The Impact of Housing Needs on Physical and Mental Health: Evidence from the Canadian Housing Survey

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By

Lawrence Agyepong

Supervised by

Dr. Nazmi Sari

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Abstract

Housing need is a critical social determinant of health, profoundly impacting the well-being of individuals and communities. Approximately 1 in 10 households in Canada live in substandard housing. Numerous studies have documented that people facing housing needs are at risk of homelessness and are more likely to experience poor health. This study examines the impact of housing needs on health outcomes in Canada. The study employs discrete choice regression models to analyze data from the Canadian Housing Survey. The findings show that housing needs negatively affect both physical and mental health, and its effect surpasses the influence of certain individual traits such as age and sex, as well as other factors like neighbourhood safety and community satisfaction. The findings also show that poor housing quality and high housing cost burden reduce the likelihood of reporting good physical and mental health. Furthermore, although high housing cost burden is the most prevalent form of housing need, housing quality consistently emerges as the most influential factor affecting physical and mental health across all specifications. These findings suggest an opportunity to tackle housing and health issues simultaneously, demonstrating that housing policies can be inherently health-improving and contribute to creating healthier and more equitable communities for all Canadians.

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1. Introduction

Housing need is a critical social determinant of health, profoundly impacting the well-being of individuals and communities. In Canada, housing need is measured by a composite indicator—core housing need—which combines different housing cost and quality standards and is used as a policy tool to identify households requiring housing support. According to the Canadian Housing Survey (CHS) 2021, approximately 1 in 10 households in Canada live in substandard housing or are in core housing need. People facing housing needs are at risk of homelessness and are more likely to have poor health outcomes. Numerous studies have documented the relationship between housing needs and health, labour and other socio-economic outcomes (Dotsikas et al., 2023; Mavromaras et al., 2011; Waterston et al., 2015).

Waterston et al. (2015) document that housing needs are associated with diminished overall health and other adverse outcomes, such as poor school performance and aggressive behaviours among Canadian children and youth. Unaffordable housing has been linked to poor physical and mental health and unhealthy behaviours (Baker et al., 2020; Dotsikas et al., 2023; Meltzer & Schwartz, 2016a). For instance, Meltzer & Schwartz (2016) showed that a higher housing cost burden is associated with a greater likelihood of poor self-reported physical health and the postponement of medical services for financial reasons among renters in New York. Other studies have found a negative association between poor physical housing conditions and crowding on physical and mental health (Palacios et al., 2021; Pilkauskas et al., 2014a; Shannon et al., 2018; Swope & Hernández, 2019).

While a substantial body of research examines the impact of housing needs on health, there is limited evidence in the health economics literature, particularly within the Canadian context. Also, although there is some evidence on the health effects of homelessness (*extreme housing need*), no recent evidence exists for those at risk of homelessness (*housing need*) in Canada. This study fills this gap by providing recent evidence on the relationship between housing needs and health outcomes in Canada. By employing discrete choice regression models to analyze data from the Public Use Micro-Data File of the Canadian Housing Survey (CHS) 2018 dataset, this study aims to accomplish two primary objectives. Firstly, it examines the effect of housing needs on physical and mental health. The study assesses whether there are discernible and significant disparities in

health outcomes between individuals residing in households experiencing housing needs and those not experiencing such needs. Secondly, the study examines the effects of specific housing need factors—housing cost burden and housing quality, on physical and mental health.

The rest of the paper proceeds as follows: Section 2 reviews the related empirical literature on housing needs and health outcomes. Section 3 describes the data and empirical strategy used in the study. Section 4 presents the study's findings. Finally, Section 5 provides the discussion and conclusion.

2. Literature Review

2.1 Housing as a Social Determinant of Health (SDH)

Social determinants of health (SDH) are the non-medical, socio-economic, and environmental conditions that influence individuals' health (Marmot et al., 2008; Solar & Irwin, 2010). The World Health Organization (WHO) defines SDH as "conditions in which people are born, grow, work, live, and age, and the broader set of forces and systems shaping the conditions of daily life." These conditions include the complex and interrelated social structures and economic systems contributing to disparities in health outcomes between individuals. These factors include education, social networks, occupation, housing conditions, and neighbourhood characteristics, all of which play crucial roles in shaping health outcomes (WHO Commission on Social Determinants of Health & World Health Organization, 2008).

Housing, in particular, has emerged as a key determinant that impacts individuals' ability to lead healthy lives (Pollack et al., 2010; Swope & Hernández, 2019). Adequate housing, characterized by secure and safe living environments that suit one's way of life and ensure access to basic living necessities and services, exerts direct and indirect influences on the health and overall well-being of individuals (Shannon et al., 2018). Dwelling in homes marked by poor air quality, pest infestation, and energy inefficiencies can directly result in adverse physical health (Fazel et al., 2014; Lebrun-Harris et al., 2013). For instance, inadequate housing conditions can increase the risk of respiratory illnesses and other health problems. Additionally, residing in unaffordable housing can generate anxiety due to the constant fear of eviction, precipitating mental health issues

such as depression and anxiety disorders, which can, in turn, affect physical health (Bentley et al., 2011; Pollack et al., 2010). Hence, according to the social determinants of health literature, housing need is expected to affect health outcomes negatively.

2.2 **Empirical Studies**

2.2.1 **Housing Needs and Health Outcomes**

Numerous studies have documented the relationship between housing needs and health, labour and other socio-economic outcomes (i.e., Hewett & Halligan, 2010; Swami, 2018). As consistently indicated in the literature, extreme forms of housing needs would exacerbate the issue of homelessness, which in turn has a direct impact on the health outcome of the individuals (i.e., Aubry et al., 2015; Fazel et al., 2014; McVicar et al., 2015; O'Campo et al., 2016). Several studies have consistently reported higher rates of chronic diseases among individuals in extreme housing need when compared to the general population, including conditions such as hypertension, cardiovascular disease, hepatitis, and depression (i.e., Bensken et al., 2021; Lebrun-Harris et al., 2013; Pribish et al., 2019).

For instance, a study conducted by Pribish et al. (2019) in Tampa, Florida, examined 183 homeless participants, revealing alarming statistics: 34.4% reported hypertension, 13.7% had diabetes, 27.1% experienced respiratory diseases, 5.6% faced hyperlipidemia, and 32.8% reported psychiatric disorders. These findings were substantiated by Bensken et al. (2021), who not only confirmed similar disease prevalence among the homeless population but also brought to light a notably higher comorbidity burden within this vulnerable group. Bensken et al. (2021) further emphasized that people facing extreme housing needs exhibit higher rates of disability, substance abuse, and alcohol use, often at two to three times the rate of the general population, indicating a significantly greater health burden.

The high prevalence of diseases among individuals facing housing needs and homelessness underscores the argument that housing is undeniably a social determinant of health. As Kulik et al. (2011) argue, inadequate housing or homelessness exposes individuals to precarious living

conditions and lifestyles, inadequate access to necessities, poor nutrition, and greater risk of violence and trauma, all of which can severely impact the physical and mental well-being of individuals. Lebrun-Harris et al. (2013) further reinforce this notion through empirical evidence, using logistic regression analysis to demonstrate that homeless patients exhibit worse health status compared to their housed counterparts, with higher rates of mental illness, a greater lifetime burden of chronic conditions, and more pronounced substance use problems. Additionally, homelessness often results in limited access to healthcare services, preventive care, and health education, exacerbating pre-existing health conditions and hindering early intervention (Kulik et al., 2011).

Subedi et al. (2022) investigated hospital readmission rates between homeless and non-homeless patients. Using propensity score matching techniques, homeless patients were matched with non-homeless patients and time-to-event analysis approaches were used to analyze time-to-readmission and 30-day readmission rates. They found higher rates of 30-day readmission among homeless patients (42.8%) compared to their non-homeless (19.9%) counterparts. Furthermore, they found that homeless patients suffering from chronic diseases, major depressive disorders and drug use disorders have a shorter time to readmission. Also, acute care utilization was found to be higher among people experiencing homelessness.

These studies collectively provide evidence of the dire physical and mental health challenges that individuals experiencing housing needs, particularly those experiencing homelessness, encounter. The consensus among these studies strongly suggests a negative association between housing needs and health outcomes. Thus, we hypothesize that individuals with housing needs will exhibit poorer physical and mental health compared to those who do not have housing needs.

2.2.2 **Housing Cost Burden and Health Outcomes**

Housing cost burden is typically measured by the shelter-cost-to-income ratio (STIR), which assesses the portion of before-tax household income spent on shelter. Housing is unaffordable if the household spends 30% or more of their before-tax household income on housing costs. The components of housing costs vary depending on tenure. For renters, housing costs include rent and utilities, such as water, fuel, electricity, and municipal services. On the other hand, homeowners'

housing costs include property taxes, mortgage payments, condo fees, and utilities. In Canada, high housing cost burden (or unaffordable housing) solely accounted for over 75% of individuals who experienced core housing needs in 2021 (DiBellonia & Kapoor, 2023). High housing costs often leave individuals with limited resources to meet other essential needs, such as food and medications, which can, in turn, impact physical and mental health.

Pollack et al. (2010) conducted a quasi-experimental study using data from the 2008 Southeastern Pennsylvania Household Health Survey to explore the link between housing affordability and health outcomes. They employed a variable representing respondents' difficulty in affording housing costs. Housing was deemed affordable if respondents reported "not very difficult" or "not difficult at all" and unaffordable if responses indicated "very difficult" or "somewhat difficult." The study examined several health status and healthcare utilization measures, including self-rated health, clinician-diagnosed chronic conditions, cost-related healthcare and prescription non-adherence, emergency department use, current smoking status, and obesity. Using propensity score methods, they found that living in unaffordable housing was associated with an increased likelihood of poor self-rated health, arthritis, and hypertension. They also found higher rates of cost-related healthcare non-adherence and prescription non-adherence among individuals in unaffordable housing. However, there was no significant relationship between housing affordability and psychiatric conditions, emergency department visits, obesity, or smoking.

Bentley et al. (2011) investigated the effects of housing affordability on mental health using longitudinal data from the Household, Income, and Labor Dynamics in Australia (HILDA) Survey spanning from 2001 to 2007. Housing was considered unaffordable if housing costs exceeded 30% of gross household income. Mental health was assessed using the Mental Component Summary (MCS), which measured respondents' vitality, social functioning, role limitations due to emotional problems, and mental health on a 0-100 scale. They found that unaffordable housing was associated with a decline in mental health among low-to-moderate-income households, with no significant association among high-income households. In a related study, Baker et al. (2020) showed that pre-existing mental health problems influence the effect of unaffordable housing on mental health. Using quantile regression, they discovered that individuals with low-to-median initial mental health were more negatively affected by unaffordable housing. In contrast, those with high initial mental health appeared to be protected.

Meltzer & Schwartz (2016) examined the effect of housing affordability on health-related outcomes among renters using data from New York City's Housing Vacancy Survey for 2011. They used self-reported health status and postponement of the five types of health care for financial reasons: dental, mental health, preventive care/checkup, treatment or diagnosis of illness or health condition and prescription drugs. For the self-reported health status, respondents rate their own health from poor to excellent, and researchers collapsed the variable into a binary measure where 1 represents good, very good and excellent health and 0 represents fair and poor health. Postponement of health care was measured by two variables: a binary measure, which takes the value 1 if the respondent reports postponing any of the five types of health care for financial reasons and 0 otherwise and a discrete variable, which counts the types of postponed health care. Housing affordability (or housing cost burden) was measured as the ratio of out-of-pocket rent to total household income. The researchers employed logit regressions to estimate the effect of housing affordability on the binary health outcomes and an ordinary least squares regression to estimate the effect of housing affordability on the number of postponed health care types.

Meltzer & Schwartz found a negative association between housing cost burden and self-reported health and that households facing high housing cost burdens are more likely to postpone health care services due to financial reasons. Furthermore, they found that the relationship was stronger for those with severe housing cost burdens, i.e., households spending more than 50% of their before-tax income on rent. The authors emphasized the importance of housing affordability by demonstrating that the effect of housing cost burden on health-related outcomes is equally or more important than the physical conditions of the housing.

These studies emphasize the complex interplay between high housing costs and individuals' ability to meet essential healthcare needs. As an essential aspect of life, housing often presents individuals and households with challenging financial trade-offs that may result in healthcare non-adherence. While there is a consensus regarding the impact of high housing cost burden on overall and physical health, the effects on mental health exhibit some variability in the research findings. Considering these insights, we hypothesize that individuals facing high housing cost burden will exhibit poorer physical and mental health than those in affordable housing.

2.2.3 **Housing Quality and Health Outcomes**

The physical conditions of housing have been shown to affect the health of individuals. Housing is of poor quality if it has issues such as defective electrical wiring or plumbing problems or needs structural repairs to components like stairs, ceilings, floors, or walls. Notably, the home is the second most common location for unintentional fatal injuries, as observed by Runyan et al., (2005). Housing-related risk factors, including the absence of window guards, inadequate lighting, and non-functional smoke alarms, can lead to injuries and, in severe cases, even fatalities (Swope & Hernández, 2019). Given that people spend a significant portion of their time within their homes (Palacios et al., 2021), these subpar physical conditions within the home environment expose occupants to risks of injury. Moreover, the specific characteristics of the home environment can exacerbate the severity of injury events (Runyan et al., 2005). Consequently, Runyan et al. argue that the degree of major repairs required in a housing unit is positively associated with the likelihood and severity of injuries, ultimately impacting overall health outcomes.

Recent research by Palacios et al. (2021) investigates the relationship between housing conditions and health outcomes. Their study draws from a longitudinal dataset tracking 25,000 German households over a span of 25 years. Housing conditions were assessed through two binary variables: one indicating the need for partial renovation and the other for full renovation. The study examined a range of health measures, including mental and physical health and healthcare utilization, which was proxied by the number of doctor visits over the last three months and the number of days individuals were sick. Using ordinary least squares and fixed effects methods, they found that inadequate housing was associated with an increased likelihood of experiencing poorer physical and mental health. Also, healthcare utilization was 11% higher among individuals residing in substandard housing. The study also revealed that the adverse effects of inadequate housing on health were considerably more pronounced for dwellings needing major renovations than those requiring partial renovations. This suggests that exposure to homes that fall short of being well-maintained is closely linked to deteriorated health outcomes. These findings align with a considerable body of literature exploring the impact of housing conditions and quality on health (e.g., Baker et al., 2016; Boch et al., 2020).

3. Data and Methods

3.1 Dataset and Study Sample

This study uses the Canadian Housing Survey (CHS), a comprehensive dataset providing information on health outcomes, housing needs, and socio-economic and demographic characteristics of Canadians. The CHS was initiated in 2018 by Statistics Canada and is to be collected every two years. There are two survey cycles (i.e., CHS 2018 and CHS 2021). This study uses the Public Use Micro File (PUMF) versions of both cycles as provided by the Centre for Income and Socioeconomic Well-being Statistics, Statistics Canada. The main analysis in this study uses the first cycle, CHS 2018, which includes information about 61,764 households, with each survey completed by the household member possessing the most comprehensive knowledge of the household's housing situation.

The sample used in this study excludes households not examined for core housing needs (1,582 households) or whose household income is not reported (3,068). This includes households on reserves, farm dwellings, or households with a zero or negative household total income before tax or a shelter-cost-to-income ratio greater than or equal to 100%. Additionally, respondents aged 17 or under are excluded from the study, resulting in a sample size of 57,112. The CHS 2021 dataset covering 40,988 households was used to assess the robustness of the results. Applying a similar age restriction as described above reduced the sample size of CHS 2021 to 36,606 observations.

3.2 Description of key variables

The dependent variables are self-reported physical health and mental health. The respondents were asked to rate their physical and mental health on a Likert scale ranging from 1 (excellent) to 5 (poor). Table 1 shows the distribution of the health variables for survey cycles 2018 and 2021. In CHS 2021, the proportion of respondents reporting "Excellent" and "Very Good" and mental health status is lower compared to CHS 2018, while those reporting "Good," "Fair," and "Poor" health is higher, indicating a decline in the people's perception of their health status. To facilitate the analysis of the impact of housing needs on health outcomes, the health variables were converted

into binary format: 1 represents "Excellent," "Very Good," and "Good," while 0 represents "Fair" and "Poor" health. This categorization is necessary for utilizing discrete choice regression models.

Table 1: Distribution of self-rated physical and mental health status

Dependent Variable	CHS 2018 N = 57,114	CHS 2021 N = 36,606	Difference* CHS 2018 – CHS 2021
Physical Health (%):			
Excellent	15.64	12.52	-3.12
Very Good	33.01	31.63	-1.38
Good	33.41	34.63	1.22
Fair	13.38	15.53	2.15
Poor	4.10	5.20	1.10
Not Stated	0.46	0.49	0.03
Mental Health (%):			
Excellent	23.19	16.71	-6.48
Very Good	33.15	31.51	-1.64
Good	30.61	33.24	2.63
Fair	9.78	14.08	4.30
Poor	2.69	3.81	1.12
Not Stated	0.58	0.66	0.08

Note: N is number of observations. *Except for individuals whose health status were not stated, all the reported differences are statistically significant at the 0.01 level.

The key independent variables of interest are housing needs, housing cost burden and housing quality. I use the core housing need variable as a measure of housing needs. Core housing needs measures whether a household lives in affordable, adequate or suitable housing or can afford alternative suitable and adequate local housing. The housing need variable is coded 1 when a household experiences core housing needs and 0 otherwise.

I derive the housing cost burden variable from the shelter-cost-to-income ratio groups variable in the CHS. The shelter-cost-to-income ratio (STIR) represents the proportion of a household's average total income spent on shelter costs. This variable classifies households based on the percentage of income spent on shelter costs: less than 30%, 30% to less than 50%, 50% to less than 100%, and over 100%. Housing cost burden is high (or housing is unaffordable) if households

spend 30% or more of before-tax income on shelter costs. Hence, I create a binary variable for housing cost burden, which takes 1 for households that spend 30% or more of income on shelter costs and 0 otherwise.

The housing quality variable measures whether housing needs any major repairs. In the CHS, respondents were asked about their dwelling conditions, categorizing dwelling repair needs into three groups: only regular maintenance, minor repairs, and major repairs. Poor housing quality is 1 for dwellings that needed major repairs and 0 otherwise.

Additionally, the survey included rich sets of respondents', household, dwelling, and neighbourhood characteristics, which I employed as control variables. These include respondent age and sex, along with various household and dwelling characteristics such as tenure, household size, household type, dwelling type, employment status of household members, education levels, province of residence, neighbourhood conditions and community satisfaction (see Table 2 for a description of the variables used in the analysis).

Table 2: Description of Variables

Variable	Mean	Description
Health Variables		
Physical Health	0.856	1 if "Excellent," "Very Good," and "Good," while 0 represents "Fair" and "Poor" self-rated general health
Mental Health	0.893	1 if "Excellent," "Very Good," and "Good," while 0 represents "Fair" and "Poor" self-rated mental health
Housing Need Variables		
Housing Need	0.116	1 if household is in core housing need and 0 otherwise
Housing Cost Burden	0.204	1 if household spends 30% or more of total before tax income or more on shelter costs and 0 otherwise
Poor Housing Quality	0.069	1 if dwelling needs a major repair and 0 otherwise
Control Variables		
Sex	0.499	1 if respondent is Female and 0 if Male*

Age of respondent	52.47	Three categories: 18 to 29 years*; 30 to 64 years and 64 and above
Household size	2.389	Number of household members
Bedrooms	2.738	Number of bedrooms in the house
Renting	0.307	1 if renting and 0 if dwelling is owned by a household member
Highest Level of Education Completed (Household level)	4.390	Seven categories ranging from "Less than high school diploma or its equivalent*" to "University certificate, diploma, degree above the bachelor's".
Province of Residence	35.93	All 10 provinces and the 3 territorial capitals. Newfoundland and Labrador*
Presence of Employed Person in Household	0.710	1 if at least one member of the household was employed and 0 otherwise
Household Type	2.964	Six categories: One couple with children; One couple without children; One lone-parent family; One census family plus additional person; One person*; Two or more persons not in census families
Dwelling Type	2.757	Six categories: Single-detached house*; Semi-detached house or other single-attached house; Row house; Apartment or flat in a duplex; Apartment in a building that has five or more storeys; Apartment in a building that has fewer than five storeys
Presence of Indigenous Household Member	0.035	1 if at least one household member is Indigenous and 0 otherwise
Presence of Visible Minority	0.211	1 if at least one household member belongs to a visible minority group and 0 otherwise.
Length of stay in unit	2.099	Three categories: those who have stayed for less than 5 years, between 5 to 10 years, and more than 10 years or always lived there.
Community Satisfaction	5.987	Scale from 0 ("Very dissatisfied") to 10 ("Very satisfied")
Neighborhood Satisfaction	0.856	1 if satisfied with neighbourhood and 0 otherwise
Safety and Security in home	0.879	1 if satisfied with safety and security within home and 0 otherwise
Vandalism	0.303	1 if vandalism/graffiti/other damages are a problem in the neighbourhood and 0 otherwise
Smog and air pollution	0.241	1 if smog or air pollution is a problem and 0 otherwise

Racial/Ethnic/Religious Attacks	0.143	1 if attacks motivated by race/ethnicity or religion is problem and 0 otherwise
People using or dealing drugs	0.319	1 if people using or dealing drugs is a problem in the neighbourhood and 0 otherwise
Mold or Mildew	0.048	1 if experienced issues with mold or mildew and 0 otherwise
Pests	0.142	1 if experienced issues with pests and 0 otherwise
Poor indoor air quality	0.099	1 if experienced issues with poor indoor air quality and 0 otherwise
***Denotes the reference group**		

3.3 **Empirical Strategy**

I employ discrete choice regression models to examine the impact of housing needs on health outcomes. First, in separate regressions, I regress the binary physical health and mental health measures on housing need, controlling for respondent, dwelling, household characteristics and neighbourhood and community variables. The logistic regression model generally takes on the following form:

$$\text{Prob}(\text{Health}_i = 1|\text{HN}_i, \text{X}_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 \text{HN}_i + \lambda \text{X}_i)}} \qquad (1)$$

Where Health_i represents health outcome (i.e., self-rated physical health or mental health) for individual i; HN_i measures whether individual i is in a household that is in housing need; X_i is a vector of control variables including respondent, household, dwelling, neighbourhood characteristics; β_0 is the intercept term; β_1 is the coefficient of housing needs while λ is a vector of coefficients of the control variables. β_1 is the coefficient of interest to this study since it captures the effect of housing need on the health outcomes. With specification (1), I estimate logistic regression models where I regress physical health and mental health on housing needs and the other covariates.

Next, I estimate the effects of housing cost burden and poor housing quality on physical health and mental health. This logistic regression model takes the following form:

$$\text{Prob}(\text{Health}_i = 1|\text{HN}_i, \text{X}_i) = \frac{1}{1 + e^{-(\beta_0 + \delta\text{HN}_i + \lambda\text{X}_i)}} \qquad (2)$$

Here, HN_i is a vector of containing housing cost burden and poor housing quality variables, and δ is a vector of their coefficients. All other notations have the same meaning as in the first specification (1). Similarly, I estimate logistic regressions to examine the effects of housing cost burden and housing quality on physical and mental health. Additionally, I estimate equations (1) and (2) using the linear probability model because it is easier to interpret than the logistics regression models.

An estimation challenge that emerges when exploring the link between housing needs and health is the issue of simultaneity bias and endogeneity (McVicar et al., 2015; Meltzer & Schwartz, 2016a). Extreme housing needs can increase the risk of precarious living conditions, adversely affecting health. Conversely, individuals with poor health are more prone to facing housing needs. Moreover, existing literature underscores the influence of other social determinants of health that may introduce confounding factors in the relationship between housing needs and health (Baker et al., 2020; Meltzer & Schwartz, 2016).

To mitigate these estimation challenges, I include controls for demographic, household, and neighbourhood characteristics to isolate the effects of social health determinants, such as age, sex, dwelling conditions, and neighbourhood attributes. This approach partially addresses potential issues of confounding variables. However, a significant challenge arises from the fact that the public use micro-file version of the CHS only provides demographic information at the household level, prioritizing respondent confidentiality. Consequently, detailed individual-level characteristics, such as education level and employment status, are inaccessible in this dataset.

To overcome this limitation, I utilized variables such as the highest education completed by any household member and whether any household member is employed as proxies for education and employment, respectively. These proxies are reasonable since the respondents are those with the most comprehensive knowledge about the housing situations of the households, and they may as well be highly educated and employed household members. Furthermore, I conducted a sensitivity analysis by exploiting how long the household has stayed in the current unit. I also used the CHS 2021 dataset to run the analysis to ensure the robustness of the models and results. These additional

steps add an extra layer of reliability to the findings and reinforce the validity of the relationships explored in the study.

4. Results

4.1 Overview of Health Outcomes and Core Housing Need

Individuals in households experiencing core housing needs reported poorer health outcomes compared to those not experiencing such housing challenges. As depicted in Figure 1, the percentage of individuals self-reporting good physical and mental health (i.e., Excellent, Very Good, and Good) in 2018 is 19 percentage points and 11.6 percentage points lower among those experiencing core housing needs compared to their counterparts in households not facing core housing needs. This difference is statistically significant (see Table A1). A similar trend persists in 2021, with individuals in core housing needs reporting poorer physical and mental health compared to those not facing such housing challenges. Additionally, we note a decline in health outcomes from 2018 to 2021, which is unsurprising given the lower perception of health status likely influenced by the COVID-19 pandemic.

Figure 1: Positive Health Outcomes and Core Housing Need (CHS 2018 and 2021)

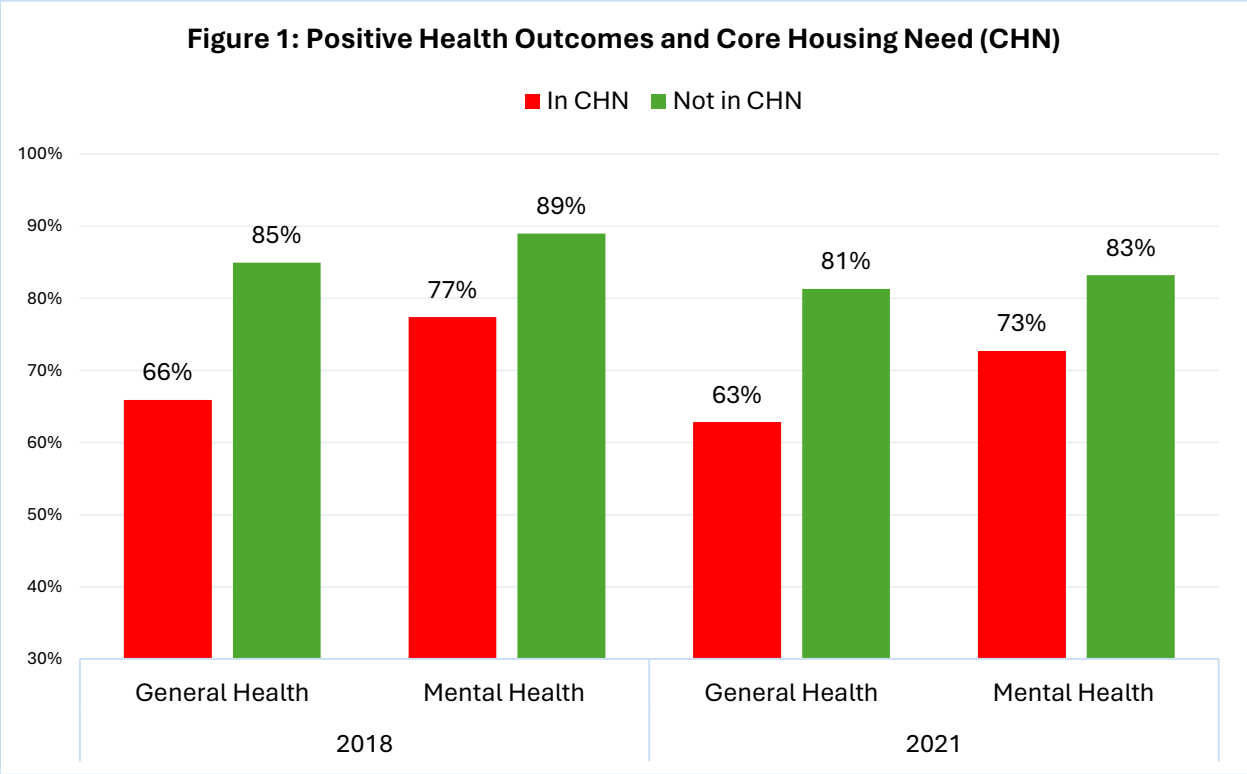

Figure Summary: The figure illustrates the percentage of individuals reporting good physical and mental health in 2018 and 2021, categorized by whether they were in core housing needs. The difference in health outcomes between those in core housing needs and those who are not is statistically significant at the 0.01 level.

Utilizing CHS 2018 data, I conducted a correlation analysis between health outcomes and housing need variables, as shown in Table 3. A significant negative correlation exists between housing needs and self-reported physical and mental health. Similarly, housing cost burden and housing quality display a negative and significant correlation with health outcomes.

Table 3: Correlation between Health Outcomes and Housing Need Variables for CHS 2018

Variables	Physical Health	Mental Health
Housing need	-0.142***	-0.116***
Housing cost burden	-0.094***	-0.101***
Poor housing quality	-0.114***	-0.102***

Note: All variables used in this correlation analysis are binary
*** p-value<.01

4.2 **Regression Results**

I employ logistic regressions to examine the impact of housing needs on self-reported physical and mental health. Following this, I assess the impact of housing cost burden and housing quality on self-reported physical and mental health. I perform various sensitivity checks to assess the robustness and reliability of the results. Additionally, I repeat the estimation using the linear probability model to facilitate easier interpretation of the results.

4.2.1 **Effect of Housing Needs on Physical Health**

First, I present the summary of regression results examining the relationship between self-reported physical health and housing needs in Table 4 and the detailed results in Table A3. The first column of Table 4 displays the logistic regression results, and the second displays the linear probability model (LPM) results. In the first column, the results indicate that individuals in housing need are 33.8% less likely to report good physical health compared to those not in housing need. This suggests a negative relationship between housing need and the likelihood of reporting good physical health, and this relationship is statistically significant at the 0.01 level. Contrasting this finding with the linear probability model (LPM) in column (2), we observe a lower estimate from the LPM, indicating that the likelihood of reporting good physical health is, on average, 7.2% lower for those in housing need compared to those not in housing need. However, the logistic regression results are deemed more reliable, given that our dependent variable is binary.

Table 4: Summary of regression results, effects of housing needs on physical health

	(1)	(2)
	Logistic	**LPM**
Housing need	0.662***	-0.072***
	(0.049)	(0.012)
Respondent/Household/Dwelling Controls?	Y	Y
Neighborhood/Community Controls?	Y	Y
Observations	47,654	47,654

Note: Y if the variables are included in the model, N if not included. Other significant controls are age (-), renting (-), presence of employed household members (+), the highest level of education (+), household type, province, presence of indigenous household members (-), presence of visible minority members (-), community and neighbourhood satisfaction (+), safety and security indoor (+), neighbourhood issues (-), people dealing or using drug (-), poor indoor air quality (-), mould and mildew issues (-), presence of pests (-). Standard error in parenthesis.

*** $p<0.01$

4.2.2 **Effect of Housing Needs on Mental Health**

Table 5 presents the summary results from the regressions of self-reported mental health on housing need, and Table A4 provides the detailed results. In column (1), the results show that individuals in housing need are 34% less likely to report good mental health compared to those not in housing need. This result is consistent with our finding for physical health. Similarly, the linear probability model (LPM) yields a lower estimate of the effect of housing need i.e., individuals in housing need are estimated to be 5.6% less likely to report good mental health compared to those not in housing need. This relationship is statistically significant. These findings suggest that individuals experiencing housing needs are more likely to have poorer mental health outcomes.

Table 5: Summary regression results, effects housing need on mental health

	(1)	(2)
	Logistic	**LPM**
Housing need	0.660***	-0.056***
	(0.053)	(0.010)
Respondent/Household/Dwelling Controls?	Y	Y
Neighborhood/Community Controls?	Y	Y
Observations	47,610	47,610

Note: Y if the variables are included in the model, N if not included. Other significant controls include age (+), renting (-), female (-), presence of employed household members (+), the highest level of education (+), household size (+), province, presence of visible minority members (+), safety and security indoor (+), community satisfaction (+), neighbourhood issues (-). Standard errors in parenthesis.
*** $p<0.01$.

4.2.3 **Effects of Housing Cost Burden and Quality on Physical and Mental Health**

I investigate the effects of housing cost burden and housing quality on self-reported physical and mental health. Table 6 summarizes the results of regressing self-reported physical health on housing cost burden and quality. The results reveal that individuals in households experiencing a high housing cost burden are 21.9% less likely to report good physical health compared to those not facing such burden. Additionally, individuals residing in poor quality housing are 42.5% less likely to report good physical health compared to their counterparts in good quality housing. These associations are statistically significant at the 0.01 level. While the linear probability model (LPM) yields similar directional effects, it provides lower estimates. Notably, housing quality has a stronger effect on physical health compared to housing cost burden. These findings remain consistent across both logistic regression and linear probability models.

Table 7 summarizes the regression results for self-reported mental health and housing cost burden and quality. The results show that individuals residing in households facing a high housing cost burden are 30.2% less likely to report good mental health compared to those not facing such burden. Similarly, individuals living in poor quality housing are 33.9% less likely to report good mental health compared to their counterparts in good quality housing. These findings suggest a significant and negative impact of housing cost burden and poor housing quality on mental health.

Furthermore, in line with the results for physical health, housing quality has a stronger effect on mental health outcomes compared to housing cost burden.

Table 6: Summary regression results, effects of housing cost burden and quality on physical health

	(1)	(2)
	Logistic	**LPM**
Housing Cost Burden	0.781***	-0.034***
	(0.050)	(0.008)
Poor Housing Quality	0.575***	-0.084***
	(0.050)	(0.014)
Respondent/Household/Dwelling Controls?	Y	Y
Neighborhood/Community Controls?	Y	Y
Observations	47,654	47,654

Standard errors in parenthesis.
*** p<0.01

Table 7: Summary regression results, effects of housing cost burden and quality on mental health

	(1)	(2)
	Logistic	LPM
Housing Cost Burden	0.698***	-0.039***
	(0.048)	(0.007)
Poor Housing Quality	0.661***	-0.054***
	(0.069)	(0.013)
Respondent/Household/Dwelling Controls?	Y	Y
Neighborhood/Community Controls?	Y	Y
Observations	47,610	47,610

Standard errors in parenthesis.
*** p<0.01

4.2.4 **Effects of the Severity of Housing Need on Physical and Mental Health**

Here, I examine the impact of severity of housing cost burden and housing quality on self-reported physical and mental health. Housing cost burden is affordable if where shelter to income ratio (STIR) is less than 30%, moderate if STIR is 30% to less than 50% and severe if STIR is 50% and above. Housing quality is classified into houses needing only regular maintenance, minor repairs, and major repairs. I introduce a new model, replacing the housing cost burden and housing quality variables with their respective categories, and present the logistic regression results in Table 8. Column 1 displays the results for the physical health model, and column 2 for the mental health model, with both models including all relevant respondents, household, dwelling, neighbourhood, and community covariates.

We observe that the odds of reporting good physical health are lower for those experiencing a severe housing cost burden than those with a moderate one. Similarly, the odds of reporting good mental health are lower for individuals with severe housing cost burden compared to those with moderate housing cost burden. Furthermore, individuals residing in houses needing major repairs are more likely to report poorer physical and mental health than those requiring minor repairs. Thus, while housing cost burden is associated with poorer health outcomes, these effects are pronounced for those allocating more than 50% of their income to housing. In addition, we learn that even minor repair needs are associated with poorer health outcomes.

Table 8: Logistic regression, severity of housing cost burden and housing quality on health

	(1) Physical Health	(2) Mental Health
Housing Cost Burden:		
Moderate (STIR 30% to less than 50%)	0.830***	0.747***
	(0.057)	(0.058)
Severe (STIR >= 50%)	0.692***	0.614***
	(0.075)	(0.067)
Housing Quality:		
Minor repairs needed	0.784***	0.699***
	(0.047)	(0.045)
Major repairs needed	0.526***	0.571***
	(0.047)	(0.061)
Respondent/Household/Dwelling Controls?	Y	Y
Neighborhood/Community Controls?	Y	Y
Observations	47,654	47,654

Note: STIR – shelter cost to income ratio.
Standard errors in parenthesis.
** p<0.05; *** p<0.01

4.3 **Sensitivity Analysis**

Our current analysis shows a contemporaneous relationship between housing needs and health outcomes. It is important to understand whether housing needs precede health outcomes or whether individuals with poorer health tend to move into substandard units. To do this, identifying the timing and direction of the relationship between housing needs and health outcomes is crucial. In the absence of longitudinal data or instrumental variable(s) to capture the direction of the relationship, I perform the following sensitivity analysis. First, I perform subgroup analysis using the length of stay in the current units. Second, I re-estimated the impact of housing needs on health using the Canadian Housing Survey 2021. These tests attempt to establish the reliability of the results.

4.3.1 **Exploiting the Length of Stay in the Current Unit**

Following Meltzer & Schwartz (2016), I exploit the variation in the length of stay to examine to what extent housing need directly affects health outcomes. Stratifying the sample into three groups based on the length of stay (i.e., less than 5 years, between 5 and 10 years, and more than 10 years), I hypothesize that, on average and controlling for all relevant covariates, housing needs should precede current health outcomes for those with longer stays in the current unit. If the coefficients of housing need variables are larger and more significant for those with longer stays, it suggests evidence that housing needs may precede declines in health outcomes.

The results of these stratified regressions for physical health are presented in Table 9 and for mental health in Table 10. In Panel A of Table 9, housing needs exhibit negative and significant effects on physical health for all three groups. However, the odds of reporting good physical health are lower for those with longer stays compared to those with shorter stays. Similarly, Panel B of Table 9 indicates that the effect of poor housing quality on physical health is stronger and more significant for those with longer stays. Also, the effect of housing cost burden on physical health is stronger for those with longer stays.

Likewise, the results in Panel A of Table 10 reveal that the odds of reporting good mental health for those experiencing housing needs are lower for those with longer stays compared to those with shorter stays. Additionally, housing cost burden and housing quality have a stronger negative and significant association with mental health for those with longer stays. In summary, the association between housing needs and health outcomes is more pronounced for those who have stayed longer in the current unit, providing suggestive evidence that housing needs may depress health outcomes.

Table 9: Stratified logistic regressions by length of stay in housing unit, self-reported physical health and housing variables.

PANEL A			
	Less than 5 years	**Between 5 and 10 years**	**10 years and above**
Housing need	0.680***	0.633***	0.644***
	(0.079)	(0.100)	(0.076)
Observations	16,710	9,875	21,069

PANEL B			
	Less than 5 years	**Between 5 and 10 years**	**10 years and above**
Housing Cost Burden	0.855***	0.655***	0.807**
	(0.088)	(0.087)	(0.082)
Poor Housing Quality	0.674**	0.574***	0.533***
	(0.108)	(0.109)	(0.064)
Observations	16,710	9,875	21,069

Note: All control variables included.
Standard errors in parenthesis.
*** p<0.01

Table 10: Stratified logistic regressions by length of stay in housing unit, self-reported mental health and housing variables.

PANEL A			
	Less than 5 years	**Between 5 and 10 years**	**10 years and above**
Housing need	0.714***	0.659**	0.572***
	(0.084)	(0.107)	(0.082)
Observations	16,685	9,869	21,056

PANEL B			
	Less than 5 years	**Between 5 and 10 years**	**10 years and above**
Housing Cost Burden	0.725***	0.728**	0.652***
	(0.073)	(0.108)	(0.080)
Poor Housing Quality	0.829	0.671*	0.534***
	(0.132)	(0.146)	(0.090)
Observations	16,685	9,869	21,056

Note: All control variables included.
Standard errors in parenthesis.
* p<0.1; ** p<0.05; *** p<0.01

4.3.2 **Evidence from Canadian Housing Survey 2021**

As an additional robustness check, I conduct an identical analysis of the health outcome variables on housing need variables using the Canadian Housing Survey 2021 dataset. Collected during the COVID-19 pandemic, we anticipate that individuals might be more prone to perceive their health status as lower, resulting in lower reported physical and mental health. Moreover, we consider the potential impact of pandemic-related income support measures such as the Canada Emergency Response Benefit (CERB) and rent freezes implemented by various governments across the country (see a report by DiBellonia & Kapoor, 2023) on housing need variables. I acknowledge that these factors could influence the relationship between housing needs variables and health outcomes. I present a summary of the results in Table 11.

In Panel A of Table 11, housing needs exhibit a negative and significant correlation (at the 0.01 level) with the likelihood of reporting good physical health. However, we observe a positive and

insignificant association between housing needs and the odds of reporting good mental health. Furthermore, the result in Panel B of Table 11 reveals that housing cost burden and housing quality have a negative and significant effect on self-reported physical health. Although both housing cost burden and quality have a negative effect on mental health, only housing quality has statistical significance. These results are generally consistent with our earlier findings, suggesting a link between housing needs and poorer health outcomes, with housing quality displaying the strongest significant effect on health outcomes.

Table 11: Logistic regression results, effect of housing need on health outcomes (CHS 2021)

PANEL A		
	(1)	(2)
	Physical Health	Mental Health
Housing need	0.692***	0.998
	(0.074)	(0.144)
Observations	24,372	24,348

PANEL B		
	(1)	(2)
	Physical Health	Mental Health
Housing Cost Burden	0.804**	0.972
	(0.073)	(0.094)
Poor Housing Quality	0.559***	0.561***
	(0.071)	(0.074)
Observations	24,372	24,348

Note: All control variables included.
Standard errors in parenthesis.
* p<0.1; ** p<0.05; *** p<0.01

5. Discussion and Conclusion

The analysis presented in this study using the Canadian Housing Survey indicates that housing needs significantly impact health. Aligned with prior studies, this study shows that housing needs negatively affect both physical and mental health, and its effect surpasses that of certain individual traits such as age and sex, as well as other factors like neighbourhood safety and community satisfaction. Furthermore, the relationship between housing needs and health persists across various robustness checks, including segmenting the sample by tenure duration or length of stay in the unit and analyzing data from the COVID-19 pandemic era, as captured in the Canadian Housing Survey 2021.

The findings reveal that poor housing quality has a negative effect on health. Even housing units with minor repair needs are significantly associated with poorer physical and mental health, corroborating the findings of Palacios et al. (2021). These findings are consistent with extensive literature examining the impact of physical housing conditions on health outcomes (e.g., Boch et al., 2020; Runyan et al., 2005; Swope & Hernández, 2019), reinforcing the notion of a direct link between physical housing conditions and health. In contrast to the findings of Meltzer & Schwartz (2016), this study suggests that the physical conditions of housing exert a stronger influence on health outcomes than the housing cost burden. Additionally, the effect of poor housing quality on health is stronger and more significant for those who have stayed longer in the housing units.

The results also show that housing cost burden significantly impacts both physical and mental health, supporting existing evidence that high housing cost burdens contribute to poor health outcomes (Baker et al., 2020; Bentley et al., 2011; Meltzer & Schwartz, 2016; Pollack et al., 2010). When housing cost burden is high, individuals or households may be compelled to make trade-offs, often sacrificing preventive health services or other health-promoting expenditures to afford housing. The adverse effect of high housing cost burden on health, as evidenced in this study, suggests the importance of such trade-offs, aligning with the conclusions drawn by Meltzer & Schwartz (2016). Moreover, akin to the findings of Meltzer & Schwartz, this study indicates that the negative effect of high housing cost burden on health is particularly pronounced for individuals experiencing severe housing cost burdens—those spending 50% or more of their household income on shelter costs. Consequently, such households, whether due to low incomes or high

shelter costs, may find themselves foregoing essential preventive health services or health-enhancing expenditures to maintain their housing, leading to a marked deterioration in their health.

Overall, this study provides evidence that housing needs - comprising both housing quality and cost burden – adversely affect physical and mental health outcomes among Canadians. However, this study did not establish a clear causal relationship despite finding robust correlations between housing needs and health outcomes. Also, the absence of longitudinal data on housing needs and health status limits the ability to precisely identify the direction of the effect between housing need measures and health outcomes. As such, the findings of the study should be interpreted cautiously. Nonetheless, this study demonstrates that a meaningful relationship exists between housing needs and health. These results suggest that addressing housing needs could potentially improve health outcomes and may benefit the health sector by reducing the pressure on healthcare utilization, potentially resulting in cost savings.

References

Al-Hemiary, N. J., Hashim, M. T., Al-Diwan, J. K., & Razzaq, E. A. (2015). Alcohol and drug abuse in post-conflict Iraq. Journal of the Faculty of Medicine Baghdad, 57(4), 290–294.

Aubry, T., Nelson, G., & Tsemberis, S. (2015). Housing first for people with severe mental illness who are homeless: A review of the research and findings from the at home—Chez soi demonstration project. The Canadian Journal of Psychiatry, 60(11), 467–474.

Baker, E., Lester, L. H., Bentley, R., & Beer, A. (2016). Poor housing quality: Prevalence and health effects. Journal of Prevention & Intervention in the Community, 44(4), 219–232. https://doi.org/10.1080/10852352.2016.1197714

Baker, E., Pham, N. T. A., Daniel, L., & Bentley, R. (2020). New evidence on mental health and housing affordability in cities: A quantile regression approach. Cities, 96, 102455. https://doi.org/10.1016/j.cities.2019.102455

Bensken, W. P., Krieger, N. I., Berg, K. A., Einstadter, D., Dalton, J. E., & Perzynski, A. T. (2021). Health Status and Chronic Disease Burden of the Homeless Population: An Analysis of Two Decades of Multi-Institutional Electronic Medical Records. Journal of Health Care for the Poor and Underserved, 32(3), 1619–1634. https://doi.org/10.1353/hpu.2021.0153

Bentley, R., Baker, E., Mason, K., Subramanian, S. V., & Kavanagh, A. M. (2011). Association Between Housing Affordability and Mental Health: A Longitudinal Analysis of a Nationally Representative Household Survey in Australia. American Journal of Epidemiology, 174(7), 753–760. https://doi.org/10.1093/aje/kwr161

Boch, S. J., Taylor, D. M., Danielson, M. L., Chisolm, D. J., & Kelleher, K. J. (2020). 'Home is where the health is': Housing quality and adult health outcomes in the Survey of Income and Program Participation. Preventive Medicine, 132, 105990. https://doi.org/10.1016/j.ypmed.2020.105990

Braubach, M., Jacobs, D. E., & Ormandy, D. (2011). Environmental burden of disease associated with inadequate housing: A method guide to the quantification of health effects of selected housing risks in the WHO European Region. World Health Organization. Regional Office for Europe.

Campagna, G. (2016). Linking crowding, housing inadequacy, and perceived housing stress. Journal of Environmental Psychology, 45, 252–266. https://doi.org/10.1016/j.jenvp.2016.01.002

DiBellonia, S., & Kapoor, G. T. (2023a). REPORT-Modernizing core housing need-Why the key indicator in Canadian.

DiBellonia, S., & Kapoor, G. T. (2023b). REPORT-Modernizing core housing need-Why the key indicator in Canadian.

Dotsikas, K., Osborn, D., Walters, K., & Dykxhoorn, J. (2023). Trajectories of housing affordability and mental health problems: A population-based cohort study. Social Psychiatry and Psychiatric Epidemiology, 58(5), 769–778. https://doi.org/10.1007/s00127-022-02314-x

Fazel, S., Geddes, J. R., & Kushel, M. (2014). The health of homeless people in high-income countries: Descriptive epidemiology, health consequences, and clinical and policy recommendations. The Lancet, 384(9953), 1529–1540.

Firdaus, G. (2018). Increasing Rate of Psychological Distress in Urban Households: How Does Income Matter? Community Mental Health Journal, 54(5), 641–648. https://doi.org/10.1007/s10597-017-0193-9

Harandi, T. F., Taghinasab, M. M., & Nayeri, T. D. (2017). The correlation of social support with mental health: A meta-analysis. Electronic Physician, 9(9), 5212–5222. https://doi.org/10.19082/5212

Hewett, N., & Halligan, A. (2010). Homelessness is a healthcare issue. Journal of the Royal Society of Medicine, 103(8), 306–307.

Kulik, D. M., Gaetz, S., Crowe, C., & Ford-Jones, E. (Lee). (2011). Homeless youth's overwhelming health burden: A review of the literature. Paediatrics & Child Health, 16(6), e43–e47. https://doi.org/10.1093/pch/16.6.e43

Lebrun-Harris, L. A., Baggett, T. P., Jenkins, D. M., Sripipatana, A., Sharma, R., Hayashi, A. S., Daly, C. A., & Ngo-Metzger, Q. (2013). Health Status and Health Care Experiences among Homeless Patients in Federally Supported Health Centers: Findings from the 2009 Patient Survey. Health Services Research, 48(3), 992–1017. https://doi.org/10.1111/1475-6773.12009

Lepore, S. J. (1994). Crowding: Effects on health and behavior. Encyclopedia of Human Behavior, 2, 43–51.

Marmot, M., Friel, S., Bell, R., Houweling, T. A., & Taylor, S. (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. The Lancet, 372(9650), 1661–1669.

Mavromaras, K., King, D., Macaitis, K., Mallett, S., & Batterham, D. (2011). Finding work: Homelessness and employment. Canberra: Department of Families, Housing, Community Services and Indigenous Affairs.

McVicar, D., Moschion, J., & Van Ours, J. C. (2015). From substance use to homelessness or vice versa? Social Science & Medicine, 136, 89–98.

Meltzer, R., & Schwartz, A. (2016a). Housing affordability and health: Evidence from New York City. Housing Policy Debate, 26(1), 80–104.

Meltzer, R., & Schwartz, A. (2016b). Housing Affordability and Health: Evidence From New York City. Housing Policy Debate, 26(1), 80–104. https://doi.org/10.1080/10511482.2015.1020321

Min Park, J., Fertig, A. R., & Metraux, S. (2011). Changes in Maternal Health and Health Behaviors as a Function of Homelessness. Social Service Review, 85(4), 565–585. https://doi.org/10.1086/663636

Mylene Riva, Pierrich Plusquellec, Robert-Paul Juster, Elhadji A Laouan-Sidi, Belkacem Abdous, Michel Lucas, Serge Dery, & Eric Dewailly. (2014). Household crowding is associated with higher allostatic load among the Inuit. Journal of Epidemiology and Community Health, 68(4), 363. https://doi.org/10.1136/jech-2013-203270

O'Campo, P., Stergiopoulos, V., Nir, P., Levy, M., Misir, V., Chum, A., Arbach, B., Nisenbaum, R., To, M. J., & Hwang, S. W. (2016). How did a Housing First intervention improve health and social outcomes among homeless adults with mental illness in Toronto? Two-year outcomes from a randomised trial. BMJ Open, 6(9), e010581.

Palacios, J., Eichholtz, P., Kok, N., & Aydin, E. (2021). The impact of housing conditions on health outcomes. Real Estate Economics, 49(4), 1172–1200. https://doi.org/10.1111/1540-6229.12317

Pilkauskas, N. V., Garfinkel, I., & McLanahan, S. S. (2014a). The Prevalence and Economic Value of Doubling Up. Demography, 51(5), 1667–1676.

Pilkauskas, N. V., Garfinkel, I., & McLanahan, S. S. (2014b). The prevalence and economic value of doubling up. Demography, 51(5), 1667–1676.

Pollack, C. E., Griffin, B. A., & Lynch, J. (2010). Housing Affordability and Health Among Homeowners and Renters. American Journal of Preventive Medicine, 39(6), 515–521. https://doi.org/10.1016/j.amepre.2010.08.002

Pribish, A., Khalil, N., Mhaskar, R., Woodard, L., & Mirza, A.-S. (2019). Chronic Disease Burden of the Homeless: A Descriptive Study of Student-Run Free Clinics in Tampa, Florida. Journal of Community Health, 44(2), 249–255. https://doi.org/10.1007/s10900-018-0580-3

Runyan, C. W., Casteel, C., Perkis, D., Black, C., Marshall, S. W., Johnson, R. M., Coyne-Beasley, T., Waller, A. E., & Viswanathan, S. (2005). Unintentional injuries in the home in the United States: Part I: Mortality. American Journal of Preventive Medicine, 28(1), 73–79. https://doi.org/10.1016/j.amepre.2004.09.010

Shannon, H., Allen, C., Dávila, D., Fletcher-Wood, L., Gupta, S., Keck, K., Lang, S., Kahangire, D. A., & World Health Organization. (2018). WHO Housing and health guidelines: Web annex A: report of the systematic review on the effect of household crowding on health.

Solar, O., & Irwin, A. (2010). A conceptual framework for action on the social determinants of health. WHO Document Production Services.

Solari, C. D., & Mare, R. D. (2012). Housing crowding effects on children's wellbeing. Social Science Research, 41(2), 464–476. https://doi.org/10.1016/j.ssresearch.2011.09.012

Subedi, K., Acharya, B., & Ghimire, S. (2022). Factors Associated With Hospital Readmission Among Patients Experiencing Homelessness. American Journal of Preventive Medicine, 63(3), 362–370. https://doi.org/10.1016/j.amepre.2022.02.004

Swami, N. (2018). The effect of homelessness on employment entry and exits: Evidence from the Journeys Home Survey.

Swope, C. B., & Hernández, D. (2019). Housing as a determinant of health equity: A conceptual model. Social Science & Medicine, 243, 112571. https://doi.org/10.1016/j.socscimed.2019.112571

Waterston, S., Grueger, B., Samson, L., Canadian Paediatric Society, & Community Paediatrics Committee. (2015). Housing need in Canada: Healthy lives start at home. Paediatrics & Child Health, 20(7), 403–407.

WHO Commission on Social Determinants of Health & World Health Organization. (2008). Closing the gap in a generation: Health equity through action on the social determinants of health: Commission on Social Determinants of Health final report. World Health Organization.

APPENDIX

Table A1: Proportions Test, Core Housing Need and Health Outcomes for 2018 and 2021

	(1) Not in core housing need	(2) In core housing need	(1) – (2) Difference
2018:			
Physical Health	84.9%	65.9%	19%***
Mental Health	89%	77.4%	11.6%***
2021:			
Physical Health	81.3%	62.9%	18.5%***
Mental Health	83.2%	72.8%	10.5%***

* p<0.1; ** p<0.05; *** p<0.01

Table A2: Pairwise Correlation between Housing Needs and Health Variables (CHS 2018)

Variables	Physical Health	Mental Health	Core housing need	Unaffordable housing	Inadequate housing
Physical health	1.000				
Mental health	0.387***	1.000			
Housing need	-0.142***	-0.116***	1.000		
Housing cost burden	-0.094***	-0.101***	0.627***	1.000	
Poor housing quality	-0.114***	-0.102***	0.129***	0.047***	1.000

Note: All variables used in this correlation analysis are binary
*** p-value<.01, ** p-value <.05, * p-value <.1

Table A3: Detailed regression results, effect of housing needs on physical health

	(1) **Logistic**	(2) **Logistic**	(3) **Logistic**	(4) **LPM**
Housing Need				
Housing need		0.651***	0.72***	-0.076***
		(0.047)	(0.059)	(0.012)
Respondent/Household/Dwelling Controls				
Age	0.977***	0.976***	0.966***	-0.002***
	(0.002)	(0.002)	(0.002)	(0.000)
Renting	0.654***	0.687***	0.746***	-0.04***
	(0.045)	(0.049)	(0.058)	(0.008)
Female	1.027	1.033	1.07	0.001
	(0.052)	(0.052)	(0.058)	(0.005)
Presence of Employed Member	1.669***	1.541***	1.475***	0.056***
	(0.111)	(0.104)	(0.109)	(0.008)
Education (Household level):				
High school diploma	1.396***	1.377***	1.369***	0.062***
	(0.122)	(0.122)	(0.126)	(0.015)
Trade certificate	1.538***	1.505***	1.481***	0.075***
	(0.160)	(0.159)	(0.168)	(0.016)
College certificate	1.678***	1.636***	1.579***	0.085***
	(0.151)	(0.149)	(0.151)	(0.015)
University cert below Bachelor's	2.305***	2.239***	2.115***	0.119***
	(0.284)	(0.279)	(0.284)	(0.017)
Bachelor's degree	2.481***	2.39***	2.277***	0.121***
	(0.249)	(0.244)	(0.243)	(0.015)
Above Bachelors	2.612***	2.506***	2.406***	0.126***
	(0.292)	(0.284)	(0.285)	(0.015)
Household Size:				
2 members	1.139	1.092	1.028	0.006

	(0.212)	(0.204)	(0.228)	(0.021)
3 members	1.047	1.006	0.9	-0.003
	(0.11)	(0.106)	(0.104)	(0.01)
4 members	1.10	1.047	0.923	-0.003
	(0.122)	(0.117)	(0.109)	(0.01)
5 or more members	1.107	1.058	0.901	-0.003
	(0.154)	(0.147)	(0.137)	(0.012)
Household Type:				
Couple no children	1.037	1.014	0.984	0.005
	(0.191)	(0.188)	(0.217)	(0.02)
Lone-parent family	0.794*	0.837	0.91	-0.015
	(0.123)	(0.13)	(0.174)	(0.017)
Census family plus addition	0.610***	0.609***	0.622***	-0.047***
	(0.078)	(0.078)	(0.085)	(0.014)
Two or more persons (not census)	0.875	0.875	0.914	-0.008
	(0.192)	(0.194)	(0.23)	(0.022)
Dwelling Type:				
Semi-detached house	1.179	1.181	1.153	0.017
	(0.162)	(0.161)	(0.162)	(0.012)
Row house	0.98	0.977	1.024	-0.004
	(0.101)	(0.101)	(0.116)	(0.012)
Apartment or flat in a duplex	1.109	1.122	1.196	0.016
	(0.148)	(0.151)	(0.163)	(0.014)
Building with 5 or more storeys	1.095	1.125	1.111	0.007
	(0.11)	(0.114)	(0.123)	(0.012)
Building with less than 5 storeys	0.96	0.977	0.98	-0.003
	(0.076)	(0.078)	(0.082)	(0.009)
Duration of stay in unit:				
5 years to less than 10 years	0.983	0.996	0.981	-0.002

	(0.07)	(0.071)	(0.077)	(0.007)
10 or more years or always lived	0.898	0.906	0.926	-0.008
	(0.06)	(0.06)	(0.068)	(0.007)
Province of residence:				
Prince Edward Island	1.201	1.195	1.126	0.013
	(0.187)	(0.185)	(0.182)	(0.015)
Nova Scotia	0.901	0.903	0.876	-0.014
	(0.107)	(0.107)	(0.113)	(0.013)
New Brunswick	0.895	0.886	0.872	-0.017
	(0.106)	(0.105)	(0.114)	(0.013)
Quebec	1.665***	1.627***	1.351**	0.043***
	(0.187)	(0.182)	(0.165)	(0.011)
Ontario	0.896	0.916	0.887	-0.014
	(0.095)	(0.097)	(0.103)	(0.012)
Manitoba	1.304**	1.318**	1.183	0.027**
	(0.156)	(0.158)	(0.155)	(0.013)
Saskatchewan	1.262	1.279**	1.272*	0.023**
	(0.150)	(0.152)	(0.167)	(0.012)
Alberta	1.307**	1.335**	1.324**	0.027**
	(0.146)	(0.150)	(0.164)	(0.012)
British Columbia	1.079	1.105	1.073	0.008
	(0.121)	(0.124)	(0.132)	(0.012)
Presence of Indigenous Member	0.636***	0.641***	0.649***	-0.054***
	(0.071)	(0.072)	(0.083)	(0.016)
Presence of Visible Minority	0.764***	0.79***	0.684***	-0.018**
	(0.056)	(0.059)	(0.055)	(0.008)
Neighborhood/Community Controls				
Community Satisfaction	1.23***	1.228***	1.129***	0.024***
	(0.015)	(0.015)	(0.015)	(0.001)

Neighborhood Satisfaction	1.344***	1.335***	1.307***	0.044***
	(0.090)	(0.090)	(0.098)	(0.010)
Vandalism	0.846***	0.846***	0.836***	-0.018**
	(0.054)	(0.055)	(0.058)	(0.007)
Smog and air pollution	0.86**	0.859**	0.9	-0.018**
	(0.052)	(0.052)	(0.06)	(0.007)
Racial/Ethnic/Religious Attacks	0.84**	0.847**	0.895	-0.024**
	(0.067)	(0.067)	(0.077)	(0.011)
People using or dealing drugs	0.779***	0.779***	0.801***	-0.026***
	(0.049)	(0.049)	(0.053)	(0.007)
Mental Health			10.64***	
			(0.714)	
cons	2.897***	3.463***	1.666**	0.717***
	(0.595)	(0.719)	(0.375)	(0.026)
N	48,092	48,092	47,960	48,092

* p<0.1; ** p<0.05; *** p<0.01

Table A4: Detailed regression results, effect of housing needs on mental health

	(1) **Logistic**	(2) **Logistic**	(3) **Logistic**	(4) **LPM**
Housing Need				
Core housing need		0.643***	0.77***	-0.059***
		(0.051)	(0.068)	(0.010)
Respondent/Household/Dwelling Controls				
Age	1.018***	1.017***	1.032***	0.002***
	(0.002)	(0.002)	(0.003)	(0.000)
Renting	0.684***	0.719***	0.805**	-0.034***
	(0.053)	(0.057)	(0.070)	(0.007)
Female	0.867**	0.871**	0.840***	-0.009*

	(0.050)	(0.050)	(0.052)	(0.005)
Presence of Employed Member	1.413***	1.278***	1.011	0.027***
	(0.109)	(0.100)	(0.089)	(0.007)
Education (Household level):				
High school diploma	1.218*	1.191	0.981	0.013
	(0.137)	(0.136)	(0.119)	(0.011)
Trade certificate	1.297*	1.256*	1.00	0.019
	(0.167)	(0.165)	(0.142)	(0.012)
College certificate	1.466***	1.414***	1.132	0.031***
	(0.167)	(0.163)	(0.14)	(0.011)
University cert below Bachelor's	1.609***	1.549***	1.068	0.039***
	(0.242)	(0.235)	(0.177)	(0.013)
Bachelor's degree	1.785***	1.699***	1.159	0.045***
	(0.214)	(0.207)	(0.149)	(0.011)
Above Bachelors	1.830***	1.737***	1.163	0.046***
	(0.243)	(0.234)	(0.163)	(0.012)
Household Size:				
2 members	1.357	1.321	1.353	0.024
	(0.259)	(0.256)	(0.295)	(0.020)
3 members	1.415***	1.377***	1.402***	0.026***
	(0.159)	(0.156)	(0.168)	(0.009)
4 members	1.474***	1.425***	1.453***	0.028***
	(0.166)	(0.161)	(0.172)	(0.009)
5 or more members	1.606***	1.553***	1.644***	0.034***
	(0.232)	(0.226)	(0.270)	(0.011)
Household Type:				
Couple no children	1.159	1.127	1.108	0.003
	(0.223)	(0.219)	(0.242)	(0.02)
Lone-parent family	0.751*	0.792	0.788	-0.025
	(0.117)	(0.125)	(0.144)	(0.016)

Census family plus addition	0.793	0.790	0.949	-0.021*
	(0.114)	(0.114)	(0.15)	(0.011)
Two or more persons (not census)	0.799	0.796	0.786	-0.03
	(0.175)	(0.177)	(0.191)	(0.024)
Dwelling Type:				
Semi-detached house	1.131	1.126	1.035	0.012
	(0.188)	(0.187)	(0.175)	(0.011)
Row house	0.88	0.878	0.882	-0.013
	(0.099)	(0.098)	(0.108)	(0.010)
Apartment or flat in a duplex	0.867	0.879	0.82	-0.006
	(0.122)	(0.123)	(0.115)	(0.013)
Building with 5 or more storeys	1.028	1.054	0.991	0.006
	(0.12)	(0.125)	(0.13)	(0.011)
Building with less than 5 storeys	0.958	0.977	0.976	0.002
	(0.085)	(0.087)	(0.093)	(0.008)
Duration of stay in unit:				
5 years to less than 10 years	0.996	1.011	1.015	-0.001
	(0.075)	(0.077)	(0.082)	(0.007)
10 or more years or always lived	0.907	0.916	0.942	-0.01
	(0.068)	(0.068)	(0.077)	(0.006)
Province of residence:				
Prince Edward Island	1.17	1.161	1.135	0.011
	(0.203)	(0.202)	(0.215)	(0.013)
Nova Scotia	1.009	1.013	1.075	-0.001
	(0.131)	(0.132)	(0.155)	(0.011)
New Brunswick	1.021	1.011	1.081	0.0002
	(0.134)	(0.133)	(0.159)	(0.011)
Quebec	2.173***	2.127***	1.99***	0.054***
	(0.270)	(0.265)	(0.272)	(0.009)
Ontario	1.045	1.068	1.151	0.003

	(0.121)	(0.124)	(0.149)	(0.010)
Manitoba	1.491***	1.506***	1.468**	0.031***
	(0.201)	(0.203)	(0.224)	(0.011)
Saskatchewan	1.121	1.135	1.042	0.011
	(0.144)	(0.146)	(0.149)	(0.011)
Alberta	1.136	1.156	1.091	0.01
	(0.136)	(0.139)	(0.146)	(0.01)
British Columbia	1.141	1.171	1.173	0.009
	(0.138)	(0.142)	(0.157)	(0.01)
Presence of Indigenous Member	0.841	0.847	1.022	-0.02
	(0.103)	(0.103)	(0.149)	(0.013)
Presence of Visible Minority	1.265***	1.306***	1.497***	0.028***
	(0.111)	(0.116)	(0.143)	(0.007)
Neighborhood/Community Controls				
Community Satisfaction	1.373***	1.371***	1.312***	0.029***
	(0.018)	(0.018)	(0.019)	(0.001)
Neighborhood Satisfaction	1.135*	1.125	1.041	0.026***
	(0.083)	(0.083)	(0.084)	(0.009)
Vandalism	0.935	0.939	1.006	-0.005
	(0.066)	(0.066)	(0.075)	(0.006)
Smog and air pollution	0.814***	0.812***	0.842**	-0.017**
	(0.055)	(0.055)	(0.062)	(0.007)
Racial/Ethnic/Religious Attacks	0.817**	0.825**	0.847*	-0.027***
	(0.068)	(0.069)	(0.075)	(0.010)
People using or dealing drugs	0.818***	0.817***	0.889	-0.016*
	(0.057)	(0.057)	(0.066)	(0.006)
Physical Health			11.122***	
			(0.757)	
cons	0.306***	0 .368***	0.054***	0.572***

	(0.071)	(0.086)	(0.014)	(0.023)
N	48,047	48,047	47,960	48,047

* p<0.1; ** p<0.05; *** p<0.01