

Duration of Public Housing Tenancy: A Population-Based Investigation

Aynslie Hinds
University of Winnipeg

Brian Bechtel
Government of Alberta

Jino Distasio
University of Winnipeg

Leslie L. Roos, and Lisa M. Lix
University of Manitoba

ABSTRACT

This study tested the association between tenancy status in public housing and demographic, geographic, socioeconomic, health status, and health service use characteristics using linked population-based administrative data from Manitoba, Canada. The data were analyzed using multivariable Cox proportional hazards regression. Age, residence location, receipt of income assistance, residential mobility, being diagnosed with a substance abuse disorder, and continuity of care were significantly associated with moving. Voluntary moves were only associated with socioeconomic characteristics, while eviction was also associated

Aynslie Hinds, Department of Community Health Sciences, University of Manitoba, Winnipeg, MB; Brian Bechtel, Community and Social Services, Government of Alberta, Edmonton, AB; Jino Distasio, Department of Geography, University of Winnipeg, Winnipeg, MB; Leslie L. Roos, Department of Community Health Sciences, University of Manitoba, Winnipeg, MB; Lisa M. Lix, Department of Community Health Sciences, University of Manitoba, Winnipeg, MB.

Aynslie Hinds is now at the Institute of Urban Studies, University of Winnipeg.

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Correspondence concerning this article should be addressed to Aynslie Hinds, Institute of Urban Studies, 515 Portage Avenue, Winnipeg, MB R3B 2E9. Email: a.hinds@uwinnipeg.ca

with health status and health service use characteristics. Public housing authorities can benefit from this profile of resident characteristics in order to identify who may need supports to have a successful tenancy.

Keywords: public housing, residential mobility, eviction, health status, healthcare utilization, administrative data

RÉSUMÉ

Cette étude a permis d'évaluer l'association entre le statut des locataires de logements sociaux et les caractéristiques démographiques, géographiques et socioéconomiques, l'état de santé et l'utilisation des services de soins de santé à l'aide de données administratives couplées sur la population du Manitoba (Canada). Les données ont été traitées à l'aide d'une analyse de régression à multiples variables des hasards proportionnels de Cox. L'âge, le lieu de résidence, l'obtention de prestations d'aide sociale, la mobilité résidentielle, la réception d'un diagnostic de trouble lié à l'abus d'alcool ou d'autres drogues et la continuité des soins ont été clairement identifiés comme des facteurs concourant au déménagement. Les déménagements volontaires ont été uniquement associés à des caractéristiques socioéconomiques, les cas d'éviction de logement ayant été également corrélés à l'état de santé des locataires et aux caractéristiques d'utilisation des services de soins de santé. Les autorités responsables des programmes de logements sociaux peuvent tirer avantage de ce portrait des caractéristiques des résidents qui a été dressé pour identifier les personnes susceptibles de nécessiter un soutien pour réussir leur expérience de location.

Mots-clés : logements sociaux, mobilité résidentielle, éviction, état de santé, utilisation des services de soins de santé, données administratives

BACKGROUND

Public housing is a form of low-income housing that is owned and managed by the government. For some people, public housing may be a “stepping stone to economic independence,” while for others, public housing is a “legitimate long-term” housing option (Whelan, 2009, p. 173). Residents may live in public housing indefinitely provided they respect the terms of their lease and continue to meet eligibility criteria. Unlike other forms of assistance, public housing is rationed due to the finite available housing stock (Dockery, Ong, Whelan, & Wood, 2008).

To date, there is a dearth of Canadian studies about health and housing outcomes of public housing residents; most of the research is from the United States and Australia. Due to housing policy differences over time between the United States and Canada, which are highlighted by Vakili-Zad (2002), American research findings may not generalize to the Canadian setting. Of particular note in recent decades are mobility programs in the United States. These programs have displaced public housing tenants in order to demolish and redevelop public housing. Affected households are either moved to another public housing development or given vouchers to rent in the private market. Consequently, many American public housing residents have experienced forced residential mobility. There is mixed evidence as to whether these moves improve health and other outcomes (Clampet-Lundquist, 2007; Clampet-Lundquist, Edin, Kling, & Duncan, 2011). While several jurisdictions in Canada have taken a similar approach (e.g., the redevelopment of Don Mount Court

and Regent Park in Toronto to mixed income communities; August, 2008; August, 2014), Manitoba has not. In the last decade, Manitoba has renovated and refurbished its public housing stock and made improvements to the physical environment, but the number of buildings and units as well as the number of people in housing has remained constant (Finlayson et al., 2013).

Manitoba Housing directly manages more than 13,000 public housing units, which are located in every health region of the province (Finlayson et al., 2013). There are a variety of housing types including single family dwellings, semi-detached units, townhouses, and apartments. In a given year there are more than 30,000 residents in public housing, with approximately half under 20 years of age (Finlayson et al., 2013).

The duration of tenancy in public housing varies; however, most studies report an average or median tenancy of less than five years (Berger, Heintze, Naidich, & Meyers, 2008; Dockery et al., 2008; Finlayson et al., 2013; Freeman, 1998; Martens et al., 2014). Two Canadian studies report tenancy duration. In Martens et al.'s (2014) study, the mean and median length of tenancy among a cohort of youth residing in public housing in Manitoba was 3.55 and 2.33 years, respectively. Finlayson et al. (2013) reported that 81% of public housing tenants in Manitoba reside for more than a year and 19% reside less than a year. Several studies reported much longer tenancies (Bahchieva & Hosier, 2001; Ruel, Oakley, Wilson, & Maddox, 2010). Tenancy duration varies by household type. One US study calculated a median tenancy duration of 4.69 years, but this was shorter for families with children (3.39 years), and longer for those with a disability (4.05 years) and those who were elderly (8.44 years; Lubell, Shroder, & Steffen, 2003). Tenancy duration also varied by source and amount of income. Another study found that families and single parents were more likely to have longer stays, while those with a disability status were more likely to have shorter tenancies (Whelan, 2009).

Several researchers have examined additional factors associated with moving out of public housing, such as age, marital status, receipt of income assistance, and household type (Bahchieva & Hosier, 2001; Freeman, 1998; Hungerford, 1996). Sex, prior residency in public housing, work experience, education level, housing market factors, income, and residence size have also demonstrated associations with moving out (Bahchieva & Hosier, 2001; Freeman, 1998; Hungerford, 1996). We are not aware of any study that has examined the association between health and moving out of public housing.

Some tenancies may terminate in a "disorderly" way, through abandonment or eviction (Pawson & Munro, 2010). In general, eviction rates vary by housing type and geographic region (Lapointe, 2004; van Laere, de Wit, & Klazinga, 2008). For example, one Canadian study reported that approximately 13% of public housing applicants were evicted in a 10 year period (Finlayson et al., 2013), while another Canadian study estimated about 18% of households received a Notice of Termination but only between 0.3% and 0.5% were actually evicted due to eviction prevention efforts such as rent repayment plans (Lapointe, 2004). Often households at risk of eviction experience a multitude of challenges (Portfolio Services and Strategic Projects Division, 2006). Risk factors for eviction include financial mismanagement (Portfolio Services and Strategic Projects Division, 2006; van Laere, de Wit, & Klazinga, 2009b), uncontrolled mental health problems (Crane, Warnes, & Fu, 2006; Portfolio Services and Strategic Projects Division, 2006; Rodriguez et al., 2012; van Laere et al., 2009b), addiction (van Laere, de Wit, & Klazinga, 2009b), antisocial behaviour (Lapointe, 2004), domestic violence management (Acacia Consulting and Research, 2006), hygiene problems (Lapointe, 2004), racism (Acacia Consulting and Research, 2006), and an inability to access income supports (Acacia Consulting and Research, 2006).

There are health, psychological, social, and economic costs to moving (Desmond & Kimbro, 2015; Distasio & McCullough, 2016; Pawson & Munro, 2010), especially when moves are unanticipated and unwanted (Smith, Alexander, & Easterlow, 1997). One study found that mothers who were evicted and their children experienced negative effects, such as difficulty obtaining basic necessities, depression and parental stress, and poor self-rated health (Desmond & Kimbro, 2015). Additionally, forced moves may lead to individuals accepting subsequent substandard housing (Canadian Mortgage and Housing Corporation, 2005; Desmond, Gershenson, & Kiviat, 2015), experiencing increased residential mobility (Desmond et al., 2015), experiencing disruptions in social networks, social isolation, and/or becoming homeless (Burt, Pearson, & Montgomery, 2007; van Laere, de Wit, & Klazinga, 2009a). Landlords also experience social and economic losses when tenants move (e.g., costs associated with repairing and cleaning units, arrears in rent, and/or legal fees; Canadian Mortgage and Housing Corporation, 2005; Crane et al., 2006; Distasio & McCullough, 2016; Pawson & Munro, 2010). Neighbourhoods with high turnover rates may be susceptible to a lack of social cohesion due to little interest in one's neighbours and one's community, which may lead to crime and social disorder (Pawson & Munro, 2010). Therefore, there are many reasons to prevent tenants from being evicted and thus there is a need to identify individuals who might be at risk of eviction.

While researchers have examined the association between various socioeconomic factors and moving out of public housing, little is known about whether health and health service use are also factors associated with moving out. We tested the association between moving out and demographic, geographic, economic, health status, and health service use characteristics. Additionally, we sought to determine whether there were differences in variable associations for intended and unintended (i.e., eviction) moves.

METHODS

Study Cohort

The cohort included all adults (18+ years) listed as the primary applicant on an application to Manitoba Housing's rental housing and who moved in between January 1, 2007 and December 31, 2008. Manitoba is a Canadian province with an ethnically diverse population of 1.2 million. All cohort members had health coverage in the year prior to their move-in date. Residents of Churchill, a remote northern community, were excluded because public housing is used to supplement the shortage of affordable market housing; it is difficult to distinguish between those who rent at a market rate and those who live in subsidized units (Finlayson et al., 2013). Public housing residents who reapplied (i.e., to move within public housing) and individuals who resided in public housing within two years of their 2007/2008 move-in date were also excluded to limit our focus to new applicants as a previous study found that repeat public housing tenants were less likely to move out (Freeman, 1998).

Data Sources

Study data comprised administrative data in the Population Research Data Repository housed at the Manitoba Centre for Health Policy. The Repository is a rich collection of anonymized health and social administrative databases linkable at the individual level via a unique scrambled personal health identification number.

The Tenant Management System (TMS) was used to identify applicants to and residents of Manitoba Housing's rental housing, public housing managed by the provincial government (approximately 2,300 buildings and 13,000 units); it does not capture social housing managed by cooperatives and non-profit groups. The population registry contains information on all Manitoba residents registered with the Manitoba Health Insurance Services Plan (excludes military personnel, the RCMP, and those new to Manitoba) and was used to obtain information on demographic characteristics, place of residence, and health insurance coverage. The registry is updated every six months (June and December), so that these "snapshots" enable residential histories to be created and changes in health coverage can be monitored. The Social Assistance Management Information Network was used to obtain information on households receiving financial support under the provincial Employment and Income Assistance program. Data from the 2006 Canadian Census was used to create a dissemination area (DA) level measure of income.

The hospital discharge abstracts database was used to obtain information on discharges from all acute and chronic care facilities. Up to 25 diagnosis codes based on the International Classification of Diseases (ICD) system are recorded (ICD-10-CA). The physician billing claims data captures the majority of ambulatory physician visits, as most physicians in Manitoba are reimbursed on a fee-for-service basis. This data source was used to obtain diagnostic information (i.e., three-digit ICD-9-CM code for the diagnosis most relevant to the visit). The admission, discharge, and transfer and E-Triage databases were used to identify visits to adult emergency departments (EDs) in Winnipeg; there is no corresponding data available on ED visits outside of Winnipeg. The Drug Program Information Network database was used to obtain information about prescription drugs dispensed from community pharmacies.

Study Variables

The study observation period was from January 1, 2007 to March 31, 2013. Tenancy duration was calculated as the number of days between the move-in and move-out dates. Eviction was identified from the move-out reason variable.

Study variables were defined in the 365 days prior to the move-in date and were time-invariant. They included demographic, geographic, economic, residential mobility, health status, and health service use characteristics. Demographic variables included sex and age group (18–24, 25–39, 40–64, 65+ years). The location of residence was determined from the six-digit postal code. Region of residence was assigned as urban and rural (i.e., Winnipeg and non-Winnipeg). Residential mobility was determined from changes in the six-digit postal code. Individuals were classified as either movers or non-movers (DeVerteuil et al., 2007; Lix et al., 2006). Economic variables included income quintile (IQ) and receipt of income assistance (IA). IQ, an area-level measure, was created from the average household income of the DAs (Roos & Mustard, 1997). The DAs are sorted from poorest to wealthiest and grouped into quintiles such that each quintile represents approximately 20% of the population. Different cut-offs are used for urban and rural areas. Individuals were classified as recipients of IA if they or a member of their household received IA at least once in the 365 days prior to the move-in date (Heaman et al., 2012). The following forms of IA were used: single parent (mother and father assistance), disability, general assistance, and other. The IA types are not mutually exclusive as there may be more than one individual in a household who received IA. Each form of IA is based on financial need in addition to other eligibility criteria.

Health status was determined by the presence of ICD codes for selected conditions in physician billing claims and hospital discharge abstracts (Appendix 1) as well by Aggregated Diagnostic Groups (ADGs). Schizophrenia and affective (mood and anxiety) disorders comprised the mental disorder category. The presence of diagnoses for the following chronic physical health conditions was identified: respiratory illness (e.g., asthma, chronic obstructive pulmonary disease, bronchitis, emphysema), diabetes, hypertension, and ischemic heart disease. Substance abuse disorder and injury diagnosis codes were also identified. ADGs are groups of ICD-9-CM/ICD-10-CA codes that represent diagnoses that are clinically similar and for which the expected or actual use of healthcare services is similar (Austin, van Walraven, Wodchis, Newman, & Anderson, 2011; Roos, Walld, & Witt, 2014). The Johns Hopkins Adjusted Clinical Groups system clusters the ICD codes into 32 mutually exclusive ADGs. A higher ADG score indicates more comorbidities.

Several measures of health service use were examined, including length of hospital stay, the numbers inpatient hospitalizations, the number of ED visits in Winnipeg, the number of ambulatory (e.g., outpatient) physician visits, the majority of physician care, and the number of different prescription drugs based on the third-level of the ATC classification system. Hospitalizations and physician visits were classified into stays/visits for a mental health or physical health reason. Mental health reasons were defined as all disorders listed in ICD-9 chapter “Mental Disorders” excluding those listed under “mental retardation” and in ICD-10 chapter “Mental, Behavioral and Neurodevelopmental disorders” excluding intellectual disabilities and developmental disorders. Any stay/visit not classified as mental health was classified as physical health. Only the first diagnosis field listed on the hospital record (i.e., the most responsible diagnosis) was used to assign reason. Separate counts of the number of general practitioner (GP) and specialist (i.e., psychiatrists, pediatricians, obstetricians and gynecologists, medical specialists, general surgeons, and surgical specialists) visits were made. The majority of physician care received was defined as: (a) the number of different GPs visited, and (b) continuity of care. Continuity of care was defined as having at least 50% of ambulatory physician visits to the same GP (Martens et al., 2009). Cohort members were classified as having continuous care (≥ 0.50), not having continuous care (< 0.05), or not applicable (< 3 physician GP ambulatory visits).

Statistical Analysis

The cohort was divided into non-movers and all movers, and the all mover group was further divided into voluntary movers (moved-on-own) and involuntary movers (evicted). Descriptive statistics, including means, standard deviations, and frequency distributions were used to characterize the groups. Chi-square tests of homogeneity were used to test the association between group membership and each of the categorical variables. Histograms, normal probability plots, and skewness and kurtosis were used to determine whether the continuous variables were normally distributed. Since all of the variables were skewed, Wilcoxon rank-sum tests were used to test between-group differences. For each variable, inferential analyses were conducted for all-movers versus non-movers, voluntary movers versus non-movers, and involuntary movers versus non-movers.

Cox proportional hazards regression models were used to test the association of demographic, geographic, economic, residential mobility, health status, and health service use characteristics with move-out status. Censoring occurred when a tenant moved out, lost health coverage, died, or the study period ended (March 31, 2013). Three models were fit to the data. The first included all members of the cohort, regardless

of the reason for moving, the second excluded individuals who were evicted, and the third excluded voluntary movers. Unadjusted and adjusted hazard ratios (HRs) and 95% confidence intervals (95% CIs) are reported. Our primary interest was the associations between moving out of public housing and the health conditions and health service use. We entered the health conditions and health service use measures to the model after controlling for socioeconomic measures. Variables were removed from the model due to multicollinearity and lack of statistical significance. Covariates that violated the proportionality assumption, as assessed by the Schoenfeld residuals, were included in the model as an interaction with time. The generalized R^2 , proposed by Allison (2010), was calculated for each of the three full models. Goodness of fit statistics were used to evaluate model fit. All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary NC, USA).

RESULTS

A total of 3,131 (65.4%) individuals were retained in the cohort of the 4,789 who were eligible (Figure 1, next page). Close to half of the cohort moved out of public housing on their own (48.6%) and another 14.2% were evicted. Those who moved out on their own resided an average of 719.8 days (SD = 520.2; median = 608), while those who were evicted resided an average of 674.1 days (SD = 469.6; median = 573). A few cohort members (0.8%) died while residing in public housing.

Sociodemographic Characteristics

Sociodemographic characteristics of the cohort are presented in Table 1. Movers were significantly younger than non-movers. The majority were urban residents; the moved-on-own group was less likely while the evicted group was more likely to be urban residents compared to the non-movers. There was an IQ gradient for movers and non-movers; the gradient was steepest for those who were evicted. Approximately two-thirds of households of movers and non-movers received IA in the 365 days prior to moving in; while 82% of the evicted households and only 60% of the moved-on-own households received IA. Single parent assistance was the most common form of IA for all groups. The evicted group was significantly more likely to receive all forms of IA, except disability IA, than the non-mover group, while the moved-on-own group was significantly less likely to receive disability IA. A higher percentage of the movers, particularly the evicted group, than the non-movers had a postal code change.

Health Status and Health Service Use Characteristics

Table 2 describes the health status and health service use characteristics of the groups. Approximately one-third of the cohort had a physician-diagnosed chronic physical illness and a mental disorder in the 365 days prior to moving into public housing; the groups did not differ significantly. Although a higher percentage of the movers had an injury and a substance abuse disorder than the non-movers, only the evicted group differed statistically from the non-movers. In fact, the evicted group who had a substance abuse disorder (11.0%) had more than twice the percentage compared to the non-mover group (5.0%). On average, non-movers ($M = 4.3$) had fewer ADGs than movers ($M = 4.5$); however, only the evicted group differed statistically from the non-movers.

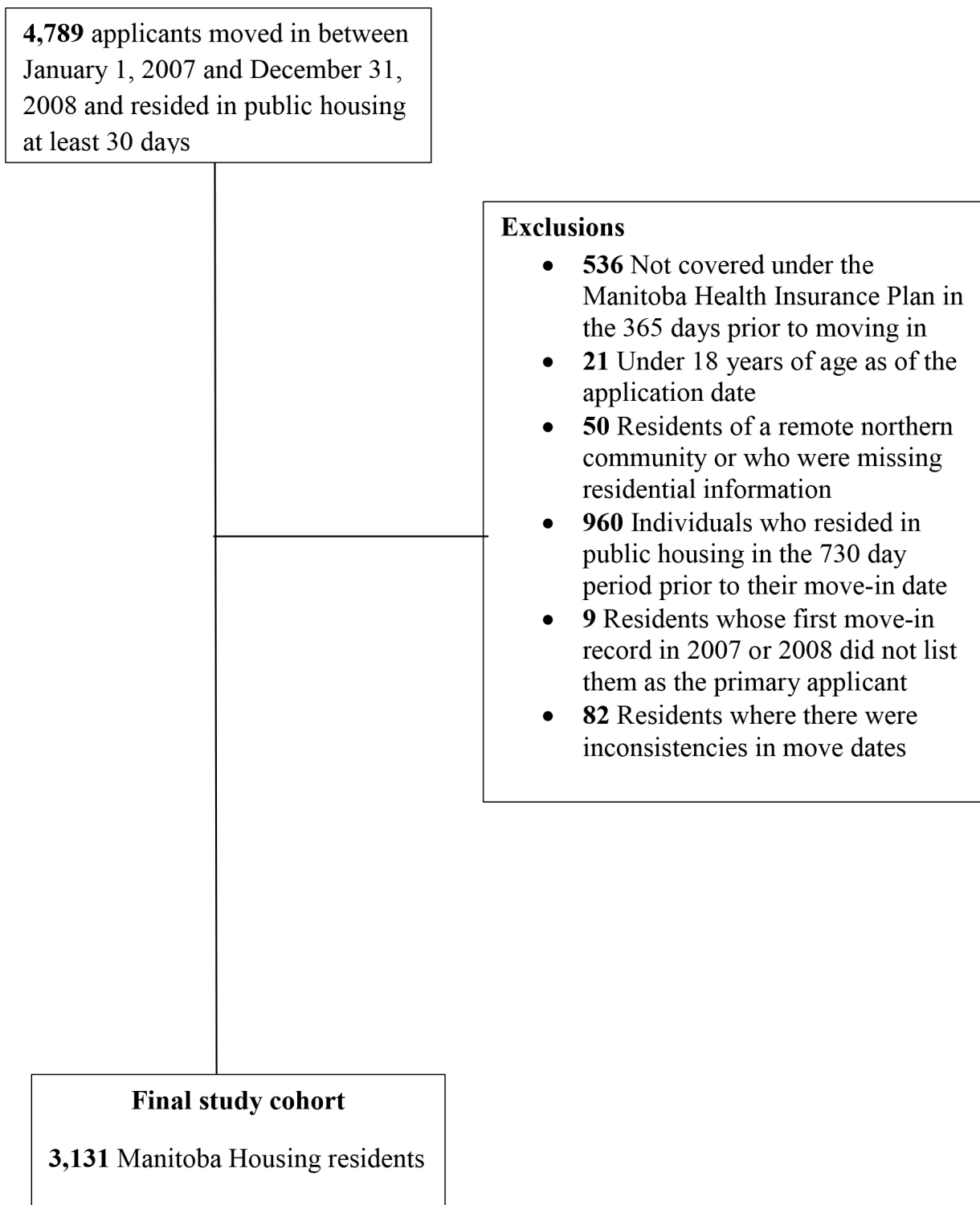
Figure 1**Flow Chart for the Construction of the Study Cohort**

Table 1
Socio-Demographic Characteristics in the 365 Days Prior to Moving into Public Housing among New Public Housing Residents by Move-Out Status

Characteristic	Moved						Non-Movers (N = 1165)	
	All Movers (N = 1966)		On Own (N = 1521)		Evicted (N = 445)			
	N	%	N	%	N	%	N	%
Sex								
Male	490	24.9	373	24.5	117	26.3	328	28.2
Female	1,476	75.1	1,148	75.5	328	73.7	837	71.9
Age (years)								
18–24	530	27.0***	381	25.1***	149	33.5***	190	16.3
25–39	689	35.1	518	34.1	171	38.4	385	33.1
40–64	507	25.8	390	25.6	117	26.3	415	35.6
65+	240	12.2	232	15.3	8	1.8	175	15.0
Region								
Winnipeg	1,091	55.5	781	51.4*	310	69.7***	668	57.3
Non-Winnipeg	875	44.5	740	48.7	135	30.3	497	42.7
Income Quintile‡								
Q1 (lowest)	944	48.0	695	45.7	249	56.0*	514	44.1
Q2	376	19.1	303	19.9	73	16.4	266	22.8
Q3	331	16.8	269	17.7	62	13.9	210	18.0
Q4	185	9.4	147	9.7	38	8.5	114	9.8
Q5 (highest)	101	5.1	83	5.5	18	4.0	48	4.1
Income Assistance†								
Yes	1,279	65.1	914	60.1**	365	82.0***	777	66.7
No	687	34.9	607	39.9	80	18.0	388	33.3
Single Parent Assistance								
Yes	780	39.7*	569	37.4	211	47.4***	404	34.7
No	1,186	60.3	952	62.6	234	52.6	761	65.3
General Assistance								
Yes	378	19.2	252	16.6	126	28.3***	202	17.3
No	1,588	80.8	1,269	83.4	319	71.7	963	82.7
Disability Assistance								
Yes	349	17.8***	245	16.1***	104	23.4	284	24.4
No	1,617	82.3	1,276	83.9	341	76.6	881	75.6
Residential Mobility								
Yes	668	34.0***	486	32.0*	182	40.9***	304	26.1
No	1,298	66.0	1,035	68.1	263	59.1	861	73.9

Note. †Does not sum to the total due to missing values.

‡Single parent, general, and disability are types of income assistance. These categories are not mutually exclusive.

* $p < 0.01$, ** $p < 0.001$, *** $p < 0.0001$

There were few statistically significant differences between the groups on the health service use variables. The cohort, on average, filled approximately five prescriptions in the year prior to moving into public housing. The distribution of physician visits was similar across the groups, with approximately 15% seeing a physician none or one time and 48% seeing a physician seven or more times in the year prior to moving into public housing. The cohort was more likely to see a physician for a physical health reason than a mental health reason. Approximately three-quarters of the groups saw a physician for a mental health reason none or one time, while approximately 18% visited a physician none or one time for a physical health reason. On average, the groups had approximately seven and 2.5 GP and specialist visits, respectively. There were two measures of continuous care. On average, all groups visited more than two GPs, with all three mover groups differing significantly from the non-movers. A higher percentage of the non-movers (75.6%) received the majority of care from the same GP compared to the three mover groups. Although a higher percentage of the mover groups were hospitalized in the year prior to moving into public housing and had longer hospital stays, only the evicted group (5.2%) differed significantly from the non-mover group (2.5%) on hospitalization for a mental health reason. Approximately 64% of the non-movers, 59% of voluntary movers, and 53% of involuntary movers did not visit an ED in the year prior to moving into public housing. The distribution of ED visits between the evicted and non-mover groups differed statistically.

Table 3 shows the HRs and 95% CIs for the unadjusted and adjusted Cox proportional hazard models for the entire cohort. An analysis of the Schoenfeld residuals indicated that the proportionality assumption for the region variable was violated, so the interaction between region and time in public housing was included in the final model. The generalized R^2 statistic for the full model was 0.045. Sex, IQ, presence of a chronic physical illness, presence of an injury, a mental disorder, and health service use were not associated with moving out of public housing, while age, region of residence, receipt of IA, residential mobility, having a physician-diagnosed substance abuse disorder, and continuity of care were significantly associated with moving out. Younger individuals, those who were residentially mobile, those who had a substance abuse disorder, and who lacked continuous care were significantly more likely to move out of public housing. Residents of Winnipeg and recipients of IA were significantly less likely to move out. That is, individuals who received IA in the year prior to moving into public housing were 21% less likely to move out at any point in time.

Table 4 shows the HRs and 95% CIs for the unadjusted and adjusted models when the evicted individuals were excluded. An analysis of the Schoenfeld residuals indicated that the proportionality assumption for the region variable was violated, so the interaction between region and time in public housing was included in the final model. The generalized R^2 statistic for the full model was 0.044. Sex, IQ, health status, and health service use characteristics were not associated with moving out of public housing voluntarily, while age, region of residence, receipt of IA, and residential mobility were significantly associated with moving out voluntarily. Younger individuals and those who were residentially mobile were significantly more likely to move out of public housing voluntarily, while Winnipeg residents and those who received IA were significantly less likely to move out.

Table 5 shows the HRs and 95% CIs for the unadjusted and adjusted Cox proportional hazards model when the voluntary movers were excluded. The generalized R^2 statistic for the full model was 0.113. Region of residence, IQ, and receipt of IA were not significantly associated with being evicted from public housing, while sex, age, and residential mobility were significantly associated with being evicted. Males were 1.4

Table 2
Health Status and Health Service Use in the 365 Days prior to Moving into Public Housing among New Residents of Public Housing by Move-Out Status

Characteristics	Moved						Non-Movers (N = 1165)	
	All Movers (N = 1966)		On Own (N = 1521)		Evicted (N = 445)			
	N	%	N	%	N	%	N	%
Chronic Physical Illness	621	31.6	486	32.0	135	30.3	393	33.7
Injury	474	24.1	341	22.4	133	29.9**	254	21.8
Mental Disorder	638	32.5	481	31.6	157	35.3	360	30.9
Substance Abuse Disorder	128	6.5	79	5.2	49	11.0***	58	5.0
ADGs	4.5	(3.0)	4.4	(3.0)	4.8	(3.1) *	4.3	(2.9)
Mean # of ADGs (SD)	5.1	(4.1)	5.0	(4.0)	5.4	(4.2)	5.2	(4.3)
# of Physician Visits								
0–1	302	15.4	236	15.5	66	14.8	169	14.5
2–6	726	36.9	558	36.7	168	37.8	414	35.5
7+	938	47.7	727	47.8	211	47.4	582	50.0
# of Physician Visits for a Mental Health Reason								
0–1	1,503	76.5	1175	77.3	328	73.7	916	78.6
2–6	350	17.8	265	17.4	85	19.1	173	14.9
7+	113	5.8	81	5.3	32	7.2	73	6.5
# of Physician Visits for a Physical Health Reason								
0–1	356	18.1	276	18.2	80	18.0	213	18.3
2–6	827	42.1	635	41.8	192	43.2	465	39.9
7+	783	39.8	610	40.1	173	38.9	487	41.8
Mean # of GP Visits (SD)	7.2	(7.0)	7.0	(6.6)	7.9	(8.3)	6.8	(6.2)
Mean # of Specialist Visits (SD)	2.3	(4.7)	2.3	(4.8)	2.6	(4.3)	2.6	(5.1)
Mean # of GPs Seen (SD)	2.7	(2.2)***	2.6	(2.2) **	2.9	(2.3)***	2.3	(1.9)
Continuity of Care								
No	391	19.9**	283	18.6*	108	24.3***	163	14.0
NA	190	9.7	143	9.4	47	10.6	121	10.4
Yes	1,385	70.5	1,095	72.0	290	65.2	881	75.6
Hospitalization								
No	1,637	83.3	1,272	83.6	365	82.0	989	84.9
Yes	329	16.7	249	16.4	80	18.0	176	15.1

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Table 2, continued
Health Status and Health Service Use in the 365 Days prior to Moving into Public Housing among New Residents of Public Housing by Move-Out Status

Characteristics	Moved						Non-Movers (N = 1165)	
	All Movers (N = 1966)		On Own (N = 1521)		Evicted (N = 445)			
	N	%	N	%	N	%	N	%
Hospitalization for a Mental Health Reason								
No	1,902	97.5	1,480	97.3	422	94.8*	1,136	97.5
Yes	64	3.3	41	2.7	23	5.2	29	2.5
Hospitalization for a Physical Health Reason								
No	1,683	85.6	1,300	85.5	383	86.1	1,009	86.6
Yes	283	14.4	221	14.5	62	13.9	156	13.4
Mean # of Inpatient Hospital Days (SD)	24.4	(49.6)	24.4	(50.0)	24.4	(48.6)	19.4	(34.9)
# Emergency Department Visits†								
0	624	57.2	461	59.0	163	52.6*	426	63.8
1	234	21.5	162	20.7	72	23.2	126	18.9
2+	233	21.4	158	20.2	75	24.2	116	17.4

Note. GP = general practitioner; †Winnipeg residents only.

* p < 0.01, ** p < 0.001, *** p < 0.0001

Table 3
Unadjusted and Adjusted Cox Proportional Hazards Ratios (HRs) and 95% Confidence Intervals (CIs) for Moving Out of Public Housing (N = 3,131)

Characteristic		Unadjusted HR (95% CI)	Adjusted HR (95% CI)
Sex	Male	0.92 (0.83,1.02)	1.07 (0.95,1.19)
	Female	Ref	Ref
Age (years)	18–24	1.51 (1.30,1.76)	1.87 (1.53,2.28)
	25–39	1.17 (1.01,1.35)	1.44 (1.19,1.73)
	40–64	0.93 (0.79,1.08)	1.09 (0.91,1.30)
	65+	Ref	Ref
Region	Winnipeg	0.90 (0.83,0.99)	0.70 (0.60,0.83)
	Non-Winnipeg	Ref	Ref
Income Quintile	NF*	0.96 (0.64,1.45)	1.11 (0.73, 1.69)
	Q1	0.94 (0.76,1.15)	0.98 (0.79,1.21)
	Q2	0.80 (0.64,1.00)	0.86 (0.69,1.07)
	Q3	0.85 (0.68,1.06)	0.91 (0.73,1.14)
	Q4	0.90 (0.71,1.15)	0.96 (0.75,1.23)
	Q5	Ref	Ref
Income Assistance	Yes	0.94 (0.86,1.03)	0.79 (0.71,0.89)
	No	Ref	Ref
Residential Mobility	Yes	1.24 (1.13,1.36)	1.17 (1.06,1.30)
	No	Ref	Ref
Chronic Physical Illness	Yes	0.95 (0.87,1.05)	1.09 (0.97,1.21)
	No	Ref	Ref
Injury	Yes	1.10 (0.99,1.22)	1.09 (0.98,1.22)
	No	Ref	Ref
Mental Disorder	Yes	1.04 (0.95,1.14)	1.09 (0.98,1.21)
	No	Ref	Ref
Substance Abuse Disorder	Yes	1.20 (1.00,1.43)	1.21 (1.01,1.47)
	No	Ref	Ref
Hospitalization	Yes	1.11 (0.98,1.25)	1.13 (1.00,1.28)
	No	Ref	Ref
Continuity of Care	No	1.25 (1.12,1.40)	1.15 (1.02,1.29)
	NA	1.01 (0.87,1.18)	0.96 (0.80,1.16)
	Yes	Ref	Ref
# of Physician Visits	7+	0.92 (0.81,1.05)	0.84 (0.70,1.01)
	2 – 6	0.95 (0.83,1.09)	0.88 (0.74,1.04)
	0 – 1	Ref	Ref

Note. Bold values denote statistically significant results. *NF = Missing. Region x Time in public housing included in the model.

Table 4

Unadjusted and Adjusted Cox Proportional Hazards Ratios (HRs) and 95% Confidence Intervals (CIs) for Moving Out of Public Housing, Excluding Evicted Individuals (N = 2,686)

Characteristic		Unadjusted HR (95% CI)	Adjusted HR (95% CI)
Sex	Male	0.91 (0.81,1.02)	1.02 (0.90,1.16)
	Female	Ref	Ref
Age (years)	18–24	1.29 (1.09,1.51)	1.69 (1.36,2.10)
	25–39	1.01 (0.86,1.17)	1.32 (1.08,1.61)
	40–64	0.79 (0.67,0.93)	1.01 (0.83,1.21)
	65+	Ref	Ref
Region	Winnipeg	0.81 (0.73,0.89)	0.64 (0.54,0.77)
	Non-Winnipeg	Ref	Ref
Income Quintile	NF*	1.01 (0.64,1.59)	1.28 (0.81,2.04)
	Q1	0.89 (0.71,1.12)	0.99 (0.79,1.25)
	Q2	0.80 (0.63,1.02)	0.89 (0.68,1.13)
	Q3	0.84 (0.66,1.08)	0.91 (0.71,1.16)
	Q4	0.90 (0.69,1.18)	0.97 (0.74,1.27)
	Q5	Ref	Ref
Income Assistance	Yes	0.82 (0.74,0.90)	0.72 (0.64,0.82)
	No	Ref	Ref
Residential Mobility	Yes	1.18 (1.06,1.31)	1.18 (1.05,1.32)
	No	Ref	Ref
Chronic Physical Illness	Yes	0.95 (0.86,1.06)	1.05 (0.92,1.19)
	No	Ref	Ref
Injury	Yes	1.03 (0.91,1.16)	1.03 (0.91,1.18)
	No	Ref	Ref
Mental Disorder	Yes	1.01 (0.91,1.13)	1.09 (0.97,1.23)
	No	Ref	Ref
Substance Abuse Disorder	Yes	1.03 (0.82,1.29)	1.11 (0.87,1.40)
	No	Ref	Ref
Hospitalization	Yes	1.08 (0.94,1.24)	1.08 (0.93,1.25)
	No	Ref	Ref
Continuity of Care	No	1.20 (1.05,1.37)	1.13 (0.98,1.29)
	NA	0.97 (0.82, 1.16)	0.91 (0.73,1.13)
	Yes	Ref	Ref
# of Physician Visits	7+	0.91 (0.79,1.06)	0.86 (0.70,1.05)
	2–6	0.94 (0.81,1.10)	0.87 (0.72,1.05)
	0–1	Ref	Ref

Note. Bold values denote statistically significant results. *NF = Missing. Region x Time in public housing included in the model.

Table 5
Unadjusted and Adjusted Cox Proportional Hazards Ratios (HRs) and 95% Confidence Intervals (CIs) for Moving Out of Public Housing, Excluding Voluntary Movers (N = 1,610)

Characteristic		Unadjusted HR (95% CI)	Adjusted HR (95% CI)
Sex	Male	0.93 (0.75,1.14)	1.37 (1.08,1.74)
	Female	Ref	Ref
Age (years)	18–24	12.73 (6.25,25.91)	12.41 (5.70,27.02)
	25–39	7.95 (3.92,16.15)	7.67 (3.59,16.40)
	40–64	5.46 (2.67,11.16)	4.50 (2.13,9.54)
	65+	Ref	Ref
Region	Winnipeg	1.55 (1.27,1.90)	1.15 (0.92,1.43)
	Non-Winnipeg	Ref	Ref
Income Quintile	NF*	0.96 (0.36,2.58)	0.74 (0.27,2.03)
	Q1	1.18 (0.73,1.91)	0.95 (0.58,1.56)
	Q2	0.74 (0.44,1.24)	0.70 (0.42,1.19)
	Q3	0.80 (0.47,1.35)	0.88 (0.52,1.50)
	Q4	0.86 (0.49,1.51)	0.90 (0.51,1.59)
	Q5	Ref	Ref
Income Assistance	Yes	2.03 (1.59,2.58)	1.09 (0.84,1.42)
	No	Ref	Ref
Residential Mobility	Yes	1.78 (1.47,2.14)	1.25 (1.02,1.53)
	No	Ref	Ref
Chronic Physical Illness	Yes	0.88 (0.72,1.08)	1.33 (1.06,1.66)
	No	Ref	Ref
Injury	Yes	1.46 (1.19,1.78)	1.36 (1.09,1.70)
	No	Ref	Ref
Mental Disorder	Yes	1.19 (0.98,1.45)	1.09 (0.88,1.36)
	No	Ref	Ref
Substance Abuse Disorder	Yes	2.02 (1.50,2.72)	1.66 (1.20,2.28)
	No	Ref	Ref
Hospitalization	Yes	1.24 (0.97,1.58)	1.38 (1.07,1.79)
	No	Ref	Ref
Continuity of Care	No	1.78 (1.42,2.22)	1.35 (1.07,1.71)
	NA	1.15 (0.85,1.57)	1.18 (0.79,1.74)
	Yes	Ref	Ref
# of Physician Visits	7+	0.94 (0.71,1.24)	0.75 (0.50,1.11)
	2–6	1.03 (0.77,1.37)	0.89 (0.62,1.29)
	0–1	Ref	Ref

Note. Bold values denote statistically significant results. *NF = Missing.

times more likely to be evicted than females. Younger tenants and those who were residentially mobile in the year prior to moving into public housing were significantly more likely to be evicted. Three of the four health status measures were significantly associated being evicted. Specifically, tenants who had a chronic physical illness, were injured in the year prior to moving into public housing, and had a substance abuse disorder were significantly more likely to be evicted, while having a mental disorder was not significantly associated with being evicted. Tenants who were hospitalized in the year prior to moving into public housing were 1.38 times more likely to be evicted and those who lacked continuous care from the same GP were 1.35 times more likely to be evicted, while number of physician visits was not significantly associated with being evicted.

DISCUSSION

There was variability in tenancy duration, but the average duration among the movers was less than two years, which is consistent with several other studies (Dockery et al., 2008; Martens et al., 2014). As in other studies, our cohort was predominantly female (Apparicio & Seguin, 2006; Finlayson et al., 2013) and the majority resided in the poorest areas and received IA. The groups did not differ with respect to the sex distribution, but compared to non-movers, movers were younger and more residentially mobile in the year prior to moving into public housing. There were some notable distinctions in socioeconomic characteristics between the evicted group and the other groups. The evicted group was more likely to live in Winnipeg and more likely to reside in the poorest income areas compared to the non-movers, while the voluntary movers were less likely to live in Winnipeg but did not differ with respect to the IQ distribution. These findings require further exploration, but one potential explanation may be that the demand for public housing is greater in Winnipeg than in other areas and the density of households is greater, so disruptive behaviour is noticed more and tolerated less.

Non-movers and movers did not differ with respect to receipt of IA; however, when the mover group was divided, the voluntary movers were less likely and the involuntary movers were more likely to receive IA compared to the non-movers. Single parent IA was the most common form of IA. Almost half of households from the evicted group received single parent IA and 23% received disability IA in the year prior to moving into public housing, which is concerning but needs to be interpreted with caution since receipt of IA was determined at the household level. Thus, the applicant to public housing in this study was not necessarily the recipient of IA in the year prior to moving into public housing. Further study is needed to determine the household composition of those evicted.

In general, the cohort was in relatively poor health, which is consistent with other studies (Digenis-Bury, Brooks, Chen, Ostrem, & Horsburgh, 2008). The average number of ADGs for all groups was more than four, indicating that on average public housing applicants had more than four different health conditions, which is more than what is reported in other studies (Bazargan et al., 2005; Black, Rabins, German, McGuire, & Roca, 1997; Black et al., 1998). Approximately one-third of the cohort had a chronic physical illness and a mental disorder, and more than 20% had an injury requiring medical attention in the year prior to moving into public housing. Other studies have also reported an increased prevalence of mental illness among public housing residents (Black et al., 1997, Black et al., 1998; Cook, Black, Rabins, & German, 2000; Cummings, Cooper, & Johnson, 2013; Gonyea & Bachman, 2008; Rabins et al., 1996; Simning, van Wijngaarden, &

Conwell, 2011; Simning, van Wijngaarden, Fisher, Richardson, & Conwell, 2012). In our study, approximately 5% of the non-movers and voluntary movers had a physician-diagnosed substance abuse disorder, which is similar to the general population of Manitoba (Fransoo et al., 2013); however, involuntary movers had more than double the percentage with a substance abuse disorder. Other studies report a high level of drug and alcohol use among public housing residents (Cummings et al., 2013; DeKeseredy, Schwartz, Alvi, & Tomaszewski, 2003; Williams & Adams-Campbell, 2000; Wiggers et al., 2001).

While Digenis-Bury et al. (2008) found that public housing residents did not differ from other Boston residents on many measures of health service use after adjusting for differences in demographic characteristics, we found a high use of healthcare. The groups averaged more than seven GP visits and more than two specialist visits in the year prior to moving into public housing. In Manitoba, the average number of ambulatory care physician visits is 4.43 per year (Fransoo et al., 2013). Compared to the non-movers, the mover groups lacked continuity of care. On average, the mover groups saw more GPs than the non-movers. Also, more than 16% of the cohort was hospitalized and among those hospitalized, the average length of stay was 20 or more days. In Manitoba, the percentage of individuals hospitalized at least once is less than 7% (Fransoo et al., 2013). A slightly higher percentage of the evicted group was hospitalized for a mental health reason compared to the non-movers. In general, individuals who were evicted tended to be worse off in terms of their health status and their health service use patterns differed from those who remained in public housing. It is worth noting that in our study, health status and health service use were defined in the year prior to the move-in date, suggesting that applicants are moving into public housing with poor mental and physical health and have a high need for healthcare, and therefore may benefit from healthcare services strategically located within public housing developments.

Age and residential mobility prior to moving into public housing were consistently associated with moving out of public housing. Younger tenants were more likely to move out voluntarily and be evicted than older individuals. Our results for age are consistent with previous research (Bahchieva & Hosier, 2001; Freeman, 1998; Hungerford, 1996). Region of residence and receipt of income assistance were significantly associated with voluntarily moving out of public housing, but not with eviction. Specifically, urban residents and IA recipients were less likely to move out of public housing voluntarily. Previous research has also found that recipients of IA were less likely to move (Bahchieva & Hosier, 2001; Hungerford, 1996). While previous research has found sex to be associated with moving out of public housing (Hungerford, 1996), sex was only associated with eviction in our study.

Health status and health service use factors were significantly associated with being evicted from public housing, but were not significantly associated with moving out voluntarily. Specifically, tenants who were treated for an injury in the year prior to moving into public housing, those who had a physician-diagnosed chronic physical health condition, and those diagnosed with a substance abuse disorder were significantly more likely to be evicted. Additionally, tenants who lacked continuous care from the same GP and those who were hospitalized were more likely to be evicted. None of the health status or health service use variables were significantly associated with moving out voluntarily, suggesting the significant relationships observed in the all-mover model was being driven by those who were evicted. Interestingly, having a mental health disorder was not significantly associated with moving out of public housing in any of the models and receipt of IA was not associated with being evicted. These findings suggest that socioeconomic factors may be helpful

in identifying who will move out of public housing in general and by extension who will have short versus long tenancies, while health and health service use factors may be useful in identifying who will be evicted.

Policy Implications

This research is important since estimating tenancy duration has implications for the overall need for public housing, for developing policies on where to assign people to housing units, and for allocating services (Dockery et al., 2008). Since the public housing stock is limited, programs to help individuals become self-sufficient may be important to free units for others in need (Freeman, 1998).

Additionally, it is important to identify early who is likely to experience housing problems in order to mitigate them; eviction is amenable to intervention. Each step in the eviction process represents an opportunity to intervene; however, the earlier the intervention, the greater the chance of prevention. Acacia Consulting and Research (2006) depict housing instability as a cycle with eight stages: safe tenancy, arrears/default, notice, application, dispute, eviction order, housing loss, and housing search. Eviction prevention programs may be universally administered or directed to at-risk tenants (Crane et al., 2006), and offer a range of support and services, including providing information and advice, conflict resolution and mediation, legal representation, and emergency financial assistance (Acacia Consulting and Research, 2006; Burt, Pearson, & Montgomery, 2007; Canadian Mortgage and Housing Corporation, 2005; Distasio & McCullough, 2016; Theodos, Popkin, Parilla, & Getsinger, 2012; van Laere et al., 2008; van Laere, De Wit, & Klazinga, 2009b). There are also longer term eviction prevention initiatives, such as providing mental health services, supportive housing services, and rent subsidies (Burt et al., 2007). In our analysis, health status and health service use were significantly associated with eviction. Thus, in addition to providing mental health supports, services to address physical health challenges may also be beneficial. Physicians may have a role in identifying individuals at-risk of eviction and to refer patients to the appropriate services. Furthermore, the significance of substance abuse in our analysis suggests there is a need to provide training to tenants in harm reduction strategies and for landlords to support a Housing First approach so individuals can obtain and maintain housing. The evidence is strong that a Housing First approach works in keeping individuals who were homeless and have a mental illness housed and that when individuals are stably housed, their functioning improves (Roy et al., 2015; Stergiopoulos et al., 2015; Tsemberis, 1999; Tsemberis, Gulcur, & Nakae, 2004). The Community Wellness Initiative is an example of an eviction prevention program in Winnipeg; it is a partnership between the Winnipeg Regional Health Authority and Manitoba Housing that began in 2005 and includes outreach and group programs offered in several Manitoba Housing buildings. The Outreach program involves a housing support worker in regular contact on a one-on-one basis for up to a year with a Manitoba Housing tenant who is at-risk of being evicted to help the tenant maintain his/her tenancy and improve quality of life.

Strengths

This study has a number of strengths. We were able to link public housing data to health data at an individual-level, and to our knowledge, no other study has examined the association between move-out status and health characteristics. Additionally, we distinguished between movers who moved on their own

and movers who were evicted. This was important as these two groups differed in socioeconomic, health, and health service use characteristics.

Limitations

There are also a number of limitations to this study. Firstly, Manitoba Housing directly manages more than 13,000 public housing units. A total of 4,500 other social housing units are operated by cooperatives, non-profit groups, and property management agencies. As well, Manitoba Housing provides housing subsidies to 17,300 households. Individual-level administrative data are only available for tenants residing in public housing that Manitoba Housing directly manages, and not for tenants residing in other forms of housing.

Although there were numerous statistically significant associations, many of the HRs were small to moderate in size and the generalized R^2 values were small. These findings may arise due to measurement error in the outcome variable. Duration of tenancy and move-out status were based on the move-in and move-out dates recorded by Manitoba Housing. To move to a new residence within Manitoba Housing, individuals have to reapply, which may result in some misclassification.

There may also be measurement error in some of the covariates. The diagnoses of the health conditions are based on physician visits and hospitalizations in the 365 days prior to moving into public housing. Only one diagnosis code is recorded for each physician visit. Consequently, the number of people with any of the health conditions may be underestimated. Residential mobility may have been underestimated if address changes were not reported to Manitoba Health.

Additionally, there are a number of variables that we could not measure due to the lack of available data, such as the vacancy rate in public housing and the availability of other affordable low-income housing (Dockery et al., 2008; Freeman, 1998; Pawson & Munro, 2010). Also, we did not include characteristics of other household members or household-level characteristics, such as the presence of children, family size, the sex-age distribution of dependents, or a history of being homeless (Bahchieva & Hosier, 2001; Freeman, 1998; Hungerford, 1996). These could be examined in future research along with determining whether status changes (i.e., marital status, household size, disease diagnosis) spark a move.

Finally, our data do not indicate reasons for a move, other than eviction. Moving may have a positive impact if individuals move to a better housing situation, are more conveniently located to services, employment, and/or school (Pawson & Munro, 2010). Moving may have a negative impact if individuals are forced to move. A qualitative study could shed additional light on the impact of moving, beyond that ascertained from this population-based study.

CONCLUSION

In summary, individuals moving into public housing tend to be in poor health; thus, mental and physical health services strategically located in public housing developments would be wise. Additionally, since health status and health service use were associated with being evicted, physicians may have a role to play in identifying who is at-risk of eviction and to coordinate the appropriate supports for these tenants, including educating them on harm reduction strategies. In general, programs should be implemented to assist

tenants become self-sufficient and address the issues that contribute to them experiencing housing instability. Finally, since the socioeconomic and health characteristics of tenants who moved on their own differed from people who were evicted, future studies examining tenancy behaviour should account for move-out reason.

**Appendix
Table I**
CD Codes Used to Define Physical and Mental Disorders

Condition	ICD-9-CM	ICD-10-CA
Injury	80 – 99	S, T
Chronic Physical		
Respiratory Illness	466, 490–493, 496	J20, J21, J40–J45
Diabetes	250	E10–E14
Hypertension	401–405	I10–I15
Ischemic Heart Disease	410–413	I20–I25
Mental Disorder		
Schizophrenia	295	F20, F21, F25, F232
Affective Disorder	296, 300, 309, 311	F31–F33, F40–F42, F44, F48, F99, F341, F380, F381, F410, F411, F412, F413, F418, F419, F431, F432, F438, F450, F451, F452, F530, F680, F930
Substance Abuse Disorder	291, 292, 303–305	F10–F19, F55

Note. *In defining affective disorders using the hospital discharge abstracts, the following four digit ICD-9-CM codes were used 296.1 to 296.8, 300.0, 300.2 to 300.4, and 300.7.

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