline** in functioning lasting greater that three months.	Whose health condition is **not responsive** to curative treatment and who are dying
Service Mix	Primarily Nursing, often single service	Primarily Therapy, rarely single service	Varying Mix, often single service	Varying Mix, rarely single service	Primarily Nursing, rarely single service
Length of service	**Time limited to 60 days**	Length of Service is **NOT** time limited less than one year	Extended period, not time limited	Extended period, not time limited	Time limited, ususally less than 6 months
Expected Clinical Outcomes	**Acute Phase resolved, client/caregiver ability to manage self-care attained**	**Client transferred to an out-patient clinic. Service goals met, client's ability to manage self-care attained**	**Client safely managing in home environment with appropriate/stable level of services from CCAC and Community Resources**	**Client safely managing in home environment with appropriate service within CCAC maximums and Community Resources.**	**Client's ability to palliate at home, if desired with appropriate CCAC services and Commnity Resources**
Discharge	Anticipated within 60 days,otherwise move to another SRC	Anticipated, otherwise will be assessed for a different SRC	Unlikely, may move to SRC 94 or 95	Likely, move to institutional care or SRC 95	Yes, at time of death
Prognosis	Recovery/Goals Met	Goals met, independent	Very slow decline	Gradual and anticipated decline	Rapid decline
Placement Application	Unlikely	Unlikely	May have an application likey Priority 3	Most likely an application, usually P2	May be an application

	91 - Acute	92- Rehabilitation	93 - Maintenance	94 - LT Supportive	95 - End of Life
Medical Condition *frequency of hospitalization	None anticipated	None anticipated	Expectation that medical conditions are **stable** < 2 hospital admissions per year	Expectation that medical condition will **decline** > 2 hospital admissions per year	May be hospitalized for palliative care
Functional Status	Improvement	Improvement	Expectation that functional status will remain **stable**	Expectation that functional status will **decline**	Decline
Need for Support	Limited	Limited	Stable need for assistance with: ADLs and IADLs	Increase need for assistance with: ADLs and IADL's	Yes
Caregiver ability to Cope *CCAC Services in place *If formal or informal caregiver support removed	No issues anticipated	No issues anticipated	Able to Cope: *CCAC Services enable client to stay at home *Client **may not require** institutionallization if no caregiver	Decreasing ability to Cope: * Additional services are required to meet caregiver's needs *Client **would require institutionalization** if no caregiver *Respite is key factor	Decreasing ability to Cope

SRC 93 This SRC is used when a client is not eligible for CCAC provider services but is eligible for case management services. case manager completes on behalf of the client an assessment for adult day program. The case manager provides ongoing case management servcies to the client until the client has been accepted by the program.

*SRC 47- Placement only clients

*SRC 48- Respite only clients

NOTE: Any client with an application for placement in a long term care home for short stay respite or long stay, Priority 2 and who is receiving in home services is assigned a service recipient category of "94" or "95".

Appendix B

Ethics Approval received from Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD

Queen's University

January 14, 2011

This Ethics Application was subject to:

☐ Full Board Review
Meeting Date:
☒ Expedited Review

Ms. T. Christine Knott
School of Rehabilitation Therapy
c/o Centre for Health Services and Policy Research
Abramsky Hall
Queen's University

Dear Ms. Knott,

Study Title: **Home Based Rehabilitation Impact on Health Outcomes, Adverse Events and Utilization of Hospital Services**
Co-Investigators: **Dr. M.A. McColl, Dr. M. Green and Dr. M.W. Rosenberg**

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following list of ethics requirements you must fulfill over the course of your study:

- **Reporting of Amendments**: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. (see http://www.queensu.ca/vpr/reb.htm).
- **Reporting of Serious Adverse Events**: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information.
- **Reporting of Complaints**: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.
- **Annual Renewal**: Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

Albert Clark
Chair, Research Ethics Board

Jan 14, 2011
Date

ORIGINAL TO INVESTIGATOR - COPY TO DEPARTMENT HEAD- COPY TO HOSPITAL – BINDER COPY - FILE COPY

Study Code: REH-489-11

- **Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete**

Appendix C

Kaplan-Meier Cumulative Hazard Function Curves for Examining the Time to a Return to Hospital to Enhance Visual Clarity

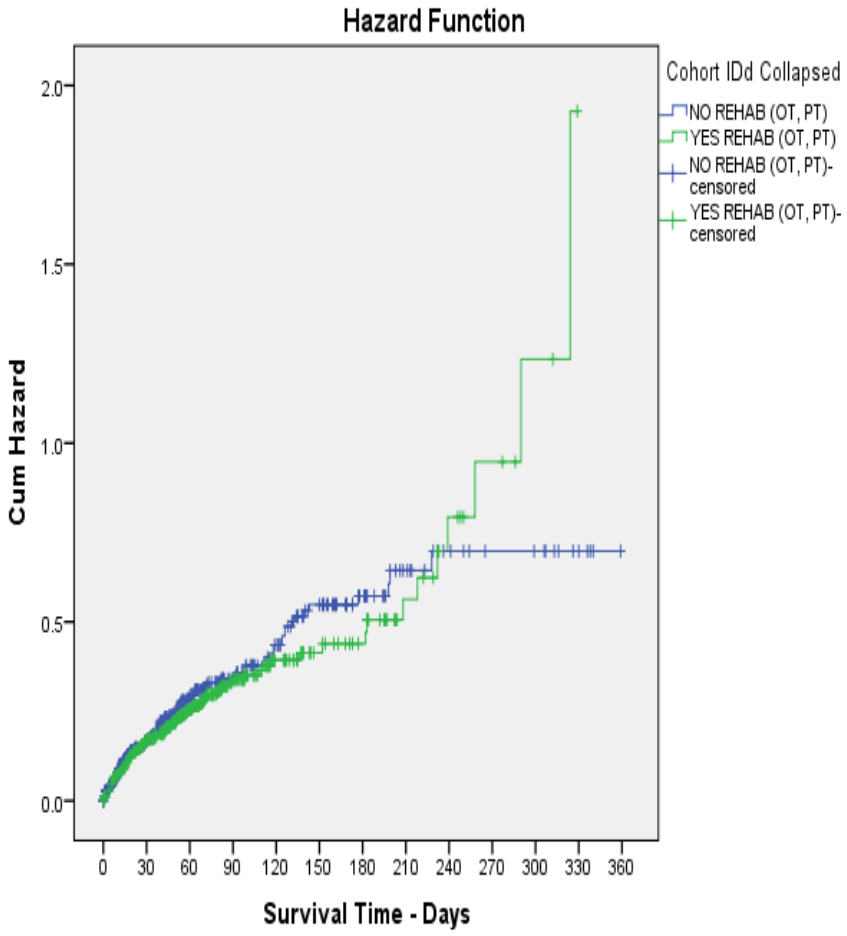
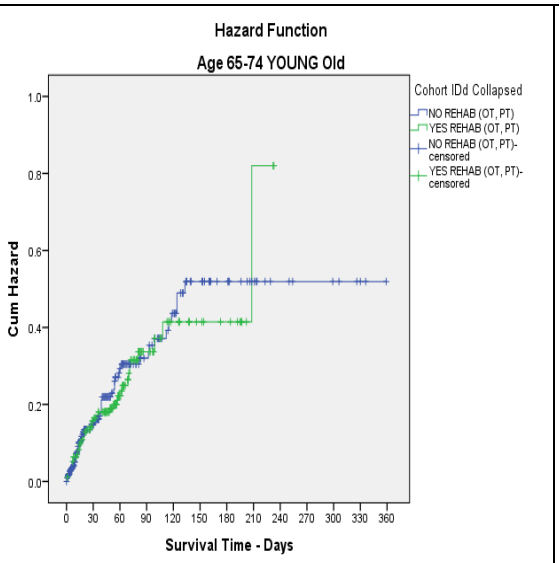


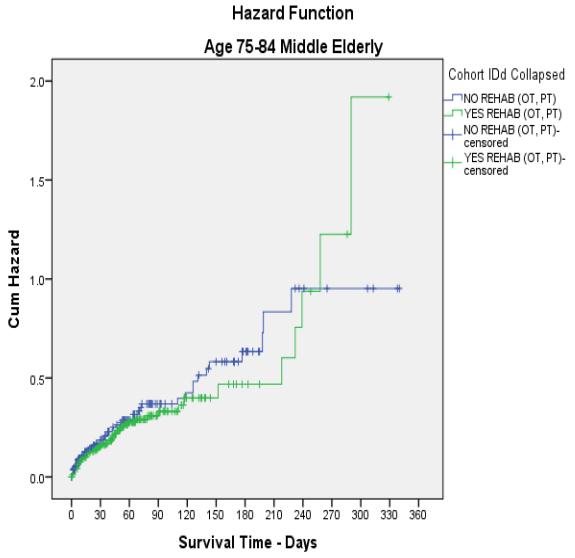
Figure C. 1. **Kaplan-Meier hazard function curves for time to hospital encounter comparing home care clients receiving rehabilitation and those who did not**

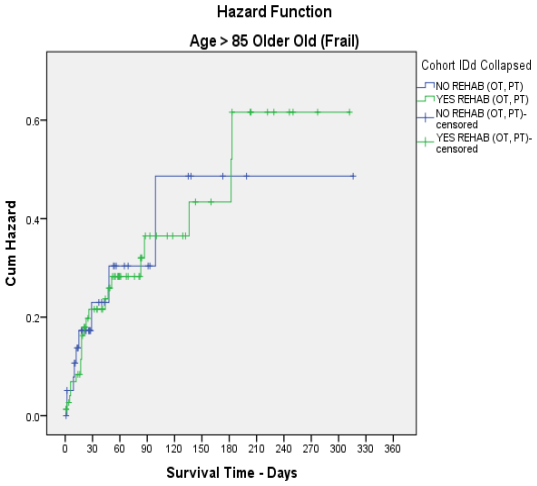
Appendix D

Kaplan-Meier Hazard Function for Age Defined by Three Categories (Young Old, Middle Elderly, Older Old)

The function was applied to determine if clearer visual clarity between groups could be achieved, while adjusting for age. There was no change to the curves from the original survival analysis detailed in Chapter 4, and no statistical difference between the curves when adjusting rehabilitation status by three age groups.







AGE		Sig.
Age65-74 Young Old	Log Rank	0.73
	Wilcoxon	0.73
	Tarone-Ware	0.70
Age75-84Middle Elderly	Log Rank	0.55
	Wilcoxon	0.42
	Tarone-Ware	0.42
Age≥85OlderOld-Frail	Log Rank	0.96
	Wilcoxon	0.86
	Tarone-Ware	0.90
Pooled	Log Rank	0.52
	Wilcoxon	0.42
	Tarone-Ware	0.40

Figure D. 1. **Kaplan-Meier hazard function curves for time to hospital encounter comparing home care clients receiving rehabilitation and those who did not and adjusting for age**

Appendix E

Kaplan-Meier Survival Function Adjusting for Sex and Examining the Effects on Time-to-Event Between Those Who Received Rehabilitation and Those Who Did Not

There was no change to the curves and to the level of statistical significance between the groups on the outcome when adjusting for sex.

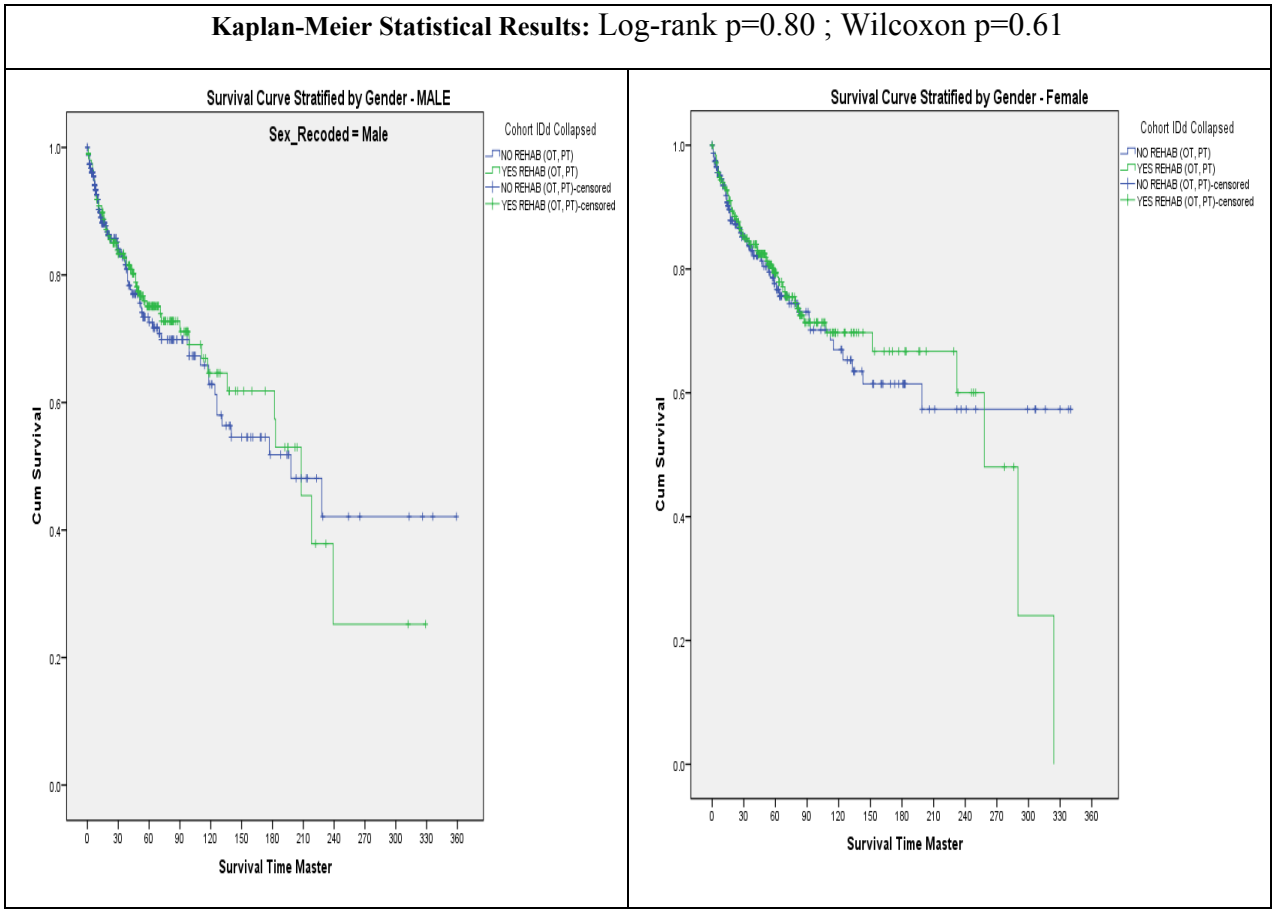


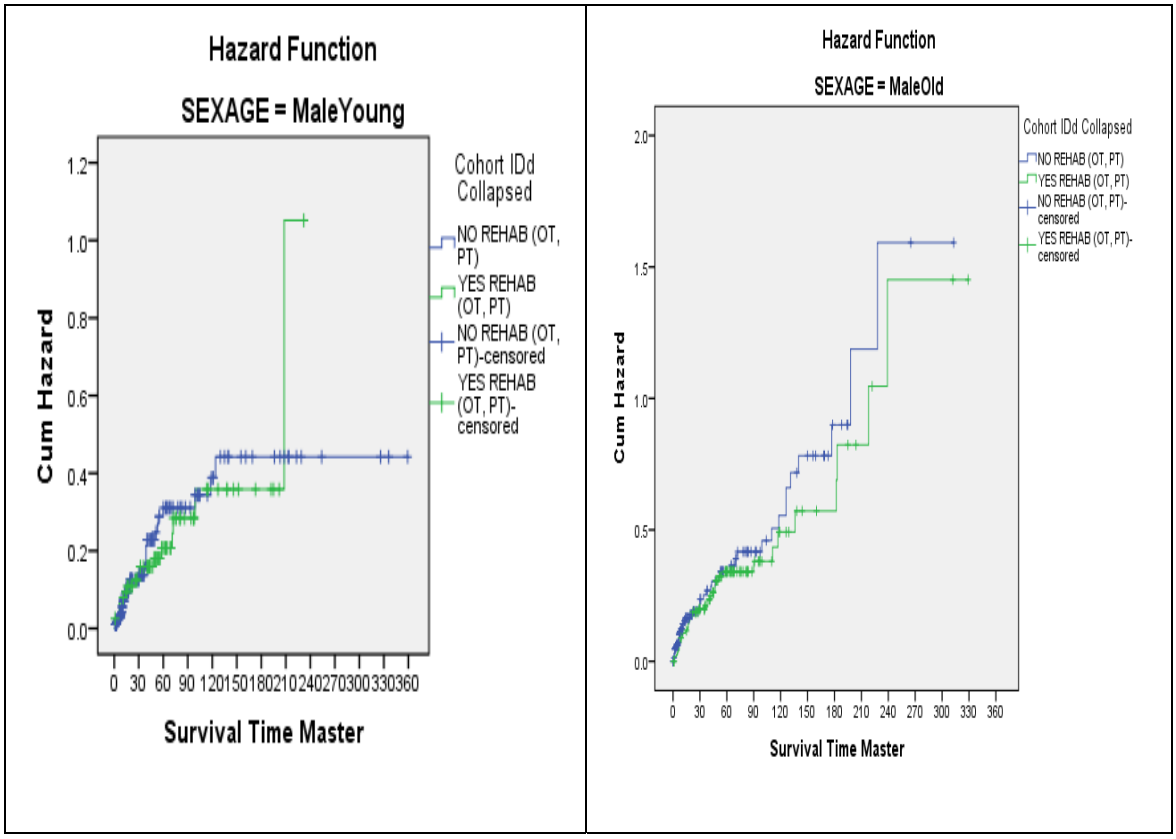
Figure E. 1. **Kaplan-Meier hazard function curves for time to hospital encounter comparing home care clients receiving rehabilitation and those who did not and adjusting for sex**

Appendix F

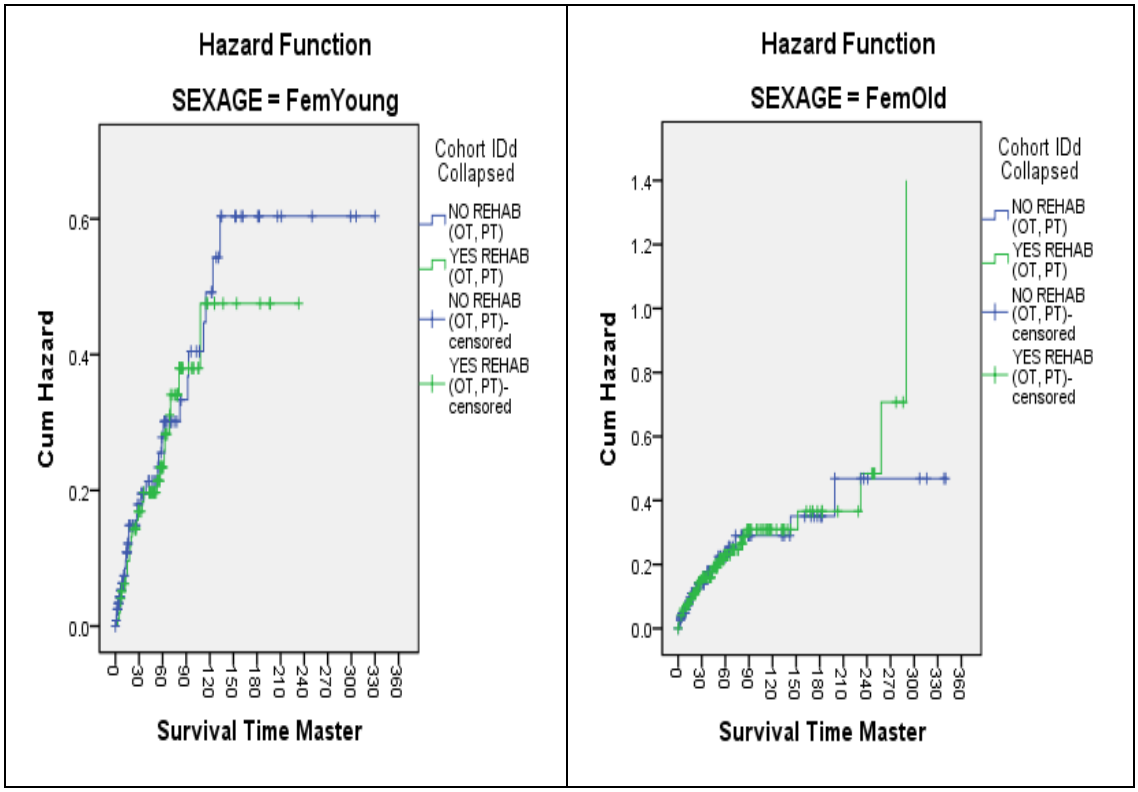
Kaplan-Meier Hazard Function Adjusting for [Combining] Age and Sex and Examining the Effects on Time-to-Event Between Those Who Received Rehabilitation and Those Who Did Not

There was no significant difference between rehabilitation groups when adjusting for age and sex at the same time. Below are curves for Sex (males)+Age (≤75 and ≥75). The following pages show results for Sex (females) +Age (≤75 and ≥75).

Stratum: Male & ≤75 and ≥75



Stratum: Female & ≤75 and ≥75



Sex and Age Combined		Significance Level
Male≤75	Log Rank (Mantel-Cox)	***0.80***
	Breslow (Generalized Wilcoxon)	***0.88***
	Tarone-Ware	***0.78***
Male≥75	Log Rank (Mantel-Cox)	***0.45***
	Breslow (Generalized Wilcoxon)	***0.48***
	Tarone-Ware	***0.47***
Fem≤75	Log Rank (Mantel-Cox)	***0.76***
	Breslow (Generalized Wilcoxon)	***0.73***
	Tarone-Ware	***0.76***
Fem≥75	Log Rank (Mantel-Cox)	***0.65***
	Breslow (Generalized Wilcoxon)	***0.97***
	Tarone-Ware	***0.97***
Pooled[a]	Log Rank (Mantel-Cox)	***0.62***
	Breslow (Generalized Wilcoxon)	***0.50***
	Tarone-Ware	***0.50***

Figure F. 1. **Kaplan-Meier hazard function curves for time to hospital encounter comparing home care clients receiving rehabilitation and those who did not and adjusting for sex and age**