

**HOUSING FIRST AND EMERGENCY DEPARTMENT UTILIZATION AMONG
HOMELESS INDIVIDUALS WITH MENTAL ILLNESS IN VANCOUVER**

by

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Abstract

Background: The purpose of this study was to evaluate the impact of Housing First at 12 months on emergency department (ED) use among homeless individuals with mental illness in Vancouver.

Methods: Homeless individuals with mental illness enrolled in the At Home/Chez Soi study were randomly assigned to a Housing First model of housing and support or Usual Care. ED data from St. Paul's Hospital and Mount Saint Joseph Hospital were linked for 382 participants in Vancouver. Negative binomial regression was used to compare the Rate of Visits and logistic regression was used to compare the Presenting Complaints, Discharge Diagnosis, and Disposition for visits from participants in Housing First or Usual Care.

Results: 60% of all participants visited the ED at least once at 12 months and the annual Rate of Visits was 3.32 (SD=6.21). After adjusting for the baseline rate and other potential confounders, the Rate of Visits at 12 months was 0.66 times less (95% CI: 0.47-0.93) for Housing First participants compared to Usual Care.

For all participants at 12 months, mental health and substance use-related reasons accounted for 30% of Presenting Complaints and 34% of Discharge Diagnoses. The majority of visits (87%) resulted in discharge from the ED, including 9% left against medical advice or without being seen, and 13% resulted in care advance. For Housing First participants compared to Usual Care at 12 months, the odds ratio for a mental health and substance use-related

Presenting Complaint (OR=0.98, 95% CI: 0.64-1.51) or Discharge Diagnosis (OR=1.18, 95% CI: 0.75-1.86) was not statistically significant, nor was the odds ratio for a care advance Disposition (OR=1.21, 95% CI: 0.68-2.15).

Conclusion: This study observed lower ED utilization for Housing First, consistent with findings from previous evaluations in other settings, which suggests that this model should be expanded for homeless individuals with mental illness similar to those recruited in this study.

This study also observed that many participants experienced acute mental health issues resulting in visits to the ED, and visited the ED without receiving care, which suggests there are opportunities to improve care for this population in the ED and other settings.

Preface

All research described in this dissertation was conducted under the approval of the University of British Columbia/Providence Health Care Research Ethics Board (certificate H11-01083).

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List of Abbreviations

CEDIS	Canadian Emergency Department Information System
CI	Confidence Interval
CONG	Congregate Housing First with modified Assertive Community Treatment
ED	Emergency Department
HF ACT	Housing First with Assertive Community Treatment
HF ICM	Housing First with Intensive Case Management
HN TAU	High Need Usual Care
ICD	International Classification of Diseases and Related Health Problems
IQR	Inter-Quartile Range
MINI	Mini-international Neuropsychiatric Interview
MN TAU	Moderate Need Usual Care
NHI	National Homelessness Initiative
OR	Odds Ratio
PHN	Personal Health Number
POST	Year After Study Enrolment
PRE	Year Before Study Enrolment
RCT	Randomized Controlled Trial
SD	Standard Deviation
TAU	Usual Care

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Chapter 1: Introduction

This study will examine the effect of a Housing First intervention on emergency department (ED) use among homeless individuals with mental illness in Vancouver. This first chapter will provide an overview of homelessness and mental illness in Canada, describe patterns of health services utilization among homeless individuals with mental illness, introduce Housing First and the At Home/Chez Soi study, and conclude with an outline of the study objectives, research questions, and conceptual framework.

1.1 Literature Review

1.1.1 Homelessness and Mental Illness in Canada

There is increasing awareness of concerns relating to homelessness and mental illness in Canada, as the public health, social, and economic consequences have become impossible to ignore. Homelessness has been estimated to cost Canadians between \$4.5 and \$6 billion dollars annually, inclusive of health care, justice, social service, and emergency shelter costs (Laird, 2007), and the economic cost of mental illness in Canada from health care costs, lost productivity, and decreased quality of life has been estimated to be more than \$50 billion annually (Lim et al., 2008). The situation is critical in Vancouver, British Columbia, where the concentration of homelessness, mental illness, and substance use is exceptionally high.

Prevalence and Burden in Canada

Homelessness in Canada has been repeatedly described as a national emergency and a national crisis, not by the Canadian government, but by the United Nations Committee on Economic, Social, and Cultural Rights and the United Nations Special Rapporteur on Adequate Housing (UN Committee on Economic, Social and Cultural Rights, 2006; UN Human Rights Council, 2009).

In 2005, the National Homelessness Initiative (NHI) estimated that 150,000 Canadians were homeless (Laird, 2007). Since this estimate was based on shelter and street counts, only capturing the state described as *absolute homelessness*, homelessness advocates suggested that the NHI underestimated the size of Canada's homeless population by as much as two-fold (Laird, 2007). Different ways of measuring and defining homelessness may also consider individuals who are living in substandard or unsafe housing, or spending a very large proportion of their income on housing as *at-risk for homelessness* or *precariously housed*, and attempt to identify individuals who are temporarily staying with friends or family (Frankish, Hwang, & Quantz, 2005).

Vancouver conducts a shelter and street count, and has observed a 136% increase in its total homeless population between 2002 and 2011 (Metro Vancouver Regional Steering Committee on Homelessness, 2012). In Vancouver and most Canadian cities, single men still constitute the largest demographic of the homeless population (Hwang, 2001).

However, homelessness increasingly affects women and youth, and Aboriginal people are greatly overrepresented in Canada's homeless population (Hwang, 2001).

There is also heterogeneity within homeless populations with respect to the duration of homelessness. Homelessness may be a temporary, periodic, or chronic experience for different individuals, and previous research has identified that chronically homeless individuals comprise a small proportion of the total homeless population, but have the greatest needs and are the highest users of services (Kuhn & Culhane, 1998).

The burden of mental illness in Canada is equally staggering, but often unappreciated due to stigma and lack of awareness. One in five Canadians will experience a mental illness in their lifetime and one in ten Canadians report symptoms of a mental illness in the past year (Health Canada, 2002; Statistics Canada, 2003). In 2006, Senator Michael Kirby's report "Out of the Shadows at Last: Transforming Mental Health, Mental Illness and Addiction Services in Canada" sounded an alarm on the state of mental health in Canada, noting that thousands of Canadians have been unable to access adequate mental health care and that a dire lack of affordable and adequate housing, as well as other social determinants of health, have adversely affected Canadians struggling with a mental illness (Kirby, 2006). This led to the creation of the Mental Health Commission of Canada in 2007, which recently created the first national mental health strategy for Canada (Mental Health Commission of Canada, 2012).

In 2007, the BC Ministry of Health also commissioned an assessment of homelessness and mental illness across the province. From this study, it was estimated that between 8,000 and 15,000 adults in BC with severe mental illness and addiction are *absolutely homeless*, and between 26,000 and 51,500 are *at-risk for homelessness* (Patterson et al., 2008). This report, and the 10-year mental health plan subsequently developed by the British Columbia Ministry of Health, identified many of the current gaps in the mental health care system and highlighted the need to increase housing options and improve the availability of support services in the community (BC Ministry of Health, 2010).

The literature also confirms that the prevalence of mental illness is significantly higher among persons who are homeless than the general population (Fischer & Breakey, 1991; Koegel, Burnam, & Farr, 1988). A recent systematic review and meta-regression analysis conducted by Fazel and colleagues included 29 studies from North America, Western Europe, Australia, and New Zealand, in which the prevalence of psychiatric disorders among homeless individuals was evaluated by clinical examination or interviews using validated diagnostic instruments (Fazel et al., 2008). The pooled prevalence was 23.1% (95% CI: 15.5%–30.8%) for personality disorders, 12.7% (95% CI: 10.2%–15.2%) for psychotic illness, 11.4% (95% CI: 8.4%–14.4%) for major depression, 37.9% (95% CI: 27.8%–48.0%) for alcohol dependence, and 23.1% (95% CI: 15.5%–30.8%) for drug dependence. In British Columbia, a survey of 500 homeless individuals in Vancouver and two other cities found even higher rates for current psychiatric disorders (Krausz & Schuetz, 2011). The prevalence in this survey was 57.3% for anxiety disorders, 22.7% for major depression, 14.9% for schizophrenic psychosis, 37.2% for alcohol dependence, and 70.1% for drug dependence.

Furthermore, 56% of respondents met the criteria for a current mental disorder and a current substance use disorder (known as a concurrent disorder).

The Relationship between Homelessness and Mental Illness

The relationship between homelessness and mental illness is complex. Not all persons who are homeless have a mental illness, and not all persons with a mental illness are homeless.

Mental illness may precede the onset of or contribute to homelessness, and homelessness may trigger or further exacerbate mental illness (Frankish, Hwang, & Quantz, 2005).

Structural factors such as the availability of affordable housing, opportunities for education and formal employment or other forms of income generation, the accessibility of health and social services, as well as individual factors such as personal coping skills, social support, and other co-morbid conditions may play an important role in mediating the relationship between mental illness and homelessness and pathways into and out of homelessness (Canadian Population Health Initiative of the Canadian Institute for Health Information, 2009; Patterson, Somers, & Moniruzzaman, 2012).

Mental illness may also contribute to the duration of homelessness. Kuhn and Culhane observed that mental illness and substance use problems among shelter users from New York City and Philadelphia were associated with repeated episodes and longer duration of homelessness (Kuhn & Culhane, 1998). Substance use was also negatively associated with housing stability among homeless persons with serious mental illness who were placed into

housing and support programs in New York City (Lipton et al., 2000) and San Diego County (Hurlburt, Hough, & Wood, 1996).

Over the past few decades, service providers and researchers have observed increasing rates of homelessness among persons with mental illness, and mental illness among persons who are homeless (Appleby & Desai, 1985; North et al., 2004). The closure of psychiatric institutions and a corresponding lack of community-based services and supports (Lamb, 1984; Markowitz, 2006), a shortage of affordable housing stock (Quigley & Raphael, 2001), increased income inequality (O’Flaherty, 1996), and reductions to the social security net (Eggleton, 2008) have all been cited as possible factors contributing to this phenomenon. Canadian critics point to decisions made by federal, provincial, and municipal governments to reduce spending on the provision social services in the early 1990s (Eggleton, 2008), and note that Canada is the only G8 country without a national strategy to address homelessness and affordable housing (Laird, 2007).

In summary, despite growing awareness of homelessness and mental illness, Canada has yet to address this public health and social crisis with effective policies and programs. The following section will discuss the implications of homelessness and mental illness for the health care system.

1.1.2 Health Services Access and Utilization

In spite of considerable health needs, persons who are homeless may experience many barriers to accessing health services and, ultimately, use the health care system in ways that are expensive, inefficient, and unsatisfactory to patients and providers.

Health Concerns among Persons who are Homeless

In addition to elevated rates of mental illness and substance use problems, persons who are homeless also suffer from a wide range of physical co-morbidities. Frequently identified concerns include chronic medical conditions, such as diabetes and hypertension, respiratory and sexually transmitted infections, including tuberculosis and HIV, skin and foot problems, fractures and injuries from falls or being struck by a motor vehicle, dental problems, and exposure to the elements (Hwang, 2001). A few studies have compared mortality rates for homeless persons with and without psychiatric disorders and found mixed results but, not surprisingly, the mortality rate among persons who are homeless is greatly elevated compared to the general population (Babidge, Buhrich, & Butler, 2001; Hwang et al., 1998; Nielsen et al., 2011).

Unmet Needs for Health Care

Given the serious burden of physical and mental health problems associated with homelessness, it may not be surprising that persons who are homeless also report high levels

of unmet needs for health care. Hwang and colleagues surveyed 1169 homeless individuals at shelters and meal programs in Toronto, and found that 17% of respondents reported unmet needs for health care, which was significantly higher than the general population of Toronto (Hwang et al., 2010). Similar studies from the United States have found even higher rates of unmet needs for health care: 25% of persons accessing homeless services throughout the United States (Kushel, Vittinghoff, & Haas, 2001), 31% of homeless adults in Los Angeles (Gelberg et al., 1997), and 32% of homeless adults in the United States who responded to the nationally representative Health Care for the Homeless User Survey (Baggett et al., 2010) reported unmet needs for health care.

Barriers to Accessing Health Care Services

These findings suggest that persons who are homeless experience many barriers to accessing health care services. In studies from the United States, lack of health insurance has consistently been associated with unmet health needs, which is alarming when considering that 57% of participants from the study by Kushel and colleagues (Kushel, Vittinghoff, & Haas, 2001) and 60% of participants from the study by Baggett and colleagues (Baggett et al., 2010) were uninsured. In addition, the Canadian study by Hwang and colleagues found that many participants did not have possession of their provincial health insurance card, most often because it was lost or stolen, or because they were newcomers to the province of Ontario (Hwang et al., 2010). Despite Canada's system of universal health insurance, not having a health insurance card or proper identification could present challenges in receiving services at the point of care, as well as discourage or delay seeking health care.

In the study by Gelberg and colleagues, competing priorities of meeting basic needs, such as securing food and shelter, were identified as another set of factors that may discourage or delay seeking health care (Gelberg et al., 1997). Other studies that have examined food insecurity and housing instability separately have also observed an inverse relationship between these factors and access to health services (Kushel et al., 2006; Reid, Vittinghoff, & Kushel, 2008).

A study by Solorio and colleagues reported that homeless youth in Los Angeles commonly had unmet needs for mental health problems because of: not knowing where or what services to use (53%), feeling embarrassed (47%), not having money to get to the service (36%) or too far away (14%), fears that the service provider would contact family (36%) or social worker/police (36%), thinking the service would not help (33%), the service wasn't open when needed (17%) or long wait times (11%), and having a bad experience with staff previously (14%) (Solorio et al., 2006). Perceptions of stigma from health care professionals has been cited as a barrier to seeking health care in other studies, in addition to other aspects of the health care facilities, such as distance, waiting times, and opening hours, as well as not having money, transportation, or a phone to keep appointments (Lewis, Andersen, & Gelberg, 2003; Wen, Hudak, & Hwang, 2007) . Gallagher and colleagues also confirmed that characteristics commonly associated with poor access to a regular source of health care in the general population, such as being male, younger age, and non-Caucasian ethnicity, were also relevant for persons who were homeless (Gallagher et al., 1997).

Patterns of Health Care Utilization

Patterns of health care utilization among persons who are homeless may reflect the barriers they face in accessing health care services. Persons who are homeless may delay and avoid seeking health care services, and when they do access health care services, they tend to visit the ED and other inpatient settings frequently, but underutilize outpatient care and preventative services (Desai, Rosenheck, & Kaspro, 2003; Kushel, Vittinghoff, & Haas, 2001). Persons who are homeless have high rates of hospitalization, often for preventable conditions (Martell et al., 1992; Salit et al., 1998).

In the study by Kushel and colleagues, they noted that 32% of homeless adults visited an ED in the past year and 23% had been hospitalized, yet another 25% reported no contact with any outpatient medical services (Kushel, Vittinghoff, & Haas, 2001). Salit and colleagues reviewed hospital discharge data from New York City and found that persons who were homeless stayed 4.1 days longer in the hospital than other low-income patients (Salit et al., 1998). Moore and colleagues examined repeat visits to an ED in Australia and found that homeless patients who were discharged from the ED were more likely to return to the ED within 28 days than those with stable housing (Moore et al., 2007)

Several studies suggest that homeless persons with mental illness and concurrent disorders visit the ED and use inpatient medical services even more frequently than other persons who are homeless (Folsom et al., 2005; Padgett & Struening, 1991). A study of ED visits and hospital stays across Canada, conducted by the Canadian Institute for Health Information,

found that mental health and behavioral disorders were the most common reasons for hospitalization among persons who were homeless, and less common for the general population. For persons who were homeless, psychoactive substance use was the most common presentation (54%), followed by schizophrenia and delusional disorders (20%) (Canadian Institute for Health Information, 2007). In Hawaii, Martell and colleagues found that persons who were homeless were admitted to acute care hospitals more than five times more often than the general population, and admitted to psychiatric hospitals more than 100 times more often than the general population (Martell et al., 1992).

In summary, persons who are homeless experience many barriers to accessing health care services, despite their considerable burden of physical and mental health needs. When they do access the health care system, they overutilize ED and inpatient services, and underutilize outpatient care. Persons who are homeless frequently present to the ED and are hospitalized for mental health-related reasons, and homeless persons with mental illness and substance use disorders may use ED and inpatient services more frequently than other persons who are homeless. As a result, there is an imperative to consider new ways to improve access to appropriate care for homeless persons with mental illness.

1.1.3 Housing First and the At Home/Chez Soi Study

Areas for intervention to improve the health of persons who are homeless include primary care, psychiatric care, and substance abuse treatment (Frankish, Hwang, & Quantz, 2005). Programs that include case management and outreach may also be successful in improving

access to services (Hwang et al., 2005). However, interventions that only address existing health needs may succeed in improving the health of persons who are homeless, without addressing homelessness and other underlying issues. As a result, interventions with housing and supports have been developed to improve health and address housing status for persons who are homeless. These interventions have the potential to improve the health of persons who are homeless, increase access and change patterns of health service utilization, and, most importantly, end homelessness.

One promising model of an intervention to provide housing and supports is Housing First. The following section will describe Housing First and introduce At Home/Chez Soi, a research demonstration project examining the impact of Housing First in Canada.

The Housing First Model and Existing Evidence

In a Housing First program, persons who are homeless are immediately placed in housing and then offered support services for mental illness, substance use, and other medical and non-medical needs. Program participants do not lose their housing if they experience a relapse or are unable to maintain abstinence, nor if they choose not to enrol in treatment programs or accept the services offered (Tsemberis & Eisenberg, 2000). This is a key element that distinguishes Housing First from many other models of transitional housing with supports, and abstinent-dependent housing with supports. Housing First is guided by principles of consumer choice, as well as harm reduction and recovery.

Assertive Community Treatment (ACT) and Intensive Case Management (ICM) are two evidence-based models of community-based support that may be combined with housing in Housing First programs (Dieterich et al., 2010; Marshall & Lockwood, 1998). ACT is a multidisciplinary team approach that provides comprehensive mental health treatment, rehabilitation and support, while ICM is delivered by individual case managers who assist clients in accessing resources across multiple services and systems. Housing First was originally implemented with a scatter-site housing model, in which program participants are provided with a rent subsidy and live in their own apartment rented through the private-rental market, though some programs have been designed with congregate housing for participants.

Housing First was developed in the United States in the 1990s, and has been implemented primarily with chronically homeless persons with severe mental illness. The early literature compared Housing First with programs that followed a step-by-step progression from transitional congregate housing to independent living, based on conditions such as abstinence from drugs and alcohol and participation in mental health and substance use treatment, and found outcomes favouring the Housing First model for improved housing stability and reduced hospitalizations, with no increases in substance use or psychiatric symptoms (Greenwood et al., 2005; Gulcur et al., 2003; Tsemberis & Eisenberg, 2000; Tsemberis, Gulcur, & Nakae, 2004; Tsemberis, 1999).

Subsequent Housing First studies that further examined patterns of health services utilization have observed decreases in the use of emergency and inpatient services and increases in the use of outpatient mental health services (Gilmer et al., 2010; Martinez & Burt, 2006; Sadowski et al., 2009). Related analyses have suggested that the impact of Housing First on

the use of health services, as well as emergency shelters and justice system interactions, may result in societal cost savings (Larimer et al., 2009; Metraux, Hadley, & Culhane, 2002).

Housing First in Canada and the At Home/Chez Soi study

Although a number of provinces and municipalities have recently adopted Housing First policies (Housing Opportunities Toronto, 2009; The Alberta Secretariat For Action On Homelessness, 2008), there is limited research on Housing First and similar programs in Canada. Toronto's Streets to Homes program has a Housing First strategy for reaching out to street-involved people with housing and case management services and has been operating since 2005. Clients surveyed in a program evaluation of Streets to Homes reported satisfaction with their housing, improvements in their quality of life, reductions in their use of emergency medical services and increases in planned medical services, and decreases in alcohol and drug use (City of Toronto, Shelter Support & Housing Administration, 2007).

The At Home/Chez Soi study is evaluating the effectiveness of Housing First for homeless individuals with a mental illness compared to the services and support currently available in Vancouver and four other Canadian cities. Funded by the Mental Health Commission of Canada from 2009 to 2013, it is the largest study of its kind in the world and involves a team of service providers and researchers in each city. In Vancouver, the Housing First intervention is being delivered by different housing and service providers and includes scatter-site housing with an ACT team, scatter-site housing with ICM support, and a congregate housing site with on-site supports.

The At Home/Chez Soi study represents a unique opportunity to provide evidence on the effectiveness of Housing First for specific Canadian contexts, such as in Vancouver, where the rates of substance use are extremely high among homeless persons with mental illness. There is particular interest among policy makers and service providers in evaluating outcomes and resultant costs for health services use, including ED use.

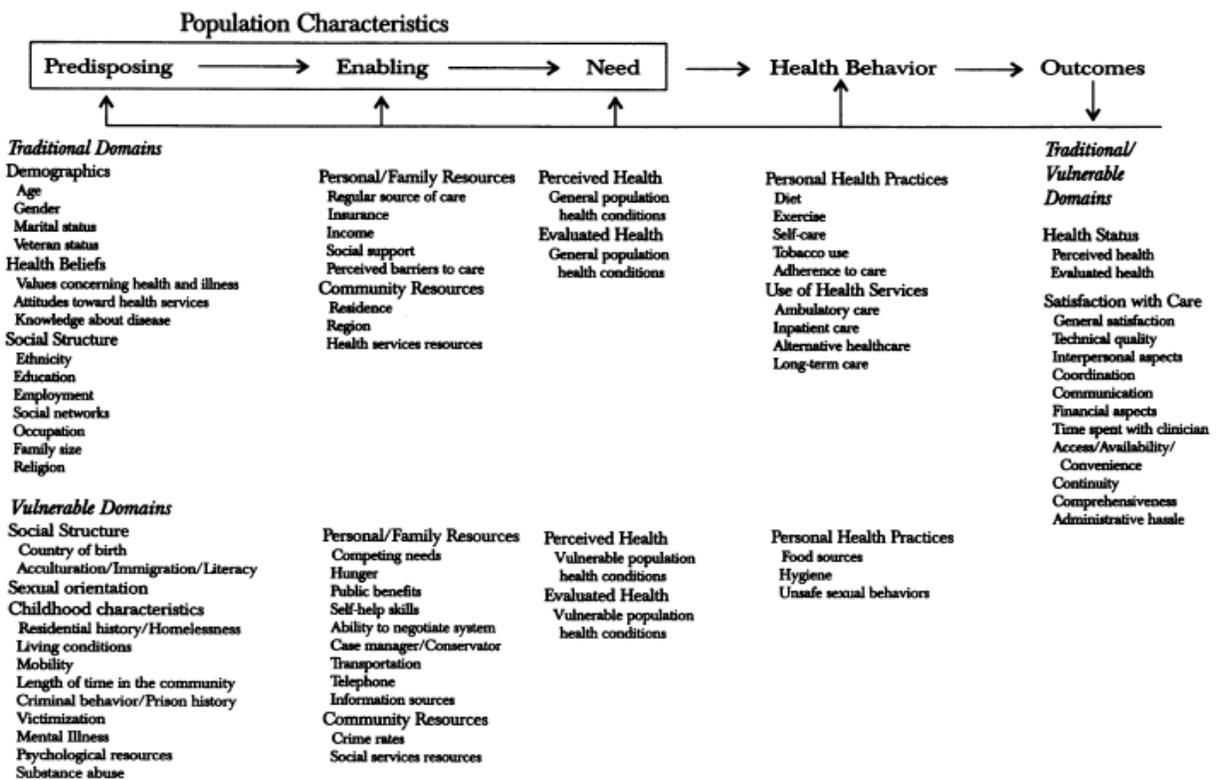
1.1.4 Conceptual Framework for Health Care Access and Utilization

For this study, the Gelberg-Andersen Behavioral Model for Vulnerable Populations was chosen as a conceptual framework to integrate the literature on homelessness, mental illness, and health services utilization and guide an analysis of the relationship between Housing First and ED utilization (Gelberg, Andersen, & Leake, 2000).

The Andersen Behavioral Model originally proposed that 3 types of factors influence the use of health services: predisposing characteristics, which are socio-cultural characteristics that exist prior to the perception of illness (e.g. age, gender, race, education, and health beliefs), enabling resources, which are resources that facilitate or impede access to and use of health services (e.g. income, health insurance coverage, distance from health services), and need factors, which are concerns perceived by the individual and/or evaluated by health care professionals that generate the need for health services (e.g. pain, symptoms of illness)

(Aday & Andersen, 1974; Andersen, 1995). The Andersen Behavioral model offers a framework to conceptualize the relationships between predisposing characteristics, enabling resources, need factors, and individual health behaviours, as well as distal outcomes, such as health status. Subsequent revisions of the model have broadened the idea of health behaviour to include personal health practices, in addition to health services use, and considered the impact of broader policies on individual-level access and utilization, such as features of the health care system, health insurance coverage, and other social policies. The Andersen Behavioral model has been used to explain and predict health services use, and has been applied extensively in the health services research literature.

Figure 1.1: The Gelberg-Andersen Behavioral Model for Vulnerable Populations



(Gelberg, Andersen, & Leake, 2000)

The Gelberg-Andersen Behavioral Model for Vulnerable Populations (Figure 1.1) is an important expansion of the original Andersen Behavioral model, and includes an emphasis on identifying additional predisposing characteristics, enabling resources, and need factors that are relevant to persons who are homeless and other vulnerable populations, such as mental illness, substance abuse, a history of victimization, severity of homelessness, receipt of public benefits, competing needs, and access to transportation and telephones, the Internet and other information sources (Gelberg, Andersen, & Leake, 2000). The expanded model recognizes that persons who are homeless may face many barriers to accessing health services and specific characteristics, resources, needs, and vulnerabilities may predict less desirable patterns of health services utilization, such as reliance on hospitals and the ED for health problems that could have been addressed earlier in primary care, particularly for a preventable condition. The Gelberg-Andersen Behavioral Model for Vulnerable Populations has also been applied in numerous research studies to describe health services utilization among persons who are homeless and other vulnerable populations (Gelberg, Andersen, & Leake, 2000; Small, 2010, 2011; Stein, Andersen, & Gelberg, 2007; Stein et al., 2000).

The Gelberg-Andersen Behavioral Model for Vulnerable Populations is a useful framework for organizing important concepts relevant to homelessness, mental illness, and patterns of health care utilization. For example, many of the barriers to accessing health care services for homeless persons with mental illness identified in the literature can be categorized as predisposing characteristics, enabling resources, or need factors: negative experiences with the health care system, such as stigma from health care professionals, may predispose individuals to avoid seeking health care, competing priorities, such as a lack of food and

shelter, are enabling resources that may delay seeking health care, and severe physical and mental health problems are need factors that may motivate the use of health services. The model also suggests some ways that Housing First may impact patterns of health care utilization. For example, stable housing may alleviate some health concerns related to living on the street, having a fixed address and access to a telephone may enable individuals to replace their health insurance card and make an appointment with a doctor, and case management or ACT may provide alternatives to care in the ED.

This study will use the Gelberg-Andersen Behavioral Model for Vulnerable Populations to inform the approach for data collection, analysis, and interpretation. The analysis will focus on the effect of an enabling factor (Housing First) on health services utilization (ED utilization) and will consider predisposing characteristics, enabling resources, and need factors as potential confounders.

1.2 Study Objectives

The overall objective of this study is to evaluate the effect of Housing First on ED utilization by homeless individuals with a mental illness in Vancouver, as compared as to the services and support currently available in Vancouver.

1.2.1 Research Questions

Each research question for this study has a descriptive aim and an analytic aim. The primary research question is:

Research Question 1: What is the rate of ED visits among Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months?

Aim 1.1: Describe the rate of ED visits for Vancouver At Home study participants.

Aim 1.2: Compare the rate of ED visits for Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months.

Secondary research questions include:

Research Question 2: What are the reasons for visiting the ED among Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months?

Aim 2.1: Identify the most common presenting complaints and discharge diagnoses and determine what proportion of visits are attributable to mental health or substance-use related reasons for Vancouver At Home study participants.

Aim 2.2: Compare the proportion of visits attributable to mental health or substance use-related reasons between Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months.

Research Question 3: What is the disposition of visits to the ED among Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months?

Aim 3.1: Identify the proportion of ED visits that are admitted to care, discharged with approval, discharged against medical advice, and discharged without being seen, and determine the disposition of ED visits attributable to mental health or substance use-related reasons for Vancouver At Home study participants.

Aim 3.2: Compare the proportion of ED visits admitted to care between Vancouver At Home study participants randomly assigned to Housing First or Usual Care after 12 months.

Chapter 2: Methodology

2.1 Study Design

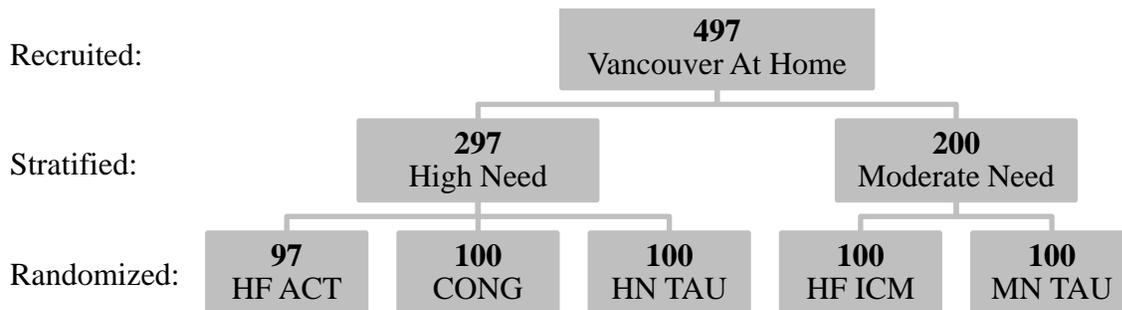
This study is nested within the Vancouver arm of the At Home/Chez Soi study (henceforth referred to as the “Vancouver At Home study”) and involves linking Vancouver At Home study participants to their ED records at St. Paul’s Hospital and Mount Saint Joseph Hospital to evaluate utilization in the 12 month period after participants were randomly assigned to Housing First or Usual Care.

The Vancouver At Home study is a randomized controlled trial (RCT) of Housing First compared to Usual Care for homeless individuals with mental illness, with 24 months of prospective follow-up (ISRCTN57595077, ISRCTN66721740). The Vancouver At Home study shares the same overall study design as the four other arms of the At Home/Chez Soi study in Winnipeg, Toronto, Montreal, and Moncton, which has also been published and registered (Goering, 2009; Goering et al., 2011).

Upon enrolment, participants were stratified into a High Need and Moderate Need group. This allocation was based on the severity of participants’ psychiatric problems and diagnosis, social functioning, and service use from the baseline interview. Then, participants were randomly assigned to Housing First or Usual Care. As a result of this stratification and randomization, there are three Housing First intervention groups and two Usual Care groups in Vancouver. For High Need participants, the Housing First intervention groups are Housing

First and Assertive Community Treatment (HF ACT) and Congregate Housing First and modified Assertive Community Treatment (CONG) and the Usual Care group is HN TAU. For Moderate Need participants, the Housing First intervention group is Housing First and Intensive Case Management (HF ICM) and the Usual Care group is MN TAU.

Figure 2.1: Vancouver At Home Study Design



Participants in one of the Housing First groups receive housing and support from the Vancouver At Home study. The type of housing and support is different for each of the three Housing First interventions. Participants in the Usual Care groups do not receive housing or support from the Vancouver At Home study.

In the HF ACT and HF ICM group, participants live in their own apartment rented through the private-rental market. The housing team for the Vancouver At Home study is responsible for corresponding with landlords and securing housing units throughout the city of Vancouver, to ensure that participants have options in the type and location of housing. Rent subsidies are provided by the Vancouver At Home study so that participants pay no more than 30 percent of their income for housing. The housing team also assists with participants' move-in and can act as a liaison if any issues arise between the participant and their landlord.

This model of housing for the HF ACT and HF ICM group is described as scatter-site housing.

In the CONG group, all participants live in the Bosman Hotel Community, a former motor hotel located in downtown Vancouver that has been converted for the Vancouver At Home Study. Participants in the CONG group have their own room and bathroom, and share amenity space with other residents.

The HF ACT group receives support from an ACT team, which consists of a multidisciplinary team directly providing health and social support services. The ACT team operates on an outreach model and is available 24 hours per day, 7 days per week. The CONG group receives support from a modified ACT team that provides health and social support services that are similar in intensity to the ACT team, but offered on-site at the Bosman Hotel. The Bosman Hotel is staffed 24/7 and some services are only available at certain times. Participants in the CONG group may also have three meals per day on-site and participate in activity and recreation programming. The HF ICM group receives support from an ICM team, which consists of case managers who provide some support directly, but primarily broker and refer participants to health and social support services as appropriate. The ICM team also operates on an outreach model and is available 12 hours per day.

The support services made available to HF ACT, CONG, and HF ICM participants are not mandatory and, besides compliance with the terms of the rental lease, the only requirement

for participants to retain their housing and rent subsidy is a weekly visit with a case manager to ensure safety and well-being.

All participants are interviewed every three months for the duration of the study, and receive a cash honorarium for completing each interview.

2.2 Study Population

The Vancouver At Home study recruited a total of 497 participants between October 2009 and June 2011. Service providers from community agencies and institutional settings, such as homeless shelters, drop-in centers, homeless outreach teams, community mental health teams, criminal justice programs, and hospitals, referred the majority of the participants.

Eligibility criteria was assessed during an initial interview and included: legal adult status, presence of a current mental disorder, and being absolutely homeless or precariously housed. Legal adult status in British Columbia is 19 years of age or older. Presence of a current mental disorder was confirmed by a documented physician diagnosis, or assessed by trained interviewers with the Mini-international Neuropsychiatric Interview (Sheehan et al., 1998). Absolute homelessness was defined as living on the street or in a shelter for at least two weeks during the past year, and precarious housing was defined as living in a rooming house, hotel, or other form of transitional housing with at least one episode of absolute homelessness in the past year.

The analysis of ED use included all Vancouver At Home study participants who (1) provided informed consent for researchers to use their personal health number (PHN) to access health records for research and (2) provided their PHN. A PHN is a unique lifetime identifier used to access health services in the province of British Columbia. All residents of British Columbia are provided with a 10-digit PHN and a physical Care Card bearing one's signature. It costs \$20 to replace a lost Care Card.

Most consenting participants provided their PHN during their initial interview. However, some consenting participants did not have their card with them at the time, or had lost their card. In some of these cases, participants were able to provide information about a recent health care provider, and a request for the PHN was forwarded to the doctor's office or clinic. Some consenting participants were not from British Columbia and did not have a PHN.

Consequently, the analysis of ED use included 382 of 497 participants from the Vancouver At Home study. The baseline characteristics of participants included in the analysis of ED use are reviewed in Section 3.1.

2.3 Sources of Data and Data Linkage

To evaluate ED utilization among Vancouver At Home study participants, participant-level data was linked from (1) the ED database for St. Paul's Hospital and Mount Saint Joseph Hospital, and (2) baseline interviews from the Vancouver At Home study. A confidential linkage was performed using participants' PHN.

The database for St. Paul's Hospital and Mount Saint Joseph Hospital stores an electronic record of each visit to the ED. The database has been well-maintained for clinical and research purposes, and has been used successfully in other research studies.

Records were retrieved for all ED visits for Vancouver At Home study participants from October 2008 to February 15, 2012. For each participant, all records for 12 months before study enrolment (PRE), and 12 months after study enrolment (POST) were retained. Visits that fell on the same date as study enrolment were considered to belong to the PRE-study period.

All Vancouver At Home study participants completed a baseline interview at study enrolment and were followed-up for an interview every three months thereafter for the study duration of 24 months. The interviews are conducted by a team of trained field researchers and consist of a series of detailed survey questionnaires, some of which are standardized instruments and some of which have been specially developed or adapted for the At Home/Chez Soi study (Adair et al., 2012).

2.4 Variables of Interest

Outcome variables describing different aspects of ED utilization were abstracted from the ED database for St. Paul's Hospital and Mount Saint Joseph Hospital. These outcomes correspond with the Research Questions, as outlined in Section 1.2.1.

Explanatory variables were abstracted from the baseline interviews. An intention-to-treat analysis was followed in order to preserve the value of randomization and, therefore, the primary explanatory variable was Study Group (Housing First or Usual Care). Secondary explanatory variables included other predisposing characteristics, enabling resources, and need factors that may have confounded the relationship between Housing First and ED utilization.

2.4.1 Outcome Variables

The outcome variable for Research Question 1 was the **Rate of Visits**. This was defined as the number of visits to the ED at St. Paul's Hospital and Mount Saint Joseph Hospital for each participant during the POST-study period. This rate per person-year accounted for participants who were withdrawn from the study prematurely or were recruited between February 2011 and June 2011, and consequently had less than 12 months of follow-up from when the ED database was accessed and linked for this study in February 2012.

The outcome variables for Research Question 2 were **Presenting Complaint** and **Discharge Diagnosis**.

In the database, one presenting complaint was recorded for each ED visit according to a code and a corresponding category from the Canadian Emergency Department Information System (CEDIS) Presenting Complaint List (Grafstein et al., 2003). Appendix A presents examples of presenting complaints and their corresponding categories from the CEDIS list. For this

study, the Presenting Complaint variable was categorized according to the CEDIS categories for the descriptive analyses in Aim 2.1, and dichotomized as Mental Health/Substance Use or Other for the logistic regression analysis in Aim 2.2.

In the database, discharge diagnoses were recorded for each ED visit according to ICD-10 (International Classification of Diseases and Related Health Problems, 10th revision) coding. Each visit could have multiple discharge diagnoses, but primary diagnoses were distinguished from secondary diagnoses, and only primary discharge diagnoses were retained for this study. Appendix A presents examples of discharge diagnoses, as recorded in the database, and their corresponding categories developed for this study. For this study, the Discharge Diagnosis variable was categorized according to the list described in Appendix A for the descriptive analyses in Aim 2.1, and dichotomized as Psychiatric disorder/Substance use or Other for the logistic regression analysis in Aim 2.2.

The outcome variable for Research Question 3 describing the disposition of each ED visit was **Disposition**. In the database, a field for Emergency Department Disposition categorized each ED visit as: Care Advance or Discharged, and a field for Discharge Disposition categorized each ED visit as: Discharged With Approval, Discharged Without Being Seen, Discharged Against Medical Advice, Discharged Home Services, Discharged to Treatment Centre, Discharged to Hospice, Discharged to Acute, Discharged While on Pass, or Discharged When Notified of Death. For this study, the Disposition variable was categorized as Care Advance or Discharged With Approval, Discharged Without Being Seen, or Discharged Against Medical Advice based on the Discharge Disposition variable for the

descriptive analyses in Aim 3.1 and dichotomized as Care Advance or Discharged based on the Emergency Department Disposition variable for the logistic regression analysis in Aim 3.2.

2.4.2 Explanatory Variables

The primary explanatory variable was **Study Group**, to compare participants randomly assigned to Housing First or Usual Care.

In the overall analyses, Study Group was dichotomized as Housing First or Usual Care and the three Housing First groups (HF ACT, CONG, and HF ICM) were combined and the two Usual Care groups were combined (HN TAU and MN TAU).

In sub-analyses, the study population was stratified by High Need and Moderate Need and analyzed separately. Study Group was categorized as HF ACT, CONG, or HN TAU for the High Need group analysis and HF ICM or MN TAU for the Moderate Need group analysis.

In multivariable models for the overall and sub-analyses, secondary explanatory variables were included in addition to the primary explanatory variable of Study Group. These secondary explanatory variables included predisposing characteristics, enabling resources and need factors that may have confounded the relationship between Housing First and ED utilization, given that: (1) the potential confounder may have been unbalanced across the Housing First and Usual Care group, (2) the potential confounder may have been associated

with ED utilization, and (3) the potential confounder was not part of the causal pathway from Housing First to ED utilization.

Predisposing Characteristics – **Age** was described as a continuous variable in years. **Sex** was dichotomized as Male or Female. **Ethnicity** was categorized as Caucasian, Aboriginal, or Mixed/Other. **Duration of Homelessness** was a continuous variable elicited by the question: “In your lifetime, what is the total amount of time you have been homeless (months)?”

Enabling Resources – Access to Health Care was described by three dichotomous variables, elicited by the questions: “Do you have a regular family doctor?” for the **Access: Family Doctor** variable, “Is there a place that you usually go to when you’re sick or in need of advice about your health?” for the **Access: Usual Place** variable, and “In the past 6 months, was there ever a time when you felt that you needed health care but you did not receive it?” for the **Access: Unmet Need** variable.

Need Factors – **Severe Mental Illness** was a dichotomous variable that included participants with current psychosis, a mood disorder with psychotic features, or a hypomanic or manic episode, as identified with the MINI at baseline. **Less Severe Mental Illness** was a dichotomous variable that included participants with a current major depressive disorder, panic disorder, or posttraumatic stress disorder, as identified with the MINI at baseline.

Substance Dependence was a dichotomous variable that included participants with a current substance dependence disorder, also identified by the MINI at baseline.

For Research Question 1, the **Baseline Rate of Visits** was included as a covariate to adjust for baseline differences in the rate of ED visits. This was defined as the number of visits at St. Paul's Hospital and Mount Saint Joseph Hospital per person-year, during the PRE-study period.

For Research Question 2 and Research Question 3, **Study Period** was included as a covariate to denote the study period of each ED visit as PRE or POST.

2.5 Statistical Analyses

Research Question 1

The unit of analysis for Research Question 1 was the participant. For the descriptive results in Aim 1.1, measures of central tendency, skew, and kurtosis were reported and graphs were constructed.

For the analytic results in Aim 1.2, negative binomial regression was used to model the **Rate of Visits** to the ED for participants randomly assigned to the Housing First or Usual Care group after 12 months. All participants, including those with zero visits, were included in the analyses.

First, univariable negative binomial regression was used to model the association between the Rate of Visits and each explanatory variable (those listed in Section 2.4.2). Next,

multivariable negative binomial regression was used to model the independent association between the Rate of Visits and Study Group, adjusting for potential confounders, and proceeded in two steps: the first multivariable model included Baseline Rate of Visits as a covariate, and the second multivariable model included Baseline Rate of Visits and the secondary explanatory variables as covariates. The univariable and multivariable negative binomial regression models were constructed for the overall study population and stratified by High Need and Moderate Need for sub-analyses.

In all models, the parameter of interest was the exponentiated coefficient for Study Group, representing the rate ratio for Housing First participants compared to Usual Care. Two-sided p-values and 95% confidence intervals were reported.

Negative binomial regression was chosen for these analyses after comparing the goodness of fit for an unadjusted Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial regression model. The Poisson distribution is often the first choice for regression models where the outcome of interest is a count or rate. However, the distribution of the Rate of Visits was over dispersed and consequently the assumption of the equivalence of the mean and variance for the Poisson distribution was not valid. For this reason, a negative binomial regression model was considered. The negative binomial distribution does not require the mean to equal the variance and is usually a good fit for over dispersed count data (Glynn & Buring, 1996). The distribution of the Rate of Visits also had many zeros (~40% of participants had zero visits). For this reason, zero-inflated Poisson and zero-inflated negative binomial regression models were also considered. Zero-inflated models are

two-component mixture models, with a Poisson or negative binomial model for predicting the count and a logit model for predicting zeros (Cheung, 2002).

Research Question 2 and Research Question 3

The unit of analysis for Research Question 2 and Research Question 3 was the visit to the ED. All visits PRE and POST were included in these analyses. For the descriptive results in Aim 2.1 and Aim 3.1, counts and proportions were reported.

For the analytic results in Aim 2.2 and Aim 3.2, logistic regression was used to model the **Presenting Complaint, Discharge Diagnosis, and Disposition** for participants randomly assigned to the Housing First or Usual Care group. Since the assumption of independence of observations was likely not valid (i.e. multiple visits for the same participant may be correlated), a generalized estimating equation (GEE) approach with an exchangeable correlation matrix was used to extend the logistic regression model to account for correlation of clustered observations (Fitzmaurice, Laird, & Ware, 2011).

The explanatory variables for the regression model were Study Group and Study Period (denoting whether each visit was PRE or POST), and the parameter of interest was the exponentiated coefficient for the Study Group * Study Period interaction term, representing the odds ratio for the Housing First group compared to Usual Care, in the POST-study period compared to PRE. Sub-analyses by High Need or Moderate Need were not conducted for these analyses. Two-sided p-values and 95% confidence intervals were reported.

2.5.1 Missing Data

Outcome data was complete for the Rate of Visits and Disposition. Missing responses for Presenting Complaint (1.5% of 2200 visits) and Discharge Diagnosis (11.5% of 2200 visits) were collapsed into the “Other” category.

No data were missing for Study Group, the primary explanatory variable. Less than 5% of responses were missing from the baseline interviews for the secondary explanatory variables. Consequently, cases with missing responses were dropped from multivariable regression models that included the secondary explanatory variables.

2.6 Ethical Considerations

This research study was conducted in accordance with the policies of the University of British Columbia, Providence Health Care-St. Paul’s Hospital, Simon Fraser University, and the Tri-Council Policy Statement on Research Involving Human Subjects.

All research described in this study was conducted under the approval of the University of British Columbia/Providence Health Care Research Ethics Board (certificate H11-01083). The protocol for the Vancouver At Home study was also approved by the Research Ethics Board at the University of British Columbia and Simon Fraser University.

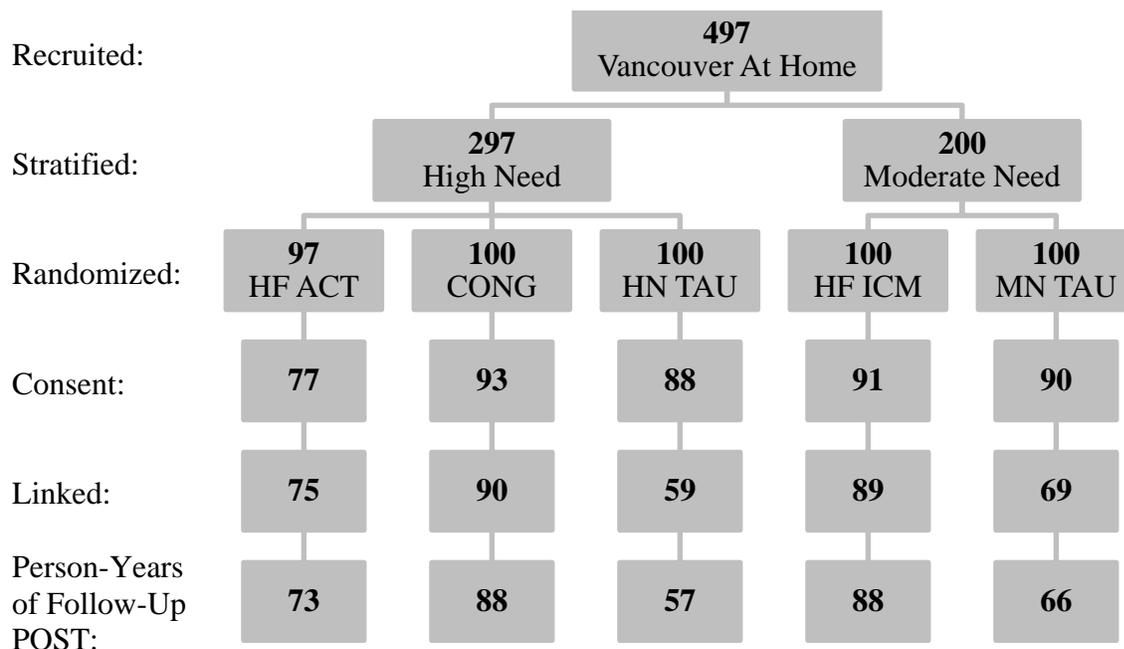
Participants were informed of potential risks and benefits of participating in the Vancouver At Home study, including the RCT study design. Participants were asked to review and sign an additional consent form allowing researchers to use their PHN to access their health records for research, with the understanding that this information would be used to evaluate the Housing First intervention and would not be released to other agencies. The primary ethical concern for this study was ensuring the confidentiality of participants' personal information, including PHNs.

Chapter 3: Results

3.1 Data Linkage

Figure 3.1 diagrams the flow of study participation and data linkage. 439 (88% of 497 total participants) Vancouver At Home study participants provided consent for the use of their PHN for research. From this group, 382 PHNs (87% of 439 consenting participants) were collected and linked to the St. Paul’s Hospital and Mount Saint Joseph Hospital ED database on February 15, 2012. Accounting for participants with less than 12 months of follow-up in the POST-study period, there were 372 person-years of prospective follow-up for 382 participants.

Figure 3.1: Results of Data Linkage



Compared to participants linked to the database and included in the analysis (n=382), participants not linked to the database (n=115) were significantly more likely to be randomly assigned to the Usual Care group (63% versus 34%; p-value <0.000), to be withdrawn from the study prior to data linkage (10% versus 4%; p-value=0.017), to not have a family doctor (55% versus 67%; p-value=0.013), and marginally significantly more likely to have a severe mental illness (80% versus 71%; p-value=0.055) (Appendix B, Table 5.3)

The data linkage retrieved records for 3312 ED visits from October 01, 2008 to February 15, 2012. After eliminating visits that were outside of the PRE or POST-study period for each participant, records for 2200 ED visits were retained, of which 962 visits were in the PRE-study period and 1238 visits were in the POST-study period.

3.2 Rate of Visits

3.2.1 Aim 1.1 – Descriptive Results

Overall, 60% of participants had at least one ED visit in the POST-study period. The top 10% most frequent users had 9 or more ED visits per year POST. The distribution of ED visits for all participants was highly right-skewed, with many excess zeros (Figure 3.2; Table 3.1). The majority of all ED visits (96%) were at St. Paul's Hospital.

The mean rate of visits increased for the overall study population from the PRE to the POST-study period, and the magnitude of the increase was greater for the Usual Care group

compared to the Housing First group (Figure 3.3). High Need participants had a higher rate of visits than Moderate Need participants. The mean rate of visits decreased from PRE to POST for the HF ACT group and increased from PRE to POST for the CONG group, but the magnitude of the increase for the CONG group was less than for the HN TAU group (Figure 3.4). The magnitude of the increase for the HF ICM group was also less than for the MN TAU group (Figure 3.5).

Figure 3.2: Distribution of Visits per Year POST for All Participants

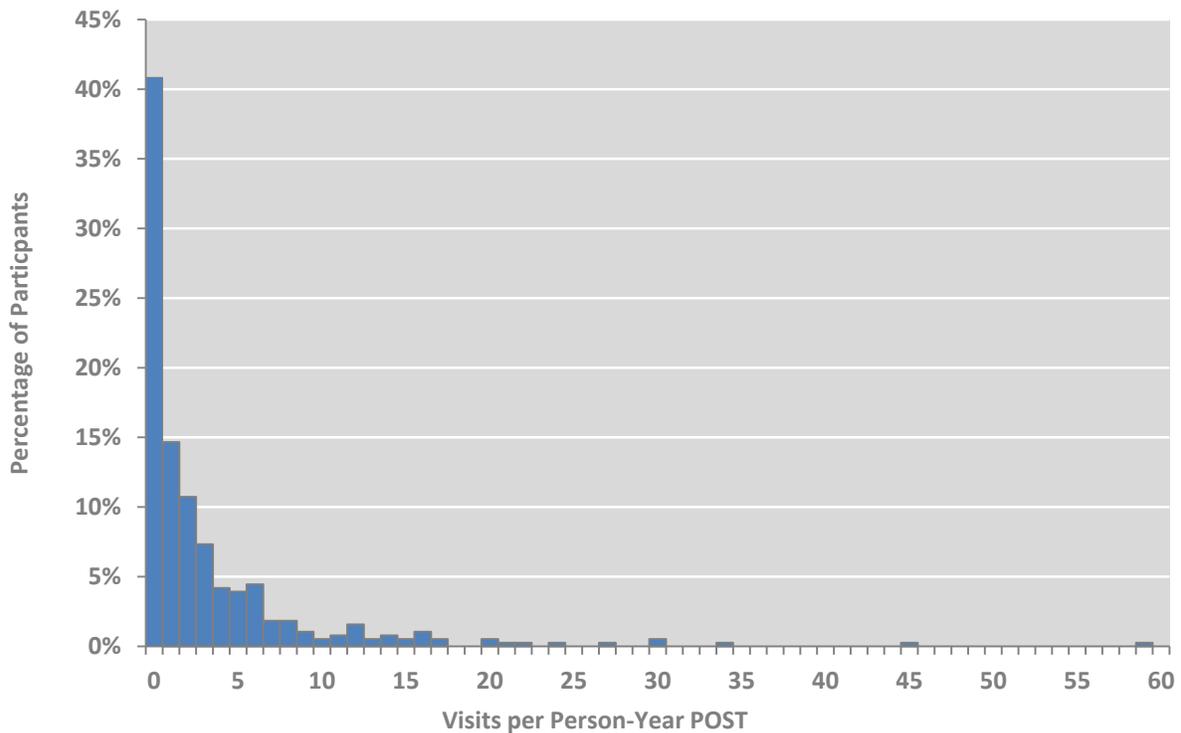


Table 3.1: Distribution of visits per year POST for All Participants

Mean (SD)	Median (IQR)	Range	Skew	Kurtosis
3.32 (6.21)	1 (0-4)	0-59	4.17	24.86

Figure 3.3: Visits per Year PRE and POST for All Participants

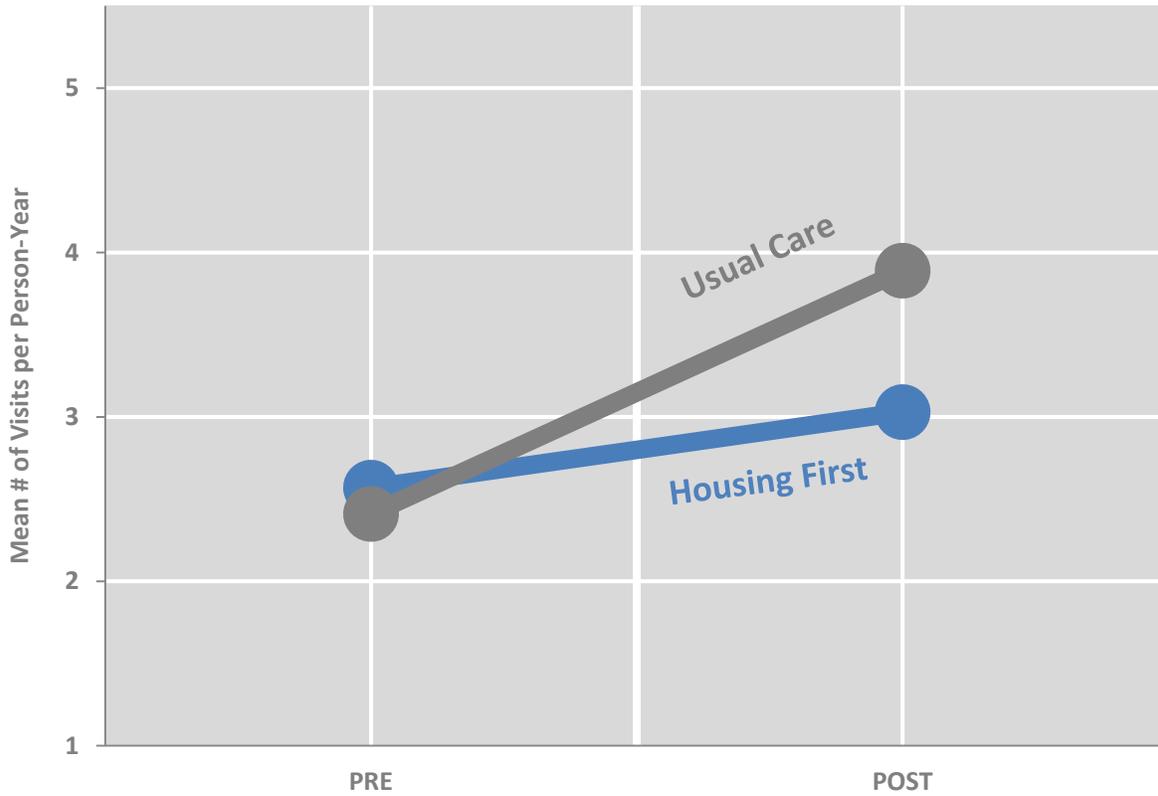


Table 3.2: Visits per Year PRE and POST for All Participants

Study Group	Study Period	Person -Years	Visits	Visits Per Person-Year			
			Total	Total	Mean (SD)	Median	Range
Housing First	PRE	254	653	653	2.57 (4.29)	1	0-34
	POST	249	746	769	3.03 (5.01)	1	0-35
Usual Care	PRE	128	309	309	2.41 (4.34)	1	0-33
	POST	123	492	500	3.89 (8.06)	1	0-59

Figure 3.4: Visits per Year PRE and POST for High Need Participants

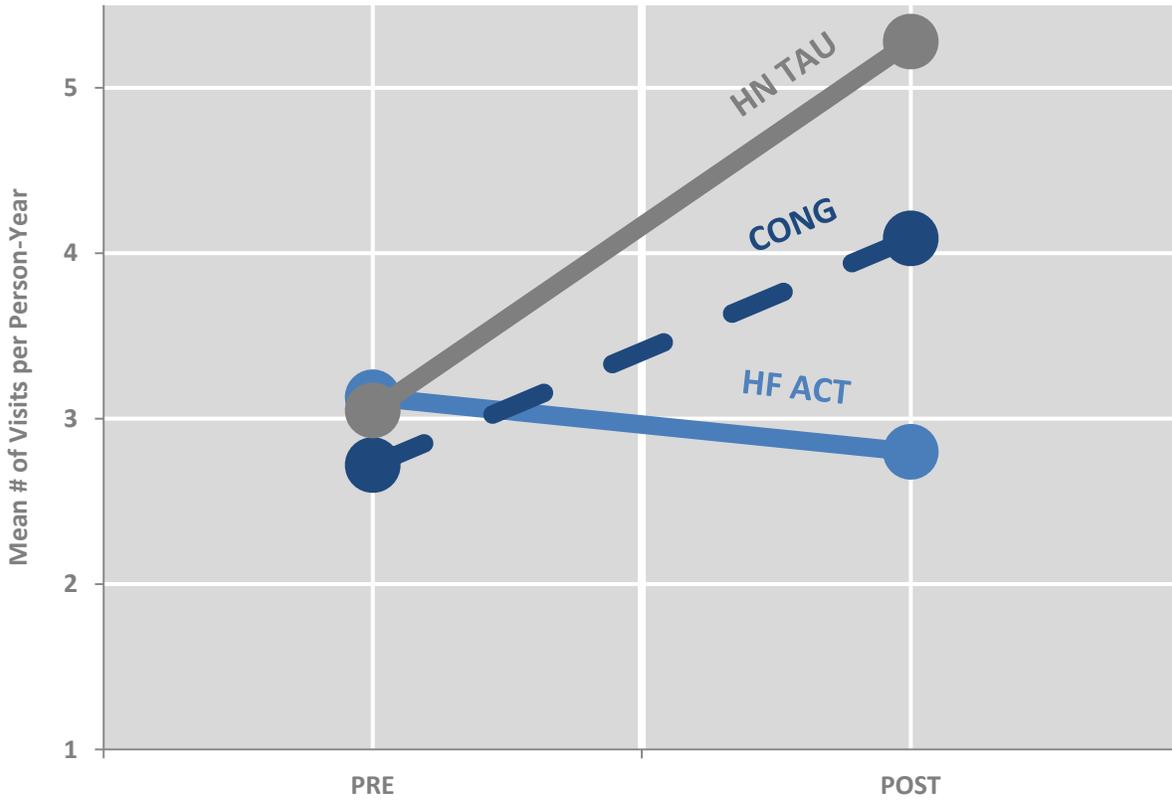


Table 3.3: Visits per Year PRE and POST for High Need Participants

Study Group	Study Period	Person -Years	Visits Per Person-Year				
			Visits Total	Visits Total	Mean (SD)	Median	Range
HF ACT	PRE	75	235	235	3.13 (5.47)	1	0-34
	POST	73	196	210	2.80 (4.80)	1.2	0-35
CONG	PRE	90	245	245	2.72 (4.18)	1	0-21
	POST	88	361	368	4.09 (6.04)	2	0-30
HN TAU	PRE	59	180	180	3.05 (5.60)	1	0-33
	POST	57	307	312	5.28 (10.7)	2	0-59

Figure 3.5: Visits per Year PRE and POST for Moderate Need Participants

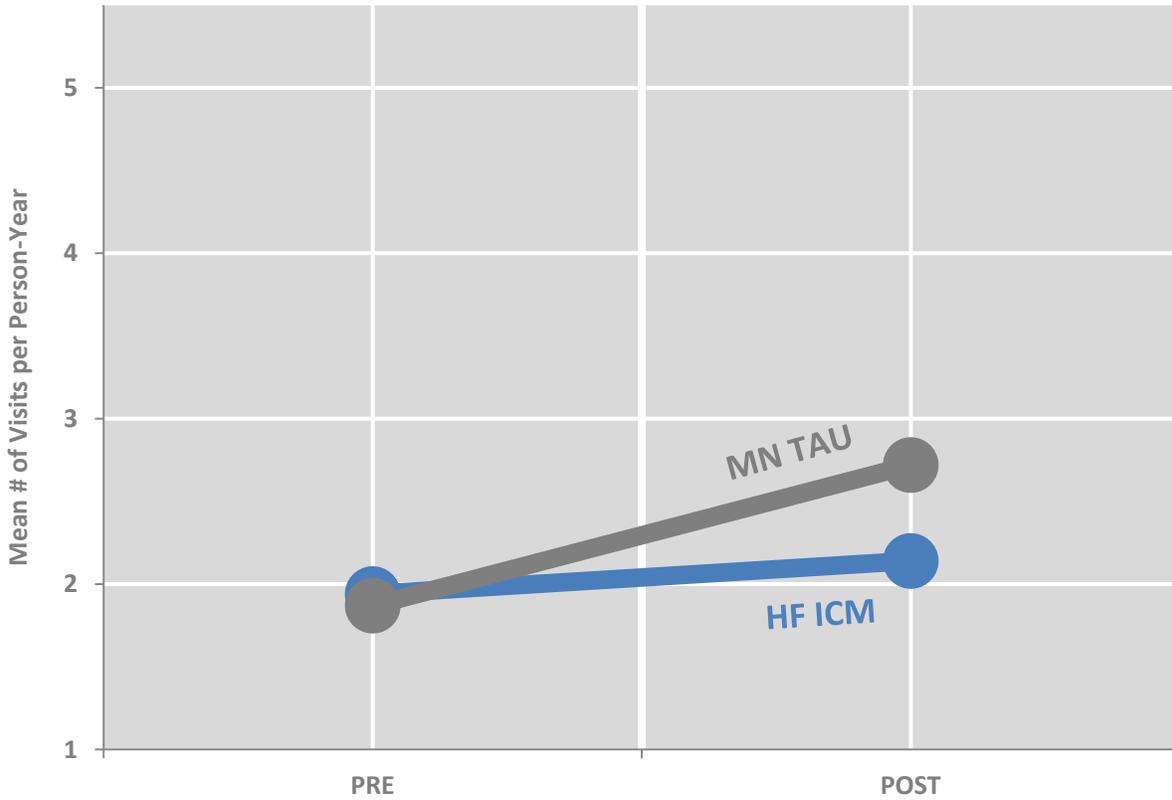


Table 3.4: Visits per Year PRE and POST Moderate Need Participants

Study Group	Study Period	Person -Years	Visits		Visits Per Person-Year		
			Total	Total	Mean SD	Median	Range
HF ICM	PRE	89	173	173	1.94 (3.08)	1	0-13
	POST	88	189	191	2.14 (3.74)	0	0-17
MN TAU	PRE	69	129	129	1.87 (2.80)	1	0-21
	POST	66	185	188	2.72 (4.63)	1	0-21

3.2.2 Aim 1.2 – Analytic Results

All Participants

Table 3.5 presents the results of the univariable and multivariable negative binomial regression models for the Rate of Visits (POST) for all participants, in which Study Group was categorized as Housing First (HF ACT, CONG, and HF ICM) or Usual Care (HN TAU and MN TAU).

The rate ratio for Housing First compared to Usual Care was significantly different in the multivariable model adjusted for the Baseline Rate of Visits and in the multivariable model adjusted for the Baseline Rate of Visits and other secondary explanatory variables, but not significantly different in the univariable regression model.

In the fully adjusted multivariable model, the Rate of Visits **was 0.66 times less (95% CI: 0.47-0.93)** for Housing First participants than Usual Care. The Rate of Visits was also positively associated with Baseline Rate of Visits, Caucasian Ethnicity, a ‘Yes’ response for the Access: Usual Place variable, and presence of a Less Severe Mental Illness, and negatively associated with Age in the fully adjusted multivariable model.

High Need Participants

Table 3.6 presents the results of the univariable and multivariable negative binomial regression models for the Rate of Visits for High Need participants in HF ACT and CONG compared to HN TAU.

For High Need participants, the rate ratio for Housing First compared to Usual Care was significantly different for the HF ACT group compared to the HN TAU group in the univariable and multivariable models, but was not significantly different for the CONG group compared to the HN TAU group in any models.

In the fully adjusted multivariable model, the Rate of Visits was **0.49 times less (95%CI: 0.29-0.84)** for HF ACT than HN TAU and 0.81 times less (95% CI: 0.49-1.35; not statistically significant) for CONG than HN TAU. The Rate of Visits was also positively associated with the Baseline Rate of Visits and negatively associated with Age in the fully adjusted multivariable model.

Moderate Need Participants

Table 3.7 presents the results of the univariable and multivariable negative binomial regression models for the Rate of Visits for Moderate Need participants in HF ICM compared to MN TAU.

For Moderate Need participants, the rate ratio for Housing First compared to Usual Care was significantly different for the HF ICM group compared to the MN TAU group in the fully adjusted multivariable model, but not significantly different in the univariable model or the multivariable model adjusted for the Baseline Rate of Visits.

In the fully adjusted multivariable model, the rate of ED visits post study enrolment was **0.47 times less (95% CI: 0.26-0.84)** for the HF ICM group compared to the MN TAU group. The Rate of Visits was also positively associated with the Baseline Rate of Visits and Caucasian Ethnicity, and negatively associated with a 'Yes' response to the Access: Unmet Need variable in the fully adjusted multivariable model.

Table 3.5: Negative Binomial Regression for Rate of Visits POST for All Participants

		Univariable Model		Multivariable Model		Multivariable Model	
		Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value
Study Group	Housing First	0.77 (0.54-1.10)	0.147	0.64 (0.46-0.89)	0.008	0.66 (0.47-0.93)	0.018
	Usual Care*	-	-	-	-	-	-
Baseline Rate of Visits		1.15 (1.10-1.20)	<0.001	1.15 (1.10-1.21)	<0.001	1.16 (1.10-1.22)	<0.001
Age (Years)		0.99 (0.97-1.00)	0.179	-	-	0.98 (0.97-1.00)	0.042
Sex	Female	1.04 (0.71 -1.51)	0.849	-	-	0.91 (0.63-1.32)	0.626
	Male*	-	-	-	-	-	-
Ethnicity	Aboriginal	1.41 (0.84-2.38)	0.195	-	-	1.03 (0.60-1.75)	0.922
	Caucasian	1.51 (1.03-2.23)	0.037	-	-	1.51 (1.04-2.20)	0.032
	Other*	-	-	-	-	-	-
Duration of Homelessness		1.00 (1.00-1.00)	0.607	-	-	1.00 (1.00-1.00)	0.557
Severe Mental Illness		0.95 (0.68-1.34)	0.780	-	-	1.10 (0.79-1.53)	0.585
Less Severe Mental Illness		1.33 (0.91-1.92)	0.137	-	-	1.62 (1.11-2.36)	0.013
Substance Dependence		1.19 (0.84-1.67)	0.323	-	-	0.97 (0.69-1.38)	0.881
Access: Family Doctor		1.18 (0.82-1.69)	0.377	-	-	1.11 (0.77-1.60)	0.575
Access: Usual Place		1.92 (1.24- 2.99)	0.004	-	-	1.67 (1.08-2.58)	0.022
Access: Unmet Need		1.45 (1.03-2.04)	0.033	-	-	1.10 (0.79-1.54)	0.580

*=Reference category

Table 3.6: Negative Binomial Regression for Rate of Visits POST for High Need Participants

		Univariable Model		Multivariable Model		Multivariable Model	
		Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value
Study Group	HF ACT	0.52 (0.31-0.89)	0.016	0.43 (0.26-0.70)	0.001	0.49 (0.29-0.84)	0.009
	CONG	0.77 (0.47-1.27)	0.314	0.68 (0.43-1.07)	0.093	0.81 (0.49-1.35)	0.417
	HN TAU*	-	-	-	-	-	-
Baseline Rate of Visits		1.12 (1.07-1.18)	<0.001	1.13 (1.08-1.19)	<0.001	1.12 (1.07-1.18)	<0.001
Age (Years)		0.99 (0.97-1.01)	0.355	-	-	0.97 (0.95-0.99)	0.011
Sex	Female	1.12 (0.70-1.79)	0.631	-	-	1.09 (0.70-1.70)	0.706
	Male*	-	-	-	-	-	-
Ethnicity	Aboriginal	1.31 (0.69-2.47)	0.407	-	-	0.84 (0.44-1.61)	0.600
	Caucasian	1.52 (0.96-2.42)	0.077	-	-	1.34 (0.84-2.13)	0.219
	Other*	-	-	-	-	-	-
Duration of Homelessness		1.00 (1.00-1.00)	0.468	-	-	1.00 (1.00-1.00)	0.394
Severe Mental Illness		1.26 (0.83-1.90)	0.275	-	-	1.16 (0.78-1.72)	0.460
Less Severe Mental Illness		0.95 (0.47-1.92)	0.893	-	-	1.24 (0.63-2.45)	0.540
Substance Dependence		1.01 (0.66-1.54)	0.980	-	-	0.71 (0.45-1.11)	0.129
Access: Family Doctor		1.23 (0.80-1.88)	0.345	-	-	1.13 (0.74-1.73)	0.575
Access: Usual Place		2.20 (1.30-3.74)	0.003	-	-	1.62 (0.96-2.75)	0.071
Access: Unmet Need		1.75 (1.16-2.63)	0.008	-	-	1.36 (0.90-2.05)	0.141

*=Reference category

Table 3.7: Negative Binomial Regression for Rate of Visits POST for Moderate Need Participants

		Univariable Model		Multivariable Model		Multivariable Model	
		Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value	Rate Ratio (95% CI)	P-Value
Study Group	HF ICM	0.78 (0.44-1.38)	0.393	0.67 (0.39-1.14)	0.141	0.47 (0.26-0.84)	0.011
	MN TAU	-	-	-	-	-	-
Baseline Rate of Visits		1.20 (1.08-1.32)	0.001	1.20 (1.10-1.33)	<0.001	1.26 (1.14-1.40)	<0.001
Age (Years)		0.99 (0.97-1.02)	0.668	-	-	1.00 (0.98-1.03)	0.896
Sex	Female	0.92 (0.49-1.73)	0.797	-	-	0.62 (0.32-1.17)	0.139
	Male*	-	-	-	-	-	-
Ethnicity	Aboriginal	1.81 (0.74-4.42)	0.193	-	-	1.79 (0.73-4.39)	0.205
	Caucasian	1.64 (0.83-3.23)	0.154	-	-	2.48 (1.25-4.92)	0.009
	Other*	-	-	-	-	-	-
Duration of Homelessness		1.00 (1.00-1.01)	0.922	-	-	1.00 (1.00-1.01)	0.812
Severe Mental Illness		0.70 (0.38-1.28)	0.248	-	-	0.88 (0.45-1.75)	0.717
Less Severe Mental Illness		1.05 (0.59-1.87)	0.879	-	-	1.34 (0.71-2.54)	0.368
Substance Dependence		1.44 (0.82-2.55)	0.208	-	-	1.42 (0.80-2.54)	0.234
Access: Family Doctor		1.23 (0.65-2.34)	0.532	-	-	1.17 (0.62-2.19)	0.629
Access: Usual Place		1.49 (0.69-3.21)	0.305	-	-	1.51 (0.69-3.31)	0.299
Access: Unmet Need		0.93 (0.52-1.67)	0.799	-	-	0.54 (0.30-0.99)	0.046

*=Reference category

3.3 Presenting Complaints

3.3.1 Aim 2.1 – Descriptive Results

The top 5 most common Presenting Complaints for the Housing First group in the POST-study period were: Mental Health (30%), General and Minor (16%), Gastrointestinal (10%), Skin (9%) and Orthopedic (8%) (Table 3.8). Combined, Mental Health and Substance Use represented 35% of Presenting Complaints for the Housing First group in the POST-study period.

The top 5 most common Presenting Complaints for the Usual Care group in the POST-study period were: General and Minor (19%), Mental Health (18%), Orthopedic (10%), Neurologic (9%), and Skin (9%). Combined, Mental Health and Substance Use represented 23% of Presenting Complaints for the Usual Care group in the POST-study period.

The proportion of visits with Mental Health or Substance Use Presenting Complaints increased from 34% to 35% for the Housing First group and decreased from 31% to 23% for the Usual Care group from PRE to POST. The proportion of visits with General and Minor, Gastrointestinal, Skin, or Orthopedic Presenting Complaints decreased from 48% to 43% for the Housing First group and increased from 43% to 46% for the Usual Care group from PRE to POST.

The most common Mental Health or Substance Use Presenting Complaints for the Housing First group in the POST-study period were: bizarre/paranoid behavior (11%), suicidal ideation/attempt (9.2%), anxiety (5.6%), and substance misuse/intoxication (5.6%). The most common Mental Health or Substance Use Presenting Complaints for the Usual Care group in the POST-study period were: bizarre/paranoid behavior (7.5%), substance misuse/intoxication (4.1%), anxiety (3.9%), and suicidal ideation/attempt (3.9%).

Table 3.8: Presenting Complaint PRE and POST

Presenting Complaint	Housing First		Usual Care	
	PRE	POST	PRE	POST
Mental Health	168 (26%)	222 (30%)	83 (27%)	90 (18%)
General and Minor	130 (20%)	117 (16%)	55 (18%)	95 (19%)
Gastrointestinal	38 (6%)	73 (10%)	25 (8%)	41 (8%)
Skin	96 (15%)	69 (9%)	30 (10%)	42 (9%)
Orthopedic	43 (7%)	58 (8%)	22 (7%)	51 (10%)
Ears Nose Throat	25 (4%)	48 (6%)	15 (5%)	36 (7%)
Neurologic	38 (6%)	38 (5%)	30 (10%)	46 (9%)
Substance Use	43 (7%)	38 (5%)	12 (4%)	27 (5%)
Cardiovascular	16 (2%)	22 (3%)	17 (6%)	28 (6%)
Infectious Disease	10 (2%)	15 (2%)	4 (1%)	8 (2%)
Respiratory	21 (3%)	20 (3%)	6 (2%)	9 (2%)
Genitourinary	7 (1%)	13 (2%)	4 (1%)	5 (1%)
Trauma	4 (1%)	4 (1%)	1 (0%)	3 (1%)
Environmental	2 (0%)	2 (0%)	1 (0%)	0 (0%)
Missing	12 (2%)	7 (1%)	4 (1%)	11 (2%)
Total Visits	653 (100%)	746 (100%)	309 (100%)	492 (100%)

3.1.1 Aim 2.2 – Analytic Results

In the GEE logistic regression for Presenting Complaint: Mental Health/Substance Use versus Others, the interaction term for Study Group: Housing First * Study Period: POST

was not statistically significant, so there was no evidence to conclude that the odds of a Mental Health or Substance Use-related Presenting Complaint was different for visits from the Housing First group compared to the Usual Care group, in the POST-study period compared to the PRE-study period (Table 3.9).

Table 3.9: GEE Logistic Regression for Presenting Complaint: Mental Health / Substance Use

Parameter	Odds Ratio (95% CI)	P-Value
Study Group: Housing First	0.94 (0.62-1.42)	0.771
Study Period: POST	0.95 (0.66-1.35)	0.761
Study Group: Housing First * Study Period: POST	0.98 (0.64-1.51)	0.941

3.2 Discharge Diagnosis

3.2.1 Aim 2.1 – Descriptive Results

The top 5 most common Discharge Diagnoses for the Housing First group in the POST-study period were: Psychiatric disorders (25%), Substance use (13%), Abscesses, cellulitis, and other skin infections (8%), Gastrointestinal and urological disorders (7%), and Medication refills and aftercare (6%) (Table 3.10). 5% of Discharge Diagnoses were categorized as Other.

The top 5 most common Discharge Diagnoses for the Usual Care group in the POST-study period were: Psychiatric disorders (17%), Substance use (11%), Musculoskeletal injuries (10%), Abscesses, cellulitis, and other skin infections (9%), and Medication refills and aftercare (8%). 6% of Discharge Diagnoses were categorized as Other.

The proportion of visits with a Discharge Diagnosis for Psychiatric disorders or Substance use increased from 34% to 38% for the Housing First group and decreased from 34% to 28% for the Usual Care group from PRE to POST. The proportion of visits with a Discharge Diagnosis for Abscesses, cellulitis, and other skin infections, Gastrointestinal and urological disorders, Musculoskeletal injuries, or Medication refills and aftercare increased from 24 % to 27% for the Housing First group and increased from 28% to 34% for the Usual Care group from PRE to POST.

The most common Psychiatric disorders or Substance use Discharge Diagnoses for the Housing First group in the POST-study period were: psychosis (8.2%), schizophrenia (5.4%), alcohol (4.7%), and suicidal attempt/ideation (3.9%). The most common Psychiatric disorders or Substance use Discharge Diagnoses for the Usual Care group in the POST-study period were: psychosis (6.3%), alcohol (3.9%), narcotic request (3.9%), and schizophrenia (3.5%).

Table 3.10: Discharge Diagnosis PRE and POST

Discharge Diagnosis	Housing First		Usual Care	
	PRE	POST	PRE	POST
Psychiatric disorders	151 (23%)	190 (25%)	76 (25%)	85 (17%)
Substance use	69 (11%)	94 (13%)	28 (9%)	54 (11%)
Abscesses, cellulitis, and other skin infections	79 (12%)	56 (8%)	31 (10%)	43 (9%)
Gastrointestinal and urological disorders	29 (4%)	55 (7%)	19 (6%)	36 (7%)
Medication refills and aftercare	26 (4%)	47 (6%)	18 (6%)	39 (8%)
Musculoskeletal injuries	29 (4%)	45 (6%)	18 (6%)	50 (10%)
Wounds, lacerations, and contusions	49 (8%)	40 (5%)	20 (6%)	27 (5%)
Respiratory disorders	21 (3%)	23 (3%)	6 (2%)	11 (2%)
Dental pain	11 (2%)	21 (3%)	7 (2%)	12 (2%)
Neurological disorders	18 (3%)	19 (3%)	15 (5%)	13 (3%)
Fractures and dislocations	17 (3%)	18 (2%)	9 (3%)	12 (2%)
Bacterial and viral infections	12 (2%)	13 (2%)	4 (1%)	5 (1%)
Cardiovascular disorders	39 (6%)	11 (1%)	6 (2%)	3 (1%)
Trauma	1 (0%)	0 (0%)	0 (0%)	0 (0%)
Other	35 (5%)	40 (5%)	14 (5%)	29 (6%)
Diagnosis missing or unclassified	67 (10%)	74 (10%)	38 (12%)	73 (15%)
Total Visits	653 (100%)	746 (100%)	309 (100%)	492 (100%)

3.2.2 Aim 2.2 – Analytic Results

In the GEE logistic regression for Discharge Diagnosis: Psychiatric disorders/Substance use versus Others, the interaction term for Study Group: Housing First * Study Period: POST was not statistically significant, so there was no evidence to conclude that the odds of a Psychiatric disorder or Substance use-related diagnosis was different for visits from the

Housing First group compared to the Usual Care group, in the POST-study period compared to the PRE-study period (Table 3.11).

Table 3.11: GEE Logistic Regression for Discharge Diagnosis: Psychiatric disorders / Substance use

Parameter	Odds Ratio (95% CI)	P-Value
Study Group: Housing First	0.87 (0.59-1.27)	0.465
Study Period: POST	0.87 (0.58-1.29)	0.477
Study Group: Housing First * Study Period: POST	1.18 (0.75-1.86)	0.465

3.3 Disposition

3.3.1 Aim 3.1 – Descriptive Results

The majority of visits resulted in discharge from the ED (Table 3.12). In the POST-study period, 102 visits from Housing First participants (14%) and 57 visits from Usual Care participants (12%) were recorded as Care Advance. The proportion of visits recorded as Care Advance increased from 13% to 14% for the Housing First group from PRE to POST and decreased from 16% to 12% for the Usual Care group from PRE to POST.

8% of visits from Housing First participants (8%) and 10% of visits from Usual Care participants were recorded as Discharged Without Being Seen or Discharged Against Medical Advice in the POST-study period.

In the POST-study period, the Presenting Complaint was Mental Health or Substance Use for 81% of visits that resulted in Care Advance, 24% of visits that were Discharged with

Approval, 12% of visits that were Discharged Without Being Seen, and 25% of visits that were Discharged Against Medical Advice.

In the POST-study period, the Discharge Diagnosis was Psychiatric disorder or Substance use for 76% of visits that resulted in Care Advance, 24% of visits that were Discharged with Approval, 29% of visits that were Discharged Without Being Seen, and 33% of visits that were Discharged Against Medical Advice.

Table 3.12: Disposition PRE and POST

Disposition	Housing First		Usual Care	
	PRE	POST	PRE	POST
Care Advance	87 (13%)	102 (14%)	48 (16%)	57 (12%)
Discharged	WA	525 (80%)	585 (78%)	238 (77%)
	WBS	10 (2%)	24 (3%)	5 (2%)
	AMA	31 (5%)	35 (5%)	18 (6%)
Total Visits	653 (100%)	746 (100%)	309 (100%)	492 (100%)

WA=With Approval, WBS=Without Being Seen, AMA=Against Medical Advice

3.3.2 Aim 3.2 – Analytic Results

In the GEE logistic regression for Disposition: Care Advance versus Discharged, the interaction term for Study Group: Housing First * Study Period: POST was not statistically significant, so there was no evidence to conclude that the odds of Care Advance was different for visits from the Housing First group compared to the Usual Care group, in the POST-study period compared to the PRE-study period (Table 3.13)

Table 3.13: GEE Logistic Regression for Disposition: Care Advance

Parameter	Odds Ratio (95% CI)	P-Value
Study Group: Housing First	0.82 (0.51-1.31)	0.403
Study Period: POST	0.73 (0.46-1.17)	0.193
Study Group: Housing First * Study Period: POST	1.21 (0.68-2.15)	0.520

Chapter 4: Conclusion

4.1 Interpretation and Implications of Study Findings

This study examined different aspects of ED utilization for 382 homeless individuals with mental illness in Vancouver, and compared study participants who were randomly assigned to Housing First or Usual Care after 12 months.

Research Question 1

Overall, there was considerable use of the ED as a source of health care among participants in this study. The majority of participants had at least one visit to the ED at St. Paul's Hospital or Mount Saint Joseph Hospital in the POST-study period, and the top 10% most frequent visitors had 9 or more visits per year POST.

This coincides with empirical studies of health care utilization among persons who are homeless, which find that, despite poor health status and high levels of unmet need for health care, persons who are homeless use inpatient and ED services frequently and underutilize outpatient care (Desai, Rosenheck, & Kaspro, 2003; Kushel, Vittinghoff, & Haas, 2001). The Gelberg-Andersen Behavioral Model for Vulnerable Populations suggests that these patterns of health care utilization are related to competing priorities and other barriers experienced by persons who are homeless (Gelberg, Andersen, & Leake, 2000; Gelberg et al., 1997).

Additionally, just as Kuhn and Culhane (Kuhn & Culhane, 1998) observed that there is a group of chronically homeless persons who constitute a small percentage of the homeless population, but use the most services and incur the greatest costs to society, health services researchers have identified that a small group of patients may account for a disproportionately large share of visits to hospital EDs. A systematic review of 25 studies from the United States estimated that 4.5% to 8% of all patients account for 21% to 28% of all visits to the ED (LaCalle & Rabin, 2010). Studies of frequent ED users find that these individuals are medically and socially vulnerable. For example, frequent ED users are more likely to experience homelessness (Lang et al., 1997; Mandelberg, Kuhn, & Kohn, 2000), low socioeconomic status (Sun, Burstin, & Brennan, 2003), and poor social support (Lang et al., 1997) than other patients, and may present to the ED for chronic medical conditions (Mandelberg, Kuhn, & Kohn, 2000), psychiatric disorders (Fuda & Immekus, 2006; Williams et al., 2001), and substance use-related issues (Fuda & Immekus, 2006; Mandelberg, Kuhn, & Kohn, 2000).

In a 3-year observational cohort study of 76 frequent ED users in Rochester, New York, Kne and colleagues observed that frequent ED use for multiple years and at multiple EDs was more common for patients with identified psychiatric and substance use problems, than for patients with medical problems (Kne, Young, & Spillane, 1998). Furthermore, a broader analysis of health care utilization indicates that frequent ED users may visit multiple EDs and may be high users of other health care services, including hospital admissions and primary care visits (Chan & Ovens, 2002; DiPietro, Kindermann, & Schenkel, 2012; Hansagi et al., 2001; Williams et al., 2001).

Given the patterns of ED utilization observed in this study and previously reported in the literature, there may be justification for interventions that target frequent ED use and divert patients who are homeless, or otherwise vulnerable, to sources of more comprehensive and accessible health care and support.

In a small systematic review of interventions for frequent ED users, Althaus and colleagues identified hospital-based case management as the most promising strategy to reduce ED visits (Althaus et al., 2011). More than a decade ago, a pilot program of hospital-based case management at St. Paul's Hospital reported success in reducing ED use for a small group of frequent ED users (Pope et al., 2000). In the pilot program, a multidisciplinary team was tasked with addressing the medical and social concerns of each patient on a case-by-case basis, and developing an individualized care plan including elements such as: referral to a primary care physician, denial of narcotic prescriptions from the ED, supportive counseling with the hospital social worker, and liaising with community and mental health services for follow-up. Another pilot program that aims to improve the integration of community-based care and reduce ED visits for frequent users of the ED residing in Vancouver's Downtown Eastside neighbourhood is also currently in progress (Bath, 2012). Interventions like Housing First may offer similar supports and strategies through ICM or ACT combined with housing, and have also been shown to be most effective in reducing service use for those chronically homeless persons who were the highest users to begin with (Goering et al., 2012).

In this study, participants were randomly assigned to a Housing First intervention or Usual Care. Although ED utilization is not the only metric of success for Housing First, many stakeholders view this as a positive outcome with important implications for clinical practice and health system and housing policy.

This study found that the Rate of Visits in the POST-study period was one-third less for Housing First participants than Usual Care, after adjusting for the Baseline Rate of Visits and other potential confounders. The Rate of Visits was higher than the Baseline Rate of Visits for both the Housing First and Usual Care groups, but the magnitude of the increase over the study period was smaller for those in the Housing First group. Based on a mean rate of 2.52 visits per person-year (the overall rate for all participants in the PRE-study period), this represents a reduction of 0.85 visits per person-year attributable to Housing First.

The effect of Housing First also varied by Study Group within the High Need and Moderate Need stratification. The Rate of Visits was 50% less for the HF ACT group compared to the HN TAU group, but not statistically significant for CONG compared to HN TAU, and 50% less for the HF ICM group compared to the MN TAU group.

Housing First participants who recorded fewer visits to the ED in the POST-study period compared to Usual Care participants may have: (1) reduced their overall use of health services, (2) used different types of health services instead of visiting the ED, or (3) used health services in different parts of Vancouver (including EDs other than St. Paul's Hospital or Mount Saint Joseph Hospital). Without additional sources of data, it is not possible to

confirm which scenario best explains the experience of Housing First participants, however, the 3 scenarios are likely not mutually exclusive. Given that the effect of Housing First was weaker and not statistically significant for the CONG group, it is likely that the observed reduction in the Rate of Visits is partly attributable to Housing First, and partly explained by participants in the HF ACT and HF ICM groups relocating to other parts of Vancouver. While participants in the CONG group living in the Bosman Hotel were located close to St. Paul's Hospital, many participants in the scatter-site housing groups moved farther away from the downtown core.

In addition to the proximity of housing to the ED, it is important to consider differences in the type of support offered to participants in the CONG group compared to the HF ACT and HF ICM group in this study. The health care and support staff on-site at the Bosman Hotel may have influenced the health care seeking behaviour of participants in the CONG group, as a result of better ascertainment of acute health concerns from more frequent contact with participants, and the willingness of support staff to accompany participants to the ED at St. Paul's Hospital.

Either scenario in which Housing First participants (1) reduced their overall use of health services or (2) used different types of health services instead of visiting the ED could be seen as a positive outcome for the intervention. Reductions in the use of the ED for Housing First participants could be related to improvements in health (i.e. less need factors) and/or removal of barriers and competing priorities (i.e. improved enabling factors) as a result of the supports

offered by the ACT, CONG, and ICM teams and the change from absolute homelessness or precarious housing to a more stable housing state.

Reductions in ED utilization have also been observed in recent evaluations of Housing First programs from the US, consistent with the findings from this study.

Martinez and Burt conducted a pre-post study of a congregate Housing First program for 236 homeless adults in San Francisco, 80% of whom were dually diagnosed with a mental disorder and a substance use disorder (Martinez & Burt, 2006). They reported a decrease in the percentage of study participants with at least one ED visit from 53% to 37% in the year after study enrolment compared to the year before, and a decrease in the mean rate of visits per year from 1.94 to 0.86. Sadowski and colleagues conducted a RCT of a case management intervention with provision of transitional housing at a respite care centre and subsequent placement in stable housing (a mix of scatter-site and congregate housing) for 407 homeless adults with chronic medical illnesses in Chicago, who were recruited at two hospitals before discharge (Sadowski et al., 2009). They reported a rate reduction of 24% for ED visits among intervention group participants, compared to control group participants, who received standard discharge planning only. Most recently, Gilmer and colleagues conducted a pre-post study of scatter-site Housing First with ACT supports for 209 Housing First clients and 154 propensity-score matched controls who were homeless and receiving outpatient mental health services in San Diego county (Gilmer et al., 2010). They observed that the probability of using ED services was reduced by 32% for Housing First clients compared to controls after 1-year.

Additionally, a number of Housing First studies observed decreases in the use of inpatient services and increases in the use of outpatient mental health services (Gilmer et al., 2010), reductions in the mean number of hospitalizations and hospital days (Sadowski et al., 2009), and reductions in the likelihood of being hospitalized and the mean number of hospital admissions per person (Martinez & Burt, 2006) for Housing First participants. Larimer and colleagues also conducted a pre-post study with a wait-list control group of congregate Housing First with on-site case management and health care for chronically homeless individuals with severe alcohol problems in Seattle, (Larimer et al., 2009). In summary, the literature also suggests that homeless individuals with chronic medical, psychiatric, or substance use issues may reduce their use of the ED, and other types of health services, when provided with housing and support through Housing First.

Building on this foundation, cost-analysis studies have been conducted for a number of Housing First programs. After accounting for changes in ED and health services utilization, as well as justice system interactions and shelter costs, there is considerable evidence that the cost of implementing Housing First may largely be offset or even result in cost savings from the societal perspective (Gilmer et al., 2010; Larimer et al., 2009; Metraux, Hadley, & Culhane, 2002; Patterson et al., 2008). Although ED utilization may not be the only metric of success for Housing First, it does have important implications. Stephen Gaetz, among others, recently articulated in a report entitled “The Real Cost of Homelessness: Can We Save Money by Doing the Right Thing?” that implementing a Housing First strategy may be the best policy option for improving outcomes for persons who are homeless and mentally ill as well as for efficiently allocating public resources (Gaetz, 2012). The findings from this

study, in addition those previously reported in the literature, support the continued provision of Housing First in Vancouver for the current cohort of study participants, as well as the expansion of this model of housing and support to individuals with similar needs.

As a caution, it is important to consider that reductions or increases in ED visits may not uniformly be positive or negative outcomes, especially from the patient's perspective.

Approximately 40% of participants had zero ED visits in the POST-study period.

Participants who did not visit the ED may not necessarily be healthier than others who visited the ED more, in actuality, some of these participants may have experienced the greatest barriers to accessing care and services. Given the considerable burden of mortality and morbidity among participants in this study, and clients of other Housing First programs, some visits to the ED may be entirely appropriate or necessary (Bernstein, 2006; Gill, Reese, & Diamond, 1996; Gill, 1994; Masso et al., 2007). Since the experience of homelessness is associated many barriers to accessing care, when individuals are housed, they may visit the ED and access other services in order to address longstanding health concerns that they were unable to get help for previously (Culhane, Park, & Metraux, 2011).

Research Question 2 and Research Question 3

This study also examined reasons for participants' visits to the ED, and the disposition of those visits.

Mental health or substance use-related reasons accounted for 30% of Presenting Complaints and 34% of Discharge Diagnoses for visits to the ED in the POST-study period. The most common mental health or substance use presentations and diagnoses included severe mental illness and acute emergencies, such as psychosis, schizophrenia, suicidal attempts or ideation, and alcohol or substance intoxication or overdose.

National studies of ED use in Canada (Canadian Institute for Health Information, 2007) and the United States (Ku et al., 2010) have also confirmed that persons who are homeless commonly present to the ED for mental health and substance use-related reasons.

Furthermore, over the past 3 years, St. Paul's Hospital has experienced an approximately 35% increase in the number of patients with mental health and/or addiction issues presenting to the ED (Buckingham, Kurdyak, O'Neill, & O'Shaughnessy, 2012). In light of this reported increase and the findings from this study, the provision of psychiatric care for patients presenting to the ED could be enhanced, and improvements in the availability and accessibility of other sources of mental health and substance use treatment could be considered.

A recent review focusing on the experience of patients with acute mental health and substance use needs in the ED offered a number of recommendations for St. Paul's Hospital, some of which are currently being implemented (Buckingham, Kurdyak, O'Neill, & O'Shaughnessy, 2012). The review team noted that patients are assessed very quickly in the ED and, in some instances, patients brought in by police under Section 28 of the Mental

Health Act were discharged from the ED without input from the psychiatry department. They recommended that all patients brought into the ED under the Mental Health Act should receive a psychiatric assessment. At the time of the review, St. Paul's Hospital had a 4-bed secure observation unit in the ED and a 13-bed psychiatry assessment unit that receives referrals from the ED. The review team recommended improving the capacity of the ED to manage complex psychiatric patients and function as a crisis stabilization unit by adding additional beds and multidisciplinary staff for the secure observation unit. These changes intend to improve the experience and quality of care received by patients with mental health and substance use issues who present to the ED.

Additionally, the capacity of outpatient mental health services could also be improved for this patient population. Recent recommendations include: enhancing the capacity of the Acute Psychiatric Assessment Clinic (a low barrier, rapid access clinic at St. Paul's Hospital) with community outreach to support the immediate follow-up of patients discharged from the ED, creating an ACT team dedicated to following patients at high risk for readmission, and improving access to mental health and addiction services for patients who do not require the intensity of ACT (Buckingham, Kurdyak, O'Neill, & O'Shaughnessy, 2012). There is a strong body of literature supporting the efficacy of ACT, and many policy documents have repeated the call for ACT in Vancouver (BC Ministry of Health, 2010; Thompson, 2010), especially looking at planning beyond the Vancouver At Home study.

Another planned initiative intends to increase collaboration between the hospital and primary care physicians who work in downtown Vancouver, especially those who have experience

and training with patients who have mental health and substance use problems. Through such an initiative, patients who present to the hospital and do not have a primary care provider could be referred to one of these physicians (Buckingham, Kurdyak, O'Neill, & O'Shaughnessy, 2012). Better continuity of care for patients with mental health needs might improve patient outcomes and relieve pressure on the acute care system. Additionally, the Burnaby Centre for Mental Health and Addiction, a residential inpatient facility for patients with complex mental health and addiction needs, is another important component of the continuum of care for patients with complex mental health and addiction issues.

Further assessment is required to better understand the needs of individuals with acute mental health and substance use needs who experience homelessness, and build on existing knowledge regarding the context of current services and supports. This is beyond the scope of this study, but the recommendations outlined above may provide a starting point for formulating an appropriate response.

From the regression analyses accounting for the dependence of repeated visits for the same participants, there was no evidence to conclude that the odds of mental health or substance use-related Presenting Complaints or Discharge Diagnoses were different for visits from the Housing First group compared to the Usual Care group. It was hypothesized that Housing First might have a differential effect on physical health or mental health after 12 months, that would result in changes in the types of presentations and diagnoses at the ED. However, study participants, including participants in the Housing First group, still experienced acute mental health emergencies that resulted in visits to the ED. Additional analyses may be

required to evaluate whether specific physical health concerns, such as chronic medical illnesses or skin infections and other issues related to living conditions, have been alleviated for Housing First participants, whether chronic mental health issues have been stabilized, and whether acute mental health episodes have been reduced, especially after a longer period of follow-up.

With respect to the Disposition of ED visits in this study, the majority of visits resulted in discharge from the ED. Of those discharged, close to 10% of visits represented instances where the patient arrived at the ED but left without being seen or against medical advice. The stigmas surrounding homelessness and mental illness are well-known, and previous studies have noted the negative experiences with the health care system and health care professionals are important barriers to health-seeking for persons who are homeless and mentally ill (Solorio et al., 2006)(Solorio et al., 2006) (Lewis, Andersen, & Gelberg, 2003). Anecdotally, this is an issue that has been addressed at St. Paul's Hospital in recent years. In one study set in an inner-city hospital in Toronto, compassionate contact with trained volunteers was found to improve patient satisfaction and decrease repeat visits to the ED among homeless adults (Redelmeier, Molin, & Tibshirani, 1995).

From the regression analyses accounting for the dependence of repeated visits for the same participants, there was no evidence to conclude that the odds of Care Advance was different for visits from the Housing First group compared to Usual Care.

Based on previous Housing First evaluations that reported reductions in the number of hospitalizations or hospital days, it was hypothesized that the disposition of visits would be different for Housing First compared to Usual Care participants in this study. However, in this study, the unit of analysis was the ED visit and the outcome of interest was the probability of care advance via the ED. Hospital admission may be related to the severity and acuity of the patient's presentation and in this study, Housing First participants commonly visited the ED for mental health and substance use-related reasons, the majority of which resulted in Care Advance. Also, studies that have observed reductions in hospital days have implied that hospitals may be willing to discharge patients earlier if they have stable housing, which would be an interesting question for future analyses.

Summary of Research Findings and Implications

In conclusion, this study observed that homeless individuals with mental illness reduced their visits to the ED after they were enrolled in a novel Housing First program, when compared to others who continued to access the services and supports currently available in Vancouver.

This supports previous evaluations of Housing First programs in other settings, adding to a body of empirical evidence that finds, among other positive outcomes such as improvements in housing stability, quality of life, and community integration, Housing First reduces the use of inpatient and ED health services, which are associated with considerable public costs.

In light of these findings, the Housing First model of scatter-site or congregate housing combined with ACT or ICM support should be offered to all individuals whose needs match those of the participants recruited to this study. There may also be other opportunities to improve the continuum of mental health care and substance use treatment for these individuals, by enhancing services provided in the ED, and offered in community and inpatient settings.

4.2 Strengths, Limitations, and Potential Threats to Internal and External Validity

Since this study shares the RCT design of the Vancouver At Home study, it shares some of the strengths and limitations of the original study. Overall, the internal validity of this study is very strong, due to the RCT design, and there are some minor concerns about external validity.

There are also some potential threats to internal validity specific to this study, related to the analysis of ED use. Firstly, participants from the Vancouver At Home study were included in this study only if they provided consent and their PHN could be located.

This mechanism of selection for inclusion in this study could have introduced a systematic bias towards observing less ED use for Housing First participants if those not included from the Usual Care group were less likely to use the ED, or a systematic bias against observing less ED use for Housing First participants if those not included from the Usual Care group were more likely to use the ED.

There may be a stronger possibility for the latter, as participants who were excluded from this study were more likely to be from the Usual Care group, to be withdrawn from the study, to have a severe mental illness, and to not have a regular family doctor (Appendix B, Table 5.3). These participants may have been more likely to use the ED than those who were included in the ED analysis.

However, according to primary data from the baseline interviews, participants who were excluded from this study were not more likely to self-report visiting any ED in the past 6 months prior to study enrolment (Appendix B, Table 5.3). At minimum, the statistical power of the analyses conducted for this study was diminished, due to the exclusion of 115 individuals.

A key limitation of this study was that the data linkage only included St. Paul's Hospital and Mount Saint Joseph Hospital. Although the majority of ED use for study participants occurs at St. Paul's Hospital in downtown Vancouver, this study underestimates overall ED use. ED use at St. Paul's Hospital is likely associated with proximity to its downtown location. Many participants were originally located downtown before they were enrolled in the study, and while participants in the CONG group living in the Bosman Hotel were located close to St. Paul's Hospital, many participants in the HF ACT and HF ICM group relocated to scatter-site housing in neighbourhoods farther away from the downtown core. This may have introduced a systematic bias towards observing decreased use for the HF ACT and HF ICM groups, compared to the CONG group.

There was potential for misclassification of the Presenting Complaint, Discharge Diagnosis, and Disposition outcome variables at two points: when the doctors and nurses recorded the outcomes in the ED database, as well as when the outcomes were categorized for this study. However, this nondifferential misclassification would be random and should not have introduced a systematic bias for the comparison of Housing First and Usual Care groups.

In the multivariable statistical modeling for Research Question 1, missing data was minimal for the secondary explanatory variables (less than 5% of responses). Cases with missing data were dropped from the analysis. This gives unbiased estimates when data are missing completely at random, but may give biased estimates when missing-ness is related to unobserved information such as the value of the observation itself or when missing-ness is conditional on other observed information (Donders et al., 2006). In either case, complete case analysis results in a minor loss of statistical power.

A negative binomial model was the best fit for the distribution of the Rate of Visits for Research Question 1. However, a zero-inflated model or other methods of stratification could have been used to better characterize the heterogeneity within this study population and describe individuals who had zero visits or many visits to the ED.

Lastly, it was not possible to detect longer trends and outcomes with a follow-up period of only up to 12 months.

The strengths of this study include its RCT design, which addresses many of the potential threats to internal validity.

The inclusion of the Usual Care group as a control group guards against history threats. In recent years, there has been an overall increase in the volume and rate of visits for all EDs in Vancouver, which may explain why an overall increase in the rate of ED visits for both the Housing First group and the Usual Care group was observed. By including the Usual Care group in the analysis, the effect of the Housing First intervention was examined separately from other concurrent changes to the health care system and social services that may have had an impact on ED use.

In this experimental study, random assignment of participants to the Housing First and Usual Care groups guards against selection bias. At the beginning of the study, participants in the Housing First and Usual Care groups would have been similar with respect to measurable and un-measurable characteristics that may be associated with ED use and other outcomes of interest. Since this study was conducted on a subset of the Vancouver At Home Study population, the multivariable statistical model for Research Question 1 also adjusted for potential confounders.

Using administrative records to collect data on health services utilization has several advantages compared to using primary data from self-reported surveys. Primary data collection may be susceptible to recall bias or reporting bias that could systematically over or underestimate utilization. For example, in an evaluation of a Housing First intervention for

chronically homeless individuals with severe alcohol problems in Seattle, Washington, Clifasefi and colleagues found that hospital use in the past 30-days was self-reported significantly more frequently than indicated by administrative records (Clifasefi et al., 2011). By using administrative records in this study, participant outcomes were tracked regardless of loss-to-follow-up. Instrumentation threats to internal validity are unlikely, as there were no relevant changes to the ED database during the study period.

The Vancouver At Home study was designed to provide evidence about which models of housing and support are efficacious for homeless adults living with a mental illness in Vancouver. Housing First may be more efficacious for some types of individuals than others, and the findings from this study may not necessarily be generalized to all homeless individuals living with a mental illness, such as youth or families. The Vancouver At Home study population was heterogeneous with respect to types of mental illness and chronicity of homelessness, among other characteristics. In this study, the prevalence of concurrent mental illness and substance use disorders was higher than in other studies of Housing First reported in the literature (Palepu et al., 2012).

The Housing First intervention in the Vancouver At Home study includes many elements that may contribute to its efficacy, such as the rent subsidy or assistance from the housing team, support from different members of the ACT team, or referrals from the ICM team. However, isolating the independent effect of the different elements of Housing First was beyond the scope of this study, which followed an intention-to-treat analysis by Study Group.

Lastly, the efficacy of the Housing First intervention may be unique to the context and setting of Vancouver. The services and supports currently available to the Usual Care group in the Vancouver At Home study may be very different than in other settings that hope to implement a Housing First program.

These concerns about external validity and generalizability are expected given that this is a RCT. Nonetheless, the potential threats to external validity are relatively minor and the findings of this study may have great relevance to other settings and interventions.

4.3 Future Research

The first opportunity to improve on this study would be to update and improve these analyses with a more complete dataset that includes all EDs in Vancouver and the surrounding area and a longer period of observation for participants to the end of the 24-month study period. Subgroup analyses could further elucidate which participants receive the most benefit from the effect of Housing First on ED utilization. These analyses could also be complemented by data on health services use in other inpatient and outpatient settings, to better understand how Housing First impacts health-seeking behavior and preferences for care in the ED compared to other settings, and data on health status, to better understand how Housing First impacts the burden of health concerns leading to ED visits. This would help clarify how the impact of Housing First on ED utilization is related to improvements in health (i.e. need factors) and/or reductions in barriers and competing priorities (i.e. enabling factors). These questions could also be investigated with qualitative research that explores the experiences of homeless individuals with mental illness with Housing First.

This study has also contributed to the foundation for important analyses of cost and benefits for Housing First in Vancouver and Canada. System-level strategic resource planning can illustrate how the benefits of Housing First may be shared among other health and social services (Werker, 2012), and a comprehensive cost-benefit analysis study could consider different perspectives (e.g. municipal, health authority, provincial, and/or federal) to develop evidence highly relevant to policy-makers.

In the future, the pilot programs supported by the At Home/Chez Soi study will hopefully lead to established programs in Canada, and future research can focus on implementation research to establish best practices for Housing First in Canada.

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Appendices

Appendix A Variables of Interest

Presenting Complaint

The Canadian Emergency Department Information System Presenting Complaint List was developed in 2003 as a list of 161 presenting complaints, divided into 18 major categories (Grafstein, Unger, Bullard, & Innes, 2003). The CEDIS system has since been adopted in many Canadian EDs, including St. Paul's Hospital and Mount Saint Joseph Hospital, and was updated in 2008 with 22 changes, for a total of 165 complaints. There are corresponding ICD-10 codes for the presenting complaints in the CEDIS list, but in many cases, the ICD-10 codes do not directly match the presenting complaints, especially when they are very specific (Grafstein et al., 2008).

When the triage nurse assesses a patient presenting to the ED at St. Paul's Hospital or Mount Saint Joseph, they select a presenting complaint from the CEDIS list that best describes the patient's concern. The presenting complaint code and corresponding category are recorded in the database. Table 5.1 lists the CEDIS categories and examples of presenting complaints relevant to this study. For this study, the Presenting Complaint variable was categorized according to the CEDIS categories for the descriptive analyses in Aim 2.1, and dichotomized as Mental Health/Substance Use or Other for the logistic regression analysis in Aim 2.2.

Table 5.1: Categories for Presenting Complaint Variable

Category	Example of presenting complaints
Mental Health	Bizarre/paranoid behavior, Anxiety, Suicidal ideation, Depressed
General and Minor	Medication request, IV antibiotics, Dressing change, Cast check / removal, Social issues, Anticoagulant for returning deep vein thrombosis
Gastrointestinal	Abdominal pain, constipation, nausea, vomiting
Skin	Laceration, localized swelling/redness, rash, wound check
Orthopedic	Upper extremity, lower extremity pain/injury
Ears Nose Throat	Dental pain, earache, facial pain, nasal trauma, eye pain
Neurologic	Headache, head injury, seizure, back pain, dizziness/vertigo
Substance Use	Substance misuse/intoxication, withdrawal, overdose
Cardiovascular	Chest pain, hypertension, edema
Infectious Disease	Fever, sore throat
Respiratory	Respiratory distress, allergic reaction, cough
Genitourinary	Dysuria, testicular/penile/vaginal pain/discharge
Trauma	Blunt chest trauma, multisystem trauma
Environmental	Burn, chemical exposure
Left Without Being Seen	
Missing	

Discharge Diagnosis

Discharge diagnosis was recorded for each ED visit according to ICD-10 coding. From reviewing the presenting complaints and discharge diagnoses, it was apparent that although there was a high level of agreement between the presenting complaint assessed by the triage nurse and the diagnosis finalized at the conclusion of the ED visit, there was disagreement in many instances (e.g. 5.5% of all visits were recorded as Substance Use presenting complaints and 11% were recorded as Substance Use discharge diagnoses).

A list of categories to classify discharge diagnoses was developed for this study, because the delineations based on the established ICD-10 chapters did not have an appropriate level of detail or relevance. The first iteration of this classification was based on the work of Marshall and colleagues (Marshall et al., 2012) and Fairbairn and colleagues (Fairbairn et al., 2011), who previously analyzed ED use using the same database at St. Paul's Hospital for studies of street-involved youth and HIV-positive injection drug users, respectively. For this study, the discharge diagnoses were sorted by the first author (Jason Tan de Bibiana) and reviewed by and discussed with a second author (Anita Palepu) until all diagnoses were classified. Table 5.2 lists the categories and examples of discharge diagnoses relevant to this study. Similar to the construction of the Presenting Complaint variable, the Discharge Diagnosis variable was categorized according to the list of categories below for descriptive analyses in 2.1, and dichotomized as Psychiatric disorder/Substance use or Other for the logistic regression analysis in Aim 2.2.

Table 5.2: Categories for Discharge Diagnosis Variable

Category	Example of discharge diagnoses
Psychiatric disorders	Psychosis NOS, Schizophrenia, Suicide Attempt/Ideation, Anxiety/Panic Attack
Substance use	Narcotic request, Alcohol intoxication, Amphetamine, Cocaine, Recreational drug intoxication/overdose
Abscesses, cellulitis, and other skin infections	Abscess/cellulitis – leg, arm, face
Gastrointestinal and urological disorders	Abdominal pain, nausea/vomiting, diarrhea
Medication refills and aftercare	Medication request (non-narcotic)
Musculoskeletal injuries	Acute back pain, chest pain, sprain
Wounds, lacerations, and contusions	Facial laceration, upper extremity contusion, wound check
Respiratory disorders	COPD, asthma, pharyngitis, pneumonia
Dental pain	Dental pain
Neurological disorders	Headache, seizure
Fractures and dislocations	Upper/lower extremity
Bacterial and viral infections	Otitis media/externa, scabies, body fluid exposure
Cardiovascular disorders	Bronchitis
Trauma	Spleen
Other	Social problem
Diagnosis missing or unclassified	Walked out / Not seen

Appendix B Data Linkage

Of 497 total Vancouver At Home study participants, 382 were linked to the ED database and included in this study. Table 5.3 presents the characteristics of participants included, and not included in this study. All variables in Table 5.3 describe participant characteristics at the time of study enrolment, as derived from the baseline interview, with the exception of Participant Status, which was determined in November 2011 prior to data linkage in February 2012.

Table 5.3: Characteristics of Vancouver At Home Study Participants

Variable		Linked to ED database		P-value*
		Yes (N=382)	No (N=115)	
Study Group	Housing First	254 (66%)	43 (37%)	0.000
	Usual Care	128 (34%)	72 (63%)	
Need Level	High Need	224 (59%)	73 (63%)	0.353
	Moderate Need	158 (41%)	42 (37%)	
Participant Status	Active	367 (96%)	104 (90%)	0.017
	Withdrawn	15 (4%)	11 (10%)	
Age	<25 years	31 (8%)	5 (4%)	0.357
	25-44 years	212 (55%)	69 (60%)	
	>44 years	139 (36%)	41 (36%)	
Gender	Male	276 (73%)	83 (73%)	0.863
	Female	104 (27%)	30 (27%)	
Ethnicity	Caucasian	210 (55%)	70 (61%)	0.535
	Aboriginal	61 (16%)	16 (14%)	
	Other	111 (29%)	29 (25%)	
Housing Status	Absolute Homelessness	297 (78%)	91 (79%)	0.754
	Precarious Housing	85 (22%)	24 (21%)	
Lifetime Duration of Homelessness	1 year	189 (50%)	57 (50%)	0.964
	>1year	189 (50%)	56 (50%)	
Severe Mental Illness	No	111 (29%)	23 (20%)	0.055
	Yes	271 (71%)	92 (80%)	
Less Severe Mental Illness	No	177 (46%)	56 (49%)	0.657
	Yes	205 (54%)	59 (51%)	
Substance Dependence	No	160 (42%)	49 (43%)	0.890
	Yes	222 (58%)	66 (57%)	
Physical Illness	No	31 (8%)	13 (11%)	0.291
	Yes	351 (92%)	102 (89%)	
Access: Family Doctor	No	124 (33%)	52 (45%)	0.013
	Yes	257 (67%)	63 (55%)	
Access: Usual Place	No	71 (19%)	23 (21%)	0.688
	Yes	306 (81%)	89 (79%)	
Access: Unmet Need	No	212 (57%)	63 (57%)	0.988
	Yes	161 (43%)	48 (43%)	
Visited Health service in Past Month	No	78 (20%)	31 (28%)	0.106
	Yes	303 (80%)	81 (72%)	
Visited ED in Past 6 Months	No	153 (41%)	53 (47%)	0.220
	Yes	222 (59%)	59 (53%)	

*P-value derived from 2-tailed chi-squared tests