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Comparing Chronic Pain in Urban and Rural Canadian Adults

Alyssa T. Jensen
The University of Western Ontario, alyssatraceyjensen@gmail.com

[COMPARING CHRONIC PAIN IN URBAN AND RURAL CANADIAN ADULTS]

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[Alyssa Jensen]

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Supervisor: Dr. Anna Zajacova

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Abstract

Previous literature has found that rural Canadians are at a health disadvantage compared to their urban counterparts across a number of health outcomes. Less is known, however, about whether this pattern extends to chronic pain, especially in a Canadian context. Using a sample of 1820 Canadian adults aged 25 and older from the Recovery and Resilience COVID-19 Survey, this study explores the relationship between rurality and chronic pain. A series of nested negative binominal regression models were estimated. It was found that rurality is associated with significantly higher pain, though three measures of socioeconomic status explained some of rural disadvantage. Information on which populations are being impacted the most by chronic pain is an important first step in trying to reduce health disparities.

Keywords: Rurality; Chronic Pain; Canada; Socioeconomic Status; Health Disparities; Population Health

Introduction

There is a growing interest in the relationship between place and health. Previous literature has found that rural Canadians are less healthy than their urban counterparts, having a shorter life expectancy, and higher rates of a number of health conditions such as hypertension and arthritis (Canadian Institute for Health Information [CIHI], 2006). Less is known, however, whether this pattern extends to chronic pain. Chronic pain's effects are wide-reaching, impacting not only the individual's quality of life, but also Canada broadly through increased health care costs and lost productivity (Van Den Kerkhof et al., 2003; Elliott et al., 1999; Tripp et al., 2006; Shupler et al., 2019). The present study uses data from the Recovery and Resilience COVID-19 Survey to examine the relationship between rurality and pain. It also explores how this relationship is influenced by sociodemographic and socioeconomic characteristics among a sample of 1820 urban and rural Canadian adults.

Literature Review

Place and Health

Geographically speaking, rural Canada accounts for ninety percent of the country's land mass (Williams and Kulig, 2012, p. 1). In terms of population, between nineteen and thirty percent of Canadians are considered rural, depending on which definition is being used (Williams and Kulig, 2012, p. 1-2). Rural areas are distinct from their urban counterparts in numerous ways, having their own unique culture, geography, lifestyle, population mix, social organization, and behaviours relating to illness and health care that differ from urban areas (Hoffman et al., 2010, p. 213, Tollefson et al., 2011, p. 481).

Place is important to health as it operates as a social resource that helps to define life chances, including exposure to risks and opportunities that play a role in overall health and

wellbeing (Williams and Kulig, 2012, p. 13). Previous literature has found a correlation between rurality and several social determinants of health. One of the most consistent findings in demographic and epidemiological research has been the strong relationship between socioeconomic status and health (Haas, 2006, p. 339). Those who are more educated, have higher incomes, work in more prestigious occupations, and overall possess more wealth, tend to be in better health, have lower rates of disability, and have lower mortality risks than their lower socioeconomic status counterparts (Haas, 2006, p. 339). This is due to both the material and non-material resources that further education and higher income grants people, from access to healthy food and gym memberships, to improving health through developing habits and skills that enable people to achieve a better life (Ross and Mirowsky, 2010, p. 33). Socioeconomic status is seen as a fundamental cause of health inequalities due to its connection to key resources including money, power, prestige, social connections, and knowledge, that allow individuals and groups the ability to avoid risks and adopt protective strategies (Phelan et al., 2010, p. S29).

Rural residents generally have lower socioeconomic status than their urban counterparts. They tend to have lower levels of educational attainment, lower socioeconomic status, and are more likely to engage in negative health-related behaviours such as having a sedentary lifestyle, smoking, and binge drinking (Vanasse et al., 2010; Pampalon et al., 2006). Rural Canadians are less likely than those living in metropolitan areas to have completed a postsecondary degree, or even finish high school (DesMeules et al., 2012, p. 24-25). Rural communities also face higher rates of unemployment and have lower median household incomes than urban communities (Williams and Kulig, 2012). Insufficient income is connected to stress, which can affect health, including rising vulnerability to serious

illnesses, such as cardiovascular and immune system diseases (Mikkonen and Raphael, 2010, p. 10). In addition, the types of industries commonly found in rural areas, such as agriculture, forestry, fishing, and mining have been linked to numerous health problems such as certain cancers, pulmonary disorders, and various types of contamination and poisoning, in addition to the physical strain that manual labour can have on the body (Pampalon et al., 2006, p. 421-422).

Furthermore, there are numerous health care related issues that rural areas face due to their geography. Rural areas often have issues with recruitment and retainment of health care workers, which can lead to longer wait times or require patients to travel for treatment (Goins et al., 2005, p. 206). Together, these factors contribute to comparatively poorer health statuses for rural residents. Rural Canadians have a shorter life expectancy, having both higher mortality and infant mortality rates than the Canadian average (CIHI, 2006). Rural Canadians also have higher levels of high blood pressure, obesity, arthritis and depression, and lower levels of self-reported functional health, self-assessed health status, and health-promoting behaviours (CIHI, 2006). The health disparities between urban and rural Canada are enough for the Canadian Health Commission to assert that geography is a determinant of health (Williams and Kulig, 2012, p. 2).

Chronic Pain

Chronic pain is a common and costly experience that can greatly impact a sufferer's quality of life (Van Den Kerkhof et al., 2003, Elliott et al., 1999, Tripp et al., 2006, Shupler et al., 2019). In broad terms, quality of life encompasses a person's perception of their physical and mental health, level of independence, social relationships, personal values and beliefs, and their interactions with their environment (Lee et al., 2008, p. 178). Chronic pain

can have wide reaching impacts, affecting those living with it in physical, mental, social, and financial ways (Elliott et al., 1999, p. 1248; Tollefson et al., 2011, p. 479). A breadwinner role, for instance, may be undermined if pain prevents a person from working, whether short- or long-term (Elliott et al., 1999, p. 1248). This may be the case more often in rural communities, due to higher rates of manual labourers (Docking et al., 2015, p. 87, Lavergne and Kephart, 2012, p. 2). Moreover, chronic pain can restrict one's ability to perform everyday tasks such as child rearing, and housework, which can lead to a shift in self-esteem, and body image, negatively impacting sufferers' mental health (Tollefson et al., 2011, p. 479, Goode et al., 2012, p. 209). It is also common for chronic pain sufferers to hide or minimize the extent of their pain to their loved ones, so as to not feel like a burden (Tollefson et al., 2011, p. 480). This again may be more prevalent in rural communities that have a culture of stoicism and self-reliance and can further impact mental health and relationships (Tollefson et al., 2011, p. 480-481).

In addition to its negative impact on the individual and their family, chronic pain also affects Canada as a country. Due to chronic pain being a medical condition in and of itself, and its often-close connection with other medical conditions, those who experience chronic pain seek healthcare more frequently than the general population. In fact, eighty percent of doctor visits in Canada each year are associated with pain, and Ontario alone spends five billion dollars annually on pain related illnesses (Tripp et al., 2006, p. 225). Moreover, this number does not include the cost of missed workdays or workers' compensation, meaning that the actual cost of chronic pain for the country is greater (Hoffman et al., 2010, p. 213). In the United States, lower back pain is cited as the most common reason for time off work, resulting in approximately 149 million working days lost per year (Goode et al., 2012, p.

205). The financial cost of chronic pain is expected to rise along with the with the increased prevalence rate (Tripp et al., 2006, p. 225).

Currently, the prevalence rate for chronic pain within the general Canadian population ranges greatly, from two to forty-six percent (Van Den Kerkhof et al., 2003, p. 161). This is due to a number of factors. First, there is no single definition of chronic pain as it can result from a number of chronic physical or neurological conditions, representing a complex and often multifactorial etiology, as it can be the defining feature of a disorder, or a symptom of a larger illness (Lee et al., 2008, p. 177). Thus, looking into diagnosis rates of a single disorder does not reflect the full picture. There are also inconsistences in measurement in respect to the duration of time pain is needed to be present for it to be deemed chronic, and in the phrasing of questions used to measure pain. Sampling errors, such as a lack of representativeness is another potential reason why there is such a large range in the prevalence rates (Van Den Kerkhof et al., 2003, p. 161).

With that said, it does appear that rates of chronic pain are on the rise. One study that used data from the Canadian Community Health Survey found that between 2000 and 2014, rates of chronic pain rose 5.7 percent from 16.3 percent to 21.0 percent while using the same self-reporting measures (Shupler et al., 2019, p. 557). There are several reasons to suspect that rates of chronic pain will continue rising, such as there being more awareness of chronic pain as a treatable health condition, leading to more people seeking treatment (Shupler et al., 2019, p. 558). In addition, the largest age cohort, the Baby Boomers, are now reaching old age, which is associated with more pain (Shupler et al., 2019, p. 557).

Rurality and Chronic Pain

Despite both the geographical disparities of health between urban and rural communities and chronic pain's large reaching effects being well-documented in the literature, there has been little done connecting these two topics together. In fact, to the best of my knowledge, there has been no nationally representative study that compares urban and rural Canadian's experiences with chronic pain. From the limited international research, however, it does appear that rural residency is associated with higher rates of chronic pain in other countries. Four American studies, for instance, found higher rates of pain and more intense pain in their rural samples (Hoffman et al., 2002; Goode et al., 2013; Day and Thorn, 2010; Zelaya et al., 2020). Similarly, a French study specifically on chronic pain with neuropathic characteristics, or pain caused by dysfunction of the peripheral or central nervous system, also found an association between rural residency and higher pain prevalence (Bouhassira et al., 2008). Again, similar results were found in a Scottish study on musculoskeletal pain in adults aged fifty-five and older, as it too found an association between rural residency and higher rates of pain (Docking et al., 2015).

In a Canadian context there have been few studies on this topic. They often use smaller, non-representative samples, though they too found similar results as the international studies. A Saskatchewan study on low back pain noted that rural residency was again associated with higher rates of pain (George, 2002). Lastly, in a study of southeastern Ontarian adults aged twenty and older, chronic pain was present for over a third of participants, with severity of pain increasing as population density decreased. (Tripp et al., 2006, p. 230). Rural residency was associated with worse pain grades, more pain sites, lower

health status, less health care utilization, and greater medication use (Tripp et al., 2006, p. 230).

Aims

The majority of the previous literature on chronic pain and rurality have been in an international setting and often discuss a specific pain site. The few studies in Canada have focused on a specific province or region within a province. The present study fills a gap in the literature by looking at pain in the population by using a representative sample comprised of respondents across Canada. The central question being asked is: do urban and rural Canadians have different rates of chronic pain?

Data and Methods

This study is based on data that was collected as a part of the Recovery and Resilience COVID-19 Survey. This dataset was developed at The University of Western Ontario and administered by Leger Opinion in August 2020. The survey was conducted online as a part of an ongoing Leger Opinion Panel. In total, the survey was completed by 2,110 Canadian respondents aged eighteen and older. The sample was designed to be nationally representative of age, gender, and region; sampling weights were provided by Leger Opinion to correct for over- and under-sampling; the weighted sample is representative of the population with respect to these three characteristics. The survey was approved by The University of Western Ontario Ethics Board.

These data are appropriate for my purposes as they ask highly relevant questions on the topic of interest, specifically surrounding one's experiences with pain, in addition to providing geographical markers in the form of postal codes that allowed for an urban/rural analysis. The analytic sample was reduced by eliminating the age category of eighteen to

twenty-four. This was done as this population is not expected to have increased rates of pain, and because the effects of socioeconomic status on health is more present in later adulthood as per the cumulative inequality theory. Eliminating this group reduced the sample by 254 respondents. Lastly, the thirty-eight respondents who did not answer questions regarding pain were also dropped. This brought the final analytic sample to 1820.

Dependent Variable: Pain

Respondents were asked questions about the frequency and interference of their pain. Frequency was determined by asking respondents how often they experienced pain in the previous thirty days, on a scale from never or almost never have pain, to always. Interference was determined using a scale from zero (pain does not interfere with general activity such as work and household chores) to ten (pain completely interferes with daily activities). These two variables were multiplied together to create a continuous pain scale from zero (no pain) to fifty-five. The pain variable was also dichotomized for logistic regression estimations. A pain score between zero and nine was deemed no pain, while a score of ten and above was deemed pain.

Key Independent Variable: Rurality

Rurality was based on respondents' postal codes. Canadian postal codes are six-character, uniformly structured, alphanumeric codes in the form of "A1A 1A1". The first number defines if the postal code is urban or rural; a zero denotes rurality, while numbers one through nine denote urbanity.

Other Explanatory Variables

Two sets of variables were included to examine the relationship between rurality and pain. First were the sociodemographic variables of sex, race/ethnicity, age, immigrant status,

and marital status. Race/ethnicity was coded into four categories: White, Asian, Indigenous, and other. Age was categorized into ten-year intervals starting at age twenty-five, with a final category for those sixty-five and older. Age is an important variable to include as previous studies have shown that rates of pain rise with age (Shupler et al., 2019, p. 558). Immigrant status was dichotomized into those born in Canada and those born outside the country. Marital status was split into three groups: living with a partner, previously partnered, and never married.

Three socioeconomic variables were also included: educational attainment, household income, and employment status. Education was divided into five categories: high school or less, some post-secondary (at either college or university level), college degree, bachelor's degree, and master's degree or higher, such as a professional degree or a doctorate. Household income was split into five categories: below $30,000 a year, between $30,001 and $60,000, between $60,001 and $90,000, and above $90,001. Lastly, employment status included six categories: full-time, part-time, retired, unemployed, not working because of a disability, and other. Socioeconomic measures were included due to their positive effects on general health being well-documented, as those with higher socioeconomic status are generally in better health than those with lower socioeconomic status (Haas, 2006, p. 339).

Analytic Approach

First, descriptive statistics for the study sample were calculated using chi-square tests to determine if the urban and rural samples were statistically different from one another. For the main analysis, negative binomial regression was chosen as the appropriate method due to pain's positive distribution. Multivariate nested models were used to assess possible effects on the relationship between the dependent variable of pain and the key independent variable

of rurality. By estimating models with and without controls for sociodemographic and socioeconomic variables, I was able to evaluate the extent to which these factors explain the association between rurality and pain. This was necessary as the additional variables included have been linked to various health differences, such as overall health and increased risk factors of certain conditions, including that of chronic pain. For instance, previous studies have shown that women experience higher rates of pain compared to men, and lower income individuals report higher rates of pain compared to their more affluent counterparts (Grol-Prokopczyk, 2017, p. 313). These models were repeated using logistic regression as a robustness check using the dichotomized pain variable.

Missing data was addressed through multiple imputation. The measures with missing values were immigrant status (0.16 percent), marital status (0.60 percent), education (0.05 percent), and household income (6.70 percent). Missing values were imputed by chained equation (M=10) using all measures in the study. Multiple imputation yields more valid results than complete case analysis when data are missing. Both the negative binomial regressions and logistic regressions were conducted using complete case analysis and multiple imputation; estimates varied slightly, but the major conclusions were unchanged. Results can be found in the appendix.

Results

Descriptive Statistics

Table 1 presents descriptive statistics for all variables divided into urban and rural categories, reporting percent. Urban and rural respondents were statistically different across a number of variables including race/ethnicity, though both groups were majority white. 91.62 percent of rural respondents were white, compared to 75.74 percent of urban respondents

(p≤.001). The urban sample had higher proportions of respondents who were Asian, Indigenous, or another race/ethnicity, and further also had more immigrants (p≤.01). Additionally, rural respondents were slightly older (p≤.05). They were also more likely to be living with a partner, while urban respondents were more likely to be previously partnered or never married (p≤.05). In terms of educational attainment, more rural respondents had a high school degree or less and were less likely than their urban counterparts to hold a bachelor's degree, a master's degree, or higher (p≤.001). Urban and rural respondents were not statistically different in terms of sex, household income, or employment status.

Nested Negative Binomial Regression Models

Table 2 presents incidence rates derived from nested negative binominal regression models using complete case analysis. Model 1 estimates predicted pain by rurality. Results reflect an association between rurality and higher rates of pain (IRR = 1.36, p≤.001).

Model 2 controls for the sociodemographic variables of age, sex, race/ethnicity, marital status, and immigrant status. Net of these variables, the relationship between rurality and pain remains statistically significant, with rurality continuing to be associated with higher pain (IRR = 1.32, p≤.001). Being female was also associated with higher pain compared to males (IRR = 1.20, p≤.001). No other variables were statistically significant.

Model 3 controls for socioeconomic status through the addition of educational attainment, household income and employment status. Rurality continues to be associated with higher pain (IRR = 1.22, p≤.01), though the addition of socioeconomic characteristics does explain some of the difference between urban and rural respondents. Being female also continued to be associated with higher pain compared to males (IRR =1.12, p≤.05). As expected, based off previous literature, being more educated (having a bachelor's degree,

master's degree or higher as compared to a high school degree or less) was associated with lower pain (IRR = 0.70, p≤.001 and IRR = 0.78, p≤.05 respectively). Similarly, having a yearly household income in the $60,001 - $90,000 category and the $90,001 or above category, was associated with less pain (IRR = 0.75, p≤.001 and IRR = 0.75, p≤.001 respectively). For employment status, two categories were statistically significant. Working part-time was associated with more pain than working full-time (IRR = 1.22, p≤.05), as too was not working due to a disability (IRR = 2.61, p≤.001). These models were repeated after multiple imputation, with results substantially the same. They can be found in the appendix.

Figure 1 presents predicted pain scores for urban and rural respondents when the explanatory variables present in model 2 are at their means. Urban respondents are expected to have a pain score of 10.53 and rural respondents a score of 13.90. Figure 2 presents the predicted pain scores when all explanatory variables in the study are at their means. Net of both sociodemographic and socioeconomic variables, urban respondents are predicted to have a pain score of 9.97, while rural respondents are predicted to have a score of 12.14. While both these predicted scores have been attenuated due to the addition of education, household income, and employment status, rural respondents continued to have higher predicted scores.

Discussion

It has been well-documented in the literature that rural Canadians are at a health disadvantage compared to their urban counterparts. Rural Canadians have a shorter life expectancy in addition to having lower levels of self-reported functional health and self-assessed health status (CIHI, 2006). Rural Canadians also have higher rates of certain conditions such as arthritis and high blood pressure (CIHI, 2006). Less is known, however, if

this pattern extends to pain. Chronic pain has many negative impacts on both the sufferer, their family, and Canada broadly. Prolonged pain can negatively affect mental and physical health, personal relationships, and have financial impacts on both the individual and the country at large through loss of work and increased health care costs. Having information on which populations are affected most can be a first step in trying to reduce these negative outcomes. This is increasingly important as rates of chronic pain have increased and are expected to continue doing so as the Canadian population ages (Shupler et al., 2019, p. 557-558).

A sample of 1820 Canadians from the Recovery and Resilience COVID-19 Survey was used to explore the relationship between chronic pain and rurality. Results suggest that rural Canadians do experience significantly higher rates of pain compared to their urban counterparts. This is consistent with previous international literature which also found an association between rurality and higher rates of pain (Hoffman et al., 2002; Goode et al., 2013; Day and Thorn, 2010; Zelaya et al., 2020). When sociodemographic variables were at their means, rural respondents had a predicted pain score 3.37 points higher than urban respondents (13.90 compared to 10.53). The addition of the three measures of socioeconomic status explained some of the rural disadvantage, though rural respondents continued to have higher rates of pain compared to their urban counterparts (9.97 compared to 12.14).

One of the most consistent patterns regarding disparities in chronic pain is gender differences. It has repeatedly been found that women report more severe levels of pain and more frequent pain in more areas of the body than men (Pieretti et al., 2016, p. 184). This finding was found in the present study as well. With all variables at their means, women's predicted pain score was 10.77, compared to men's 9.64. The difference between urban and

rural respondents' predicted pain scores is less than the difference between the genders (2.17 compared to 1.13). Further, when men and women were split into urban and rural subcategories, rural men had a higher predicted score than urban women. This suggests that rurality is an important factor when examining which groups are more likely to experience chronic pain.

There are a number of potential reasons as to why there is a relationship between rurality and higher pain. Prior health research has noted the role that socioeconomic factors play in one's experiences with both health generally, and pain specifically. One of the key findings within this study was that socioeconomic status explained some of the urban/rural differences in pain. As noted, place operates as a social resource that helps to define life chances through shaping exposures to risks and opportunities (Williams and Kulig, 2012, p. 13). Rural Canadians experience a greater number of population health risks compared to urban Canadians that build up over the life course. This plays a large role in their comparative vulnerability across a number of population health determinants, including pain. Compared to their urban counterparts, rural Canadians generally have lower levels of educational attainment, lower socioeconomic status, and are more likely to engage in negative health-related behaviours including smoking and having a sedentary lifestyle (Vanasse et al., 2010; Pampalon et al., 2006). Consistent with previous literature, the present study found that rural respondents were less likely than those living in metropolitan areas to have a postsecondary degree (DesMeules et al., 2012, p. 24-25). Rural communities generally also face higher rates of unemployment and have lower median household incomes than urban communities, though this study did not find a statistically significant difference between urban and rural respondents' household income (Williams and Kulig, 2012).

The strong relationship between socioeconomic status and health has been one of the most consistent findings in demographic research over the past half-century (Haas, 2006, p. 339). Being more educated, having a higher income, working in a more prestigious occupation, and possessing more wealth overall, is associated with better health (Haas, 2006, p. 339). In terms of pain, numerous studies have found less education to be associated with higher pain prevalence (Dionne et al., 2001; Day and Thorn, 2010; Kim et al., 2014; Grol-Prokopczyk, 2017; Zajacova et al., 2020; Cutler et al., 2020). One American study on adults aged fifty-one and older found that those with no high school degree reported pain scores more than double that of respondents with graduate degrees (Grol-Prokopczyk, 2017, p. 315). As mentioned, rural respondents were more likely than their urban counterparts to be less educated.

The demographic characteristics of rural areas, that being generally poorer and less educated than their urban counterparts, corresponds with an elevated risk for pain. In addition, it can also impact one's reaction to their pain, such as their coping strategies. Education's positive impact on health is related to both the material and non-material resources it grants individuals. From a human capital perspective, one way that education improves health is through developing habits, skills, resources, and abilities that enable people to achieve a healthier life (Ross and Mirowsky, 2010, p. 33). Education can bring about a sense of control over one's own life, which can provide motivation and confidence to overcome obstacles to live a healthy life and confront health problems as they arise (Ross and Mirowsky, 2010, p. 33). Low socioeconomic status has been linked to several poor pain-related outcomes. For instance, lower educational attainment is associated with low self-efficacy for managing pain, low perceived control, and high catastrophizing (Kim et al.,

2014, p. E638). Level of education may be associated with individual coping behaviour, as distraction and reinterpretation strategies may be dependent on cognitive skills which can be enhanced through higher education (Day and Thorn, 2010, p. 472).

In addition, some ways that people manage their pain requires financial resources. Advantaged degrees are associated with higher incomes which provide people more resources to cope with their pain, such as being able to afford treatments that may not be covered by insurance, including massage therapy and homeopathic medicine. Rurality can act as a barrier to these resources as rural residents may not have the same resources readily available in their area compared to their urban counterparts. This means that even if they have the disposable income to pay for out-of-pocket treatments, their location may pose a barrier to actually getting it. This is in addition to the fact that rural residents are less likely to have extra income to pay for these treatments in the first place. Socioeconomic status and rurality can not only play a role in risk of pain, but also shape chronic pain sufferers' reactions to their pain, including its intensity and disability is causes (Kim et al., 2014, p. E638).

Moreover, certain types of pain, such as back pain, have also been linked to physically demanding jobs that involve repetitive stress on the spine (Dionne et al., 2001, p. 464). Those with low education are more likely to work in these types of careers. This is particularly true for rural residents due to the fact that many blue-collar industries such as mining and forestry, are commonly found in less populated areas (Pampalon et al., 2006, p. 422). While not always the case, those with low education may have poorer sick leave benefits. The fear of losing their job due to needing to take time off because of their pain can

prompt lower income individuals to return to a physically demanding job before their injury has healed (Dionne et al., 2001, p. 464). This risks reinjury and can prolong symptoms.

In addition to the connection between lower socioeconomic status, the agency it instills, and rural residency, chronic pain may also be amplified by numerous barriers related to the geography of rural regions. For instance, rural communities often have difficulty in the recruitment and retention of health care workers such as physicians and nurses, and often have medical services that are limited and narrow in range and scope (Day and Thorn, 2010, p. 472). This means that many seeking specialized treatment often have the additional stress of long wait times and having to travel for medical care. This can bring about added expenses and may be logistically challenging without a personal vehicle, as rural areas often do not have adequate public transportation systems in place (Goins et al., 2005, p. 209). Moreover, negative health care experiences can impact mental health, and build resentment towards health care, making patients less likely to seek help in the future, potentially exacerbating their symptoms, which may explain some of the association between rurality and increased pain.

Limitations

This study did have limitations. The relatively modest sample size of 1820 does increase the potential for false negatives. This occurs when a relationship was deemed not statistically significant when it should have been, thereby under-estimating the magnitude of an association. In addition, the key independent variable, rurality, was determined based off respondents' postal codes. Postal codes are not updated frequently. This means that some towns that were once rural, but now due to population increases, fall slightly above that range, are still indicated as being rural. Furthermore, postal codes do not distinguish between

rural and remote, meaning that a small town close to a population center is treated the same as a remote village. The Recovery and Resilience COVID-19 Survey dataset also does not provide information on whether respondents have a family doctor, or access to pain specialists in their area. As mentioned, this may be an additional factor in rural sufferer's experiences with their pain, as longer travel and wait times can prolong treatment and add to a perceived lack of control, which may encourage catastrophizing.

Future Research

While information was collected about employment status, particular field of work was not. The types of industries commonly found in rural areas, including agriculture, forestry, fishing, and mining, have all been linked to numerous health problems such as certain cancers, pulmonary disorders, and various types of contamination and poisoning (Pampalon et al., 2006, p. 421-422). Physically demanding jobs also put more stress on the body, and places individuals at an increased risk of injury that can cause chronic pain. Previous American literature on chronic pain have noted a connection between physically demanding jobs and higher rates of pain, though this is still an underdeveloped topic in a Canadian context, especially in how it relates to rural residents (Andersson, 1994; George, 2002; Cutler et al., 2020). Future studies may include this variable to gain further insight on the connection between occupation, rurality, and chronic pain.

Conclusion

There is a growing body of literature reflecting that rural Canadians have worse health than their urban counterparts. Chronic pain is an important area of health research as it has adverse effects on both individuals and the country at large due to its impacts on mental, emotional, and physical wellbeing, and increased health care costs (Tripp et al., 2006, p.

225). This study fills a gap in the literature by connecting these two topics together. Using a representative sample of 1820 Canadian adults from the Recovery and Resilience COVID-19 Survey, this study examined the relationship between rurality and pain, and how this relationship is influenced by sociodemographic and socioeconomic characteristics. Results suggest that rural Canadians do experience significantly higher rates of pain. A part of the excess rural pain is due to the more limited socioeconomic resources of the rural population. Future research should examine additional factors that drive the rural excess of pain, such as occupation. Information on which populations are being impacted the most by chronic pain is an important first step in trying to reduce health disparities.

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Table 1.
Characteristics of the Analytic Sample, Recovery and Resilience COVID-19 Survey 2020 by Rurality, Reporting Percent

	Total Sample N=1820	Rural N=193	Urban N=1627	P-value
Pain				
Pain Score (SE)	11.00 (0.29)	14.18 (1.01)	10.62 (0.30)	<0.001
Sex				
Male	48.17	51.52	47.89	0.708
Female	51.73	49.48	51.99	
Other	0.01	0	0.11	
Race/Ethnicity				0.000
White	77.98	91.87	76.36	
Asian	12.18	1.43	13.44	
Indigenous	1.85	1.59	1.88	
Other	7.99	5.11	8.32	
Age				0.041
Between 25-34	17.85	15.35	18.14	
Between 25-44	17.97	11.26	18.75	
Between 45-54	20.25	21.97	20.05	
Between 55-64	18.72	21.02	19.56	
65 and Older	24.22	30.40	23.50	
Immigrant Status				0.004
Born in Canada	80.44	89.52	79.38	
Born Outside Canada	19.49	10.48	20.44	
Missing	0.16	0.00	0.18	
Marital Status				0.037
Living With a Partner	63.74	73.32	62.62	
Previously Partnered	14.17	11.23	14.51	
Never Married	21.48	14.92	22.24	
Missing	0.61	0.53	0.62	
Education				0.000
High School or Less	14.76	22.67	13.84	
Some Post-Secondary	16.74	20.95	16.25	
College Degree	22.08	27.75	21.42	
BA	30.13	17.84	31.57	
MA or Higher	16.23	10.79	16.87	
Missing	0.06	0	0.05	
Household Income				0.672
<30,000	16.55	18.74	16.30	
30,001-60,000	23.30	25.41	23.05	
60,001-90,000	21.26	21.65	21.21	
>90,001	32.19	28.85	32.58	
Missing	6.70	5.34	6.86	
Employment Status				0.0781
Full-Time	43.60	36.82	44.39	
Part-Time	12.43	13.77	12.28	
Retired	28.18	36..21	27.25	
Unemployed	4.95	3.61	5.11	
Disabled	3.22	4.04	3.13	
Other	7.61	5.55	7.85	

Note: Ns are unweighted, percentages are weighted
Sampling weights are designed to be nationally representative of age, gender, and region by Recovery and Resilience COVID-19 Survey

Table 2.
Summary of Negative Binomial Regression Analysis Predicting Pain, Recovery and Resilience COVID-19 Survey 2020 Reporting Incidence Rate, Complete Case Analysis

	Model 1 (N=1820)	Model 2 (N=1806)	Model 3 (N=1685)
Rural (Urban)	1.36***	1.32***	1.22***
Sex (Male)			
Female	-	1.20***	1.12*
Other	-	1.08	0.96
Race/Ethnicity (White)			
Asian	-	0.86	0.98
Indigenous	-	1.36	1.15
Other	-	1.02	1.01
Age (Between 25-34)			
Between 35-44	-	0.93	0.92
Between 45-54	-	1.03	0.89
Between 55-64	-	1.03	0.95
65 and Older	-	1.05	0.91
Immigrant Status (Non-Immigrant)			
Born Outside of Canada	-	0.90	0.97
Marital Status (Living with a Partner)	-	1.06	0.89
Previously Partnered	-	0.98	0.87
Never Married			
Education (HS and Less)	-	-	0.95
Some Post-Secondary	-	-	1.01
College Degree	-	-	0.70***
BA	-	-	0.78*
MA or Higher			
Household Income (<30,000)	-	-	0.90
30,001-60,000	-	-	0.75***
60,001-90,000	-	-	0.67***
>90,001			
Employment Status (Full-Time)	-	-	1.22*
Part-Time	-	-	1.10
Retired	-	-	1.23
Unemployed	-	-	2.61***
Disabled	-	-	1.06
Other			

Sampling weights are designed to be nationally representative of age, gender, and region by Recovery and Resilience COVID-19 Survey
*p<.05, **p<.01, ***p<.001.

Table 3.
Summary of Negative Binomial Regression Analysis Predicting Pain, Recovery and Resilience COVID-19 Survey 2020, Reporting Incidence Rate, After Multiple Imputation

	Model 1 (N=1820)	Model 2 (N=1820)	Model 3 (N=1820)
Rural (Urban)	1.36***	1.32***	1.31***
Sex (Male)			
Female	-	1.20***	1.11*
Other	-	1.08	0.92
Race/Ethnicity (White)			
Asian	-	0.85	0.97
Indigenous	-	1.36	1.22
Other	-	0.98	1.00
Age (Between 25-34)			
Between 35-44	-	0.93	0.92
Between 45-54	-	1.03	0.90
Between 55-64	-	1.04	0.93
65 and Older	-	1.04	0.90
Immigrant Status (Non-Immigrant)			
Born Outside of Canada	-	0.91	1.00
Marital Status (Living with a Partner)	-	1.19	0.89
Previously Partnered	-	0.98	0.87
Never Married			
Education (HS and Less)	-	-	0.95
Some Post-Secondary	-	-	1.03
College Degree	-	-	0.70***
BA	-	-	0.78***
MA or Higher			
Household Income (<30,000)	-	-	0.92
30,001-60,000	-	-	0.77**
60,001-90,000	-	-	0.70***
>90,001			
Employment Status (Full-Time)	-	-	1.22*
Part-Time	-	-	1.13
Retired	-	-	1.27*
Unemployed	-	-	2.78***
Disabled	-	-	1.11
Other			

Sampling weights are designed to be nationally representative of age, gender, and region by Recovery and Resilience COVID-19 Survey
*p<.05, **p<.01, ***p<.001.

Table 4.
Summary of Logistic Regression Analysis Predicting Pain, Recovery and Resilience COVID-19 Survey 2020 Reporting Odds Ratios, Complete Case Analysis

	Model 1 (N=1820)	Model 2 (N=1806)	Model 3 (N=1685)
Rural (Urban)	1.719***	1.628**	1.486*
Sex (Male)			
Female	-	1.361**	1.261*
Other	-	2.506	1.686
Race/Ethnicity (White)			
Asian	-	0.820	1.057
Indigenous	-	1.284	1.253
Other	-	0.945	0.987
Age (Between 25-34)			
Between 35-44	-	0.873	0.922
Between 45-54	-	0.978	0.874
Between 55-64	-	0.884	0.850
65 and Older	-	0.907	0.907
Immigrant Status (Non-Immigrant)			
Born Outside of Canada	-	0.831	0.865
Marital Status (Living with a Partner)	-	0.992	0.764
Previously Partnered	-	0.872	0.693*
Never Married			
Education (HS and Less)	-	-	0.846
Some Post-Secondary	-	-	0.807
College Degree	-	-	0.409***
BA	-	-	0.551**
MA or Higher			
Household Income (<30,000)	-	-	0.940
30,001-60,000	-	-	0.730
60,001-90,000	-	-	0.670*
>90,001			
Employment Status (Full-Time)	-	-	1.473*
Part-Time	-	-	0.977
Retired	-	-	1.473*
Unemployed	-	-	12.625***
Disabled	-	-	1.284
Other			

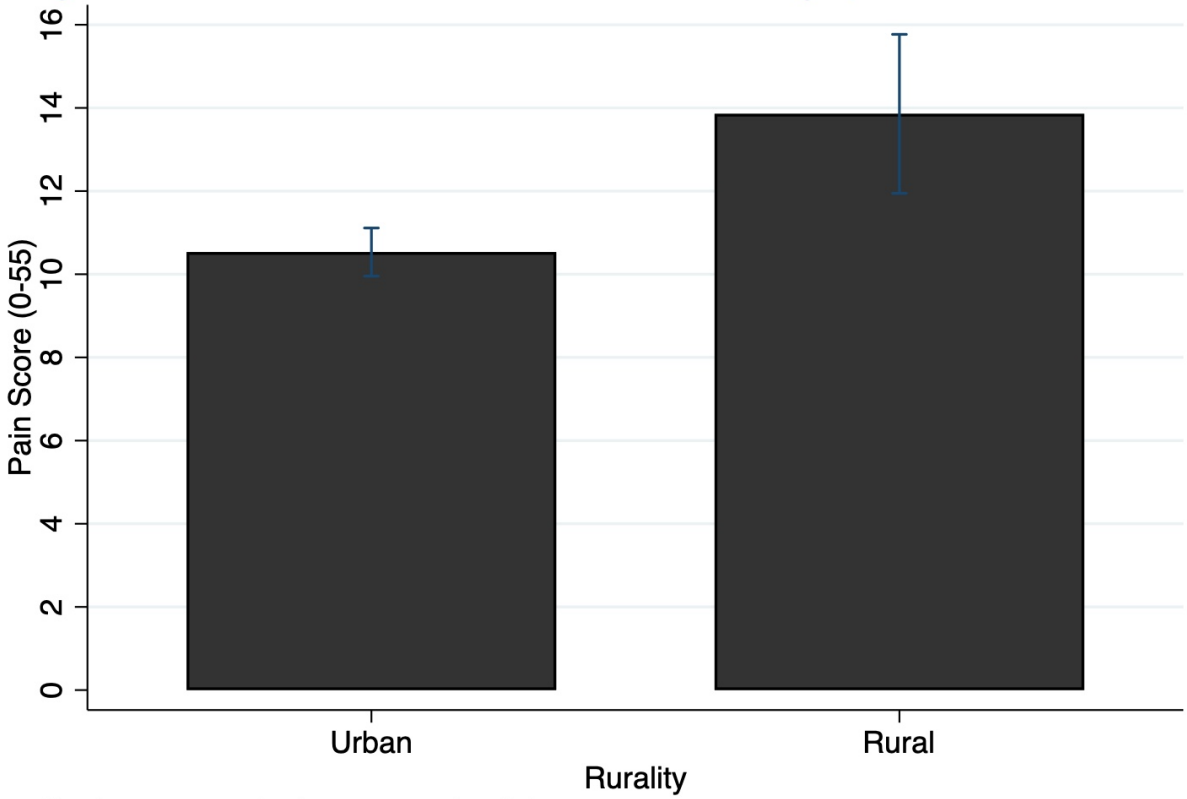
Sampling weights are designed to be nationally representative of age, gender, and region by Recovery and Resilience COVID-19 Survey
*p<.05, **p<.01, ***p<.001

Table 5.
Summary of Logistic Regression Analysis Predicting Pain, Recovery and Resilience COVID-19 Survey 2020 Reporting Odds Ratios, After Multiple Imputation

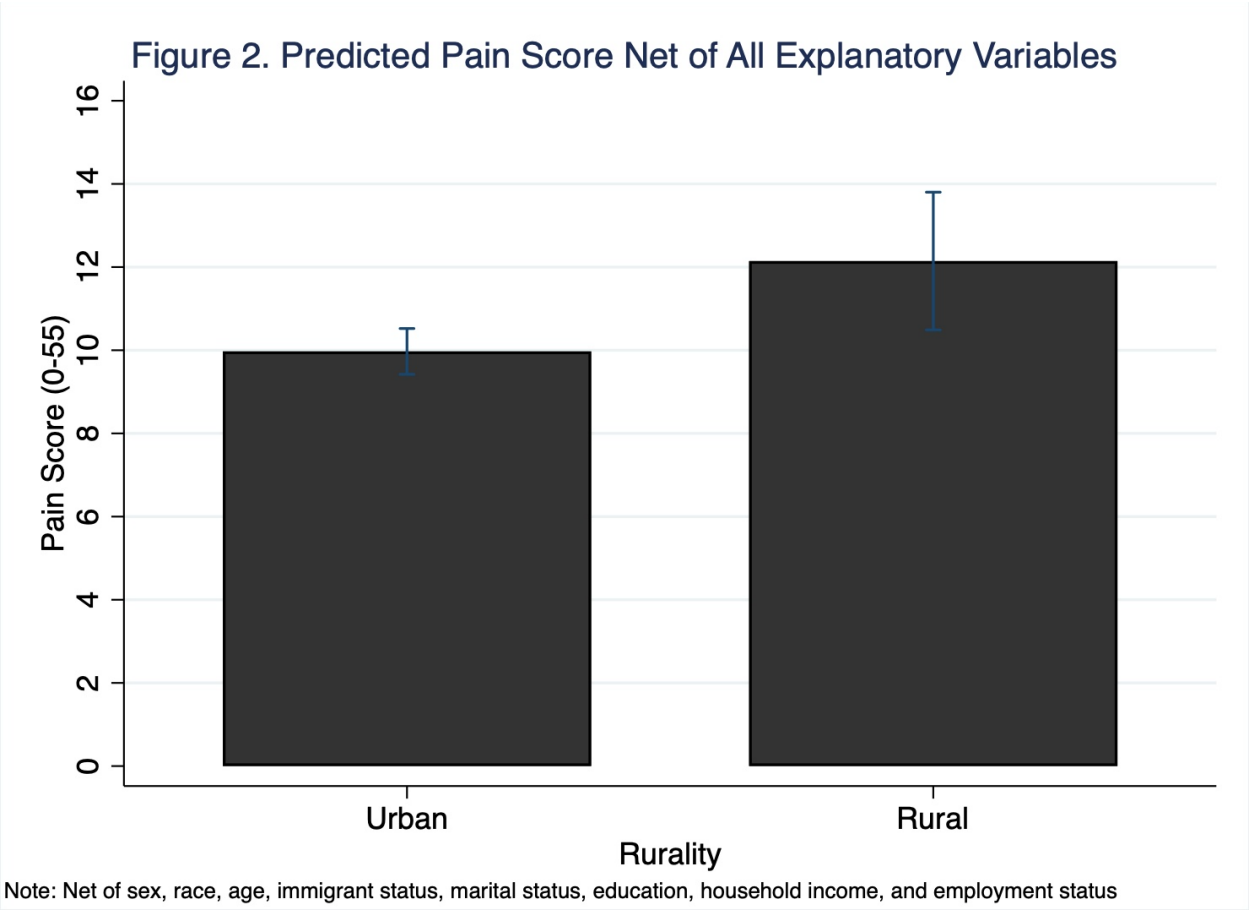
	Model 1 (N=1820)	Model 2 (N=1820)	Model 3 (N=1820)
Rural (Urban)	1.72***	1.65***	1.48*
Sex (Male)			
Female	-	1.36**	1.24*
Other	-	2.52	1.63
Race/Ethnicity (White)			
Asian	-	0.81	1.01
Indigenous	-	1.29	1.29
Other	-	0.91	0.95
Age (Between 25-34)			
Between 35-44	-	0.87	0.87
Between 45-54	-	0.99	0.83
Between 55-64	-	0.89	0.80
65 and Older	-	0.91	0.84
Immigrant Status (Non-Immigrant)			
Born Outside of Canada	-	0.84	0.90
Marital Status (Living with a Partner)	-	0.98	0.76
Previously Partnered	-	0.87	0.71*
Never Married			
Education (HS and Less)	-	-	0.79
Some Post-Secondary	-	-	0.82
College Degree	-	-	0.40***
BA	-	-	0.53***
MA or Higher			
Household Income (<30,000)	-	-	0.95
30,001-60,000	-	-	0.75
60,001-90,000	-	-	0.68*
>90,001			
Employment Status (Full-Time)	-	-	1.50*
Part-Time	-	-	1.04
Retired	-	-	1.68*
Unemployed	-	-	14.32***
Disabled	-	-	1.32
Other			

Sampling weights are designed to be nationally representative of age, gender, and region by Recovery and Resilience COVID-19 Survey
*p<.05, **p<.01, ***p<.001.

Figure 1. Predicted Pain Score Net of Sociodemographic Characteristics



Note: Net of sex, race, age, immigrant status and marital status



Note: Net of sex, race, age, immigrant status, marital status, education, household income, and employment status