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Trend of the burden of chronic illnesses: using the Canadian Community Health Survey

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ABSTRACT

Objectives: Burden of illnesses has been described in the literature using the health-related quality of life (HRQoL) in people with chronic conditions. However, the studies reporting trends of burden are sparse. The aim of this study was to explore the trends of burden of chronic illness from the perspective of HRQoL.

Study design: This was a secondary analysis of administrative database.

Methods: Seven data sets of the Canadian Community Health Survey from 2001 to 2014 were obtained for the analysis. Multiple linear and logistic regression models were used on each data set to assess the burden of illness on the Health Utilities Index Mark III (HUI_3), life satisfaction (LS), and perceived health (PH).

Results: People with the effect of stroke constantly had low scores on the HUI_3, LS, and PH. Regression analyses revealed that arthritis, back problem, and mood disorder have greater impact on the HUI_3 score. Effect of stroke, mood disorder, and anxiety disorder stably had the largest negative impact on LS, while chronic obstructive pulmonary disease (COPD), effect of stroke, and cancer had the largest effect on PH.

Conclusion: This study identified that arthritis, back pain, mood disorder, effect of stroke, and COPD constantly have high burden on health outcomes compared with other chronic condition over the past decade.

Introduction

Chronic disease is defined as 'a disease that persists over a long period. The symptoms of chronic diseases are sometimes less severe than those of the acute phase of the same disease. Chronic disease may be progressive, result in complete or partial disability, or even lead to death.'[1] In Canada, cancers, heart diseases, and cerebrovascular

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diseases were reported as the highest three mortality rates in 2011 and those three diseases have been listed since 2000.[2] The impact of those chronic diseases to society has been well studied in the literature, especially regarding mortality rate. However, it is no longer enough to measure changes in population health by simple mortality rate.[3] Thus, many patient-reported outcome measures (PROMs) have been developed and included in many studies to assess the burden of illness. Life satisfaction (LS) and perceived health (PH, as known as global health rating or self-rated health [SRH]) are the most frequently endorsed PROMs in clinical studies. The LS is reported as a predictor of longevity and psychiatric morbidity, with dose-response relationships evident between life dissatisfaction and all-cause disease, injury, and mortality.[4] PH is a simple global assessment that can serve as a global measure of health status, including specific health problems, general physical functioning, and health behavior.[5,6] LS and PH likely represent related features of individuals' global welfare and are highly correlated.[7–9] Over the past decade, health-related quality of life (HRQoL) has emerged as an important outcome measurement.[10] To determine the burden of illness and optimal treatment for a disease, one factor to consider is its impact on different areas of the individual's life besides the illness itself, i.e. his or her well-being. It is particularly useful in determining the impact of chronic diseases. Various assessment tools have been developed to measure HRQoL in the general population and used in the population-based health survey. The Health Utilities Index Mark III (HUI_3) is one of the generic HRQoL assessment tools, which was developed by McMaster University and has been included in the Canadian census since 2000.

Diverse studies have been conducted in the past decades to describe the HRQoL, LS, and PH in people with chronic diseases in a quantitative manner, and some studies compare the burden of illness on the chronic diseases.[4,11–16] However, the trend of those relationships and burdens are rarely reported. It is essential to assess the large data with multiple time points when the trend is the focus of study because those PROM may fluctuate and are confounded by various factors, such as socio-economic status (SES), which often change over time.[17–19]

The objectives of this study are to explore the trends of HRQoL, including LS and PH in people with chronic illness, and to evaluate the burden of illnesses.

Methods

The Public Use Microdata Files (PUMF) for the Canadian Community Health Survey (CCHS) were obtained from the Statistics Canada. The CCHS is an annual, cross-sectional survey that inquires residents of Canada about health status, healthcare utilization, and health determinants. The Canadian Institute for Health Information (CIHI), Statistics Canada, and Health Canada together created the CCHS to collect and provide a source of data on the health of the Canadian population to be used for health surveillance programs and population research. It is conducted in 110 health regions across the ten provinces and the three territories. The survey was targeted toward individuals who were at least 12 years of age, except for individuals who were living on an Aboriginal settlement in the provinces, individuals who were full-time members of the Canadian forces, and individuals who were institutionalized or in certain health regions in Quebec. More details of the CCHS is found online.[53] In this study, the PUMF for the years 2001–2002, 2003, 2005, 2007–2008, 2009–2010, 2012, and 2013–2014 were obtained for analysis.

Study variables

For this study, the following main variables were extracted from the CCHS data set.

Health Utilities Index Mark III

The Health Utilities Index mark III (HUI_3) is used to measure HRQoL. The HUI_3 comprises generic, preference-based, and health classification systems that are used to measure health status to report HRQoL. In the HUI_3, domains of health or attributes are defined as follows: vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain. In this study, only aggregated score was used for the analysis. The HUI_3 is valid, reliable, and responsive to change in health status for both youth and adult and disabled population.[20] The aggregated score has a minimum of −0.341 and a maximum of 1.00 (indicating optimal HRQoL). Negative score is thought by the developers to indicate health states considered worse than death.

Life satisfaction

LS is a single question rated on a 5-ordinal scale (in general, 'How satisfied are you with your life?' Very satisfied, satisfied, neither, dissatisfied, and very dissatisfied). This question is consistent with Organisation for Economic Co-operation and Development (OECD) recommendations on measuring LS.[21] The LS is a simple scale that has been used in large epidemiological studies.[22] This item was available only since 2003, and thus, it is missing in the 2001–2002 data set.

Perceived health

PH is also a single question rated on a 5-ordinal scale ('How would you describe your health this past month?' 'Excellent,' 'very good,' 'good,' 'fair,' and 'poor'). PH is a commonly used outcome in epidemiological studies, including with many disease populations. PH is a simple global assessment, but it has high predictive validity for mortality, independent of other medical, behavioral, or psychosocial risk factors.[23]

Chronic diseases

The items regarding 'chronic conditions' in the CCHS were used to identify whether the participant has a chronic disease. It includes asthma, arthritis, back problem, high blood pressure, migraine headaches, chronic obstructive pulmonary disease (COPD), diabetes, heart disease, cancer, intestinal/stomach ulcers, effect of stroke, urinary incontinence, bowel disorder/incontinence, mood disorder, and anxiety disorder. Mood disorder and anxiety disorder were not asked in the 2001–2002 data set.

Analysis

Descriptive statistics for the sample characteristics were performed for each chronic condition each year. A profile plot was used to illustrate the trend of the HUI_3 scores. LS and PH were recorded as binary variables: 'Very satisfied' and 'satisfied' were recorded as 'satisfied' and 'neither'; 'dissatisfied' and 'very dissatisfied' were recorded as 'neither or dissatisfied' for LS; also 'Excellent,' 'very good,' and 'good' as 'good health' and 'poor' or 'fair' as 'bad health' for PH. The trends of LS and PH are described in the tables. Trend analyses were performed using the chi-squared trend test for LS and PH[24] and non-parametric tests of trend for HUI_3.[25]

To evaluate the burden of chronic illnesses, a multiple linear regression analysis was performed on the HUI_3 as a dependent variable, and multiple logistic regression analyses were performed on LS and SRH as dependent variables. Standardized regression coefficient (beta) in multiple linear regression and odds ratio (OR) in logistic regression were investigated to quantify the burden of chronic illnesses. Because some chronic diseases are known to be related to age and gender, both regression models were controlled by age (15-ordinal scale) and gender (male or female).

All statistical analyses were carried out using Stata, version 14, (Stata Statistics/Data Analysis, StataCorp LP, College Station, TX), and the profile plot of the HUI_3 score was created using R, version 3.3.3, with ggplot2, version 2.2.1.[26]

Results

Sample sizes were 127,462 for the year 2013–2014, 61,707 for the year 2012, 124,188 for the year 2009–2010, 131,061 for the year 2007–2008, 132,221 for the year 2005, 42,592 for the year 2003, and 130,880 for the year 2001–2002 data set. Most of the data sets had similar age and gender distributions; percentages of the population younger than 50 years were approximately 50% (range 43.5%–61.8%) in all data sets, and percentage of male ranged from 45.2% to 49.4%.

Fig. 1 illustrates the trend of mean HUI_3 scores on each chronic disease from 2002 to 2014. The mean HUI_3 scores in the samples without chronic condition ranged from 0.921 in 2012 to 0.942 in 2008. A slight but significant linear trend toward improvement/deterioration was found in the majority of conditions. Although mean scores in the samples without chronic condition were persistently high, there were some fluctuations and the order changes year by year. Explicitly, 'the effect of stroke,' 'mood disorder,' and 'urinary incontinence' presented constantly low scores than other conditions.

Regarding the percentage of 'satisfied' participants, there were some fluctuations and change over time. A slight but significant linear trend toward improvement/deterioration was found in the majority of conditions, but 'the effect of stroke' and 'mood disorder' had constantly low value than other conditions. The percentage of 'satisfied' in 'effect of stroke' ranged 56.4%–71.5%, and that in 'mood disorder' ranges from 66.2% to 67.8% (Table 1).

In the percentage of 'good health,' there were some fluctuations, and the order changes across years with a significant linear trend on most of the conditions, but the 'effect of stroke' and 'COPD' had constantly low value than other conditions. The percentage of 'good health' in 'effect of stroke' ranged from 38.6% to 46.6%, and that in 'COPD' ranged from 38% to 51.8% (Table 2).

Results from the regression models showed the impact of chronic diseases on the health outcomes. Table 3 indicates that arthritis (beta from −0.19 to −0.16, all $P<0.001$), back problem (beta from −0.22 to −0.14, all $P<0.001$), and mood disorder (beta from −0.19 to −0.16, all $P<0.001$) constantly had greater impact than other chronic conditions on the HUI_3 score. Effect of stroke (OR from 0.35 to 0.49, all $P<0.001$), mood disorder (OR from 0.28 to 0.35, all $P<0.001$), and anxiety disorder (OR from 0.52 to 0.59, all $P<0.001$) persistently had largest negative impact on LS (Table 4), while COPD (OR from 0.26 to

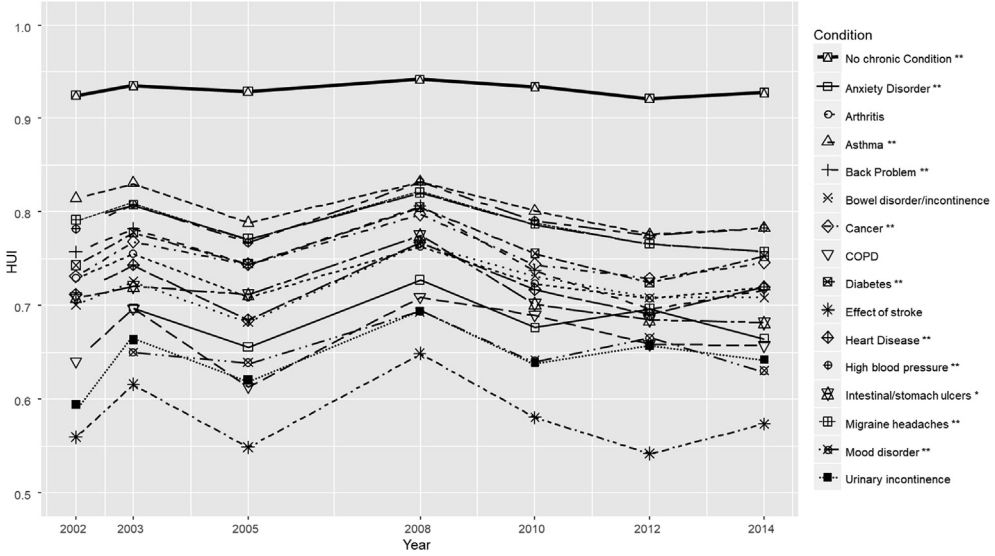

Fig. 1 – Trend of mean HUI_3 scores on each chronic disease. *P<0.05, **P<0.01. COPD, chronic obstructive pulmonary disease; HUI_3, Health Utilities Index Mark III.

Table 1 – Trend of 'satisfied' on life satisfaction from each chronic condition.

Condition	Year of data set							P-value
	2001–2	2003	2005	2007–8	2009–10	2012	2013–4	
No chronic condition	NA	94.0%	93.8%	93.8%	93.9%	94.5%	94.2%	<0.01
Anxiety disorder	NA	73.8%	**70.0%**	**70.5%**	**70.7%**	71.2%	71.1%	0.835
Arthritis	NA	85.5%	84.4%	83.9%	79.5%	79.2%	80.5%	<0.01
Asthma	NA	86.3%	85.3%	84.9%	83.7%	84.0%	83.8%	<0.01
Back problem	NA	85.3%	83.4%	83.6%	79.8%	79.9%	80.4%	<0.01
Bowel disorder/incontinence	NA	80.1%	81.8%	80.5%	78.9%	78.2%	78.7%	<0.01
Cancer	NA	81.8%	79.2%	82.2%	76.2%	78.0%	75.3%	<0.01
COPD	NA	**73.4%**	72.3%	73.9%	72.6%	71.6%	**70.5%**	<0.01
Diabetes	NA	83.9%	82.8%	82.1%	77.7%	76.2%	78.4%	<0.01
Effect of stroke	NA	**71.5%**	**69.5%**	**69.0%**	**63.7%**	**56.4%**	**60.9%**	<0.01
Heart disease	NA	81.5%	80.7%	80.5%	75.0%	74.2%	75.0%	<0.01
High blood pressure	NA	87.2%	86.0%	85.7%	82.2%	81.7%	82.2%	<0.01
Intestinal/stomach ulcers	NA	79.6%	79.1%	79.0%	74.8%	75.3%	73.5%	<0.01
Migraine headaches	NA	84.9%	84.2%	83.8%	83.1%	82.6%	82.5%	<0.01
Mood disorder	NA	**66.5%**	**66.2%**	**66.6%**	**67.2%**	**66.7%**	**67.8%**	0.023
Urinary incontinence	NA	75.2%	75.8%	76.4%	72.1%	**70.3%**	71.8%	<0.01

COPD, chronic obstructive pulmonary disease.
Note that the lowest three percentages are bolded in each year.

Table 2 – Trend of 'good health' on perceived health from each chronic condition.

Condition	Year of data set							P-value
	2001–2	2003	2005	2007–8	2009–10	2012	2013–4	
No chronic condition	95.5%	97.0%	96.6%	96.8%	97.1%	97.4%	97.1%	<0.01
Anxiety disorder	NA	65.5%	65.4%	66.8%	65.2%	67.3%	67.4%	<0.01
Arthritis	66.5%	67.9%	68.0%	68.0%	67.8%	69.6%	70.7%	<0.01
Asthma	76.1%	76.2%	76.1%	75.5%	76.1%	75.7%	75.8%	0.560
Back problem	73.9%	74.2%	73.4%	73.5%	71.2%	71.3%	71.4%	<0.01
Bowel disorder/incontinence	59.9%	60.7%	66.3%	67.0%	66.6%	65.9%	67.2%	<0.01
Cancer	52.7%	**52.1%**	**48.1%**	56.4%	56.0%	62.5%	**57.8%**	<0.01
COPD	**38.0%**	**41.8%**	**41.5%**	**41.9%**	**50.2%**	**51.8%**	**51.3%**	<0.01
Diabetes	54.8%	58.0%	58.3%	59.5%	59.8%	62.0%	63.5%	<0.01
Effect of stroke	**38.6%**	**45.9%**	**41.0%**	**44.0%**	**46.0%**	**43.2%**	**46.6%**	<0.01
Heart disease	**48.8%**	53.6%	51.9%	**53.7%**	**54.5%**	**55.8%**	58.5%	<0.01
High blood pressure	67.2%	70.7%	69.6%	71.2%	71.7%	73.1%	73.5%	<0.01
Intestinal/stomach ulcers	63.0%	59.7%	62.8%	62.7%	61.1%	62.3%	61.6%	0.250
Migraine headaches	78.0%	77.3%	79.3%	78.8%	77.7%	77.5%	77.4%	0.048
Mood disorder	NA	60.3%	62.6%	63.5%	62.4%	62.8%	63.2%	0.195
Urinary incontinence	53.1%	56.7%	56.3%	59.0%	58.0%	59.4%	61.5%	<0.01

COPD, chronic obstructive pulmonary disease.
Note that the lowest three percentages are bolded in each year.

0.37, all $P<0.001$), effect of stroke (OR from 0.30 to 0.38, all $P<0.001$), and cancer (OR from 0.26 to 0.40, all $P<0.001$) had the largest effect on the PH (Table 5).

Discussion

Population-based health survey enables researchers to gather health-related data at the population level. This is useful as it provides evidence-based research to support the development of health policies and interventional health programs that address population needs. Meanwhile, longitudinal studies are necessary to evaluate the burden of illnesses and the impact of HRQoL changes in healthcare services. However, there are few studies describing the burden of various chronic illnesses on HRQoL using population-based health survey over time. Thus, the aim of this study was to describe the secular trend of HRQoL including PH and LS in people with chronic diseases using large census data in Canada. Measuring the effect and changes over time can identify which types of chronic disease are associated with the lowest scores. This information will help various stakeholders to understand the deficiencies within the healthcare system to better address the needs of people with chronic diseases.

The burden of chronic diseases have been studied by researchers, and there are several studies reporting the relationships between chronic disease and HRQoL, LS, and/or PH. Wang et al.[16] reported that back pain, depression,

Table 3 – Trend of multiple linear regression standardized coefficients for HUI_3.

Condition	Year of data set						
	2001–2	2003	2005	2007–8	2009–10	2012	2013–4
Anxiety disorder	NA	−0.084**	−0.085**	−0.113**	−0.086**	−0.053**	−0.097**
Arthritis	**−0.181****	**−0.168****	**−0.186****	**−0.159****	**−0.171****	**−0.164****	**−0.171****
Asthma	−0.039**	−0.020**	−0.030**	−0.032**	−0.019**	−0.021	−0.011**
Back Problem	**−0.168****	**−0.140****	**−0.155****	**−0.140****	**−0.170****	**−0.223****	**−0.176****
Bowel disorder/incontinence	−0.065**	−0.054**	−0.078**	−0.064**	−0.044**	−0.044**	−0.053**
Cancer	−0.034**	−0.03**	−0.018*	−0.027**	−0.030**	−0.018**	−0.027**
COPD	−0.056**	−0.042**	−0.039**	−0.028**	−0.049**	−0.077**	−0.071**
Diabetes	−0.055**	−0.041**	−0.039**	−0.053**	−0.052**	−0.060**	−0.051**
Effect of stroke	−0.102**	−0.098**	−0.099**	−0.092**	−0.104**	−0.121**	−0.097**
Heart disease	−0.066**	−0.070**	−0.065**	−0.078**	−0.062**	−0.072**	−0.056**
High blood pressure	−0.021**	−0.015**	−0.037**	−0.011**	−0.012**	0.006**	−0.019**
Intestinal/stomach ulcers	−0.071**	−0.058**	−0.026**	−0.030**	−0.051**	−0.022	−0.039**
Migraine headaches	−0.076**	−0.054**	−0.063**	−0.060**	−0.054**	−0.069**	−0.067**
Mood disorder	NA	**−0.171****	**−0.185****	**−0.157****	**−0.191****	**−0.157****	**−0.184****
Urinary incontinence	**−0.126****	−0.112**	−0.087**	−0.102**	−0.111**	−0.083**	−0.111**
Observations	94,914	31,835	10,835	17,645	82,431	2211	87,220

COPD, chronic obstructive pulmonary disease; HUI_3, Health Utilities Index Mark III.
Note that the highest three negative betas on the HUI_3 scores are bolded each year.
*P<0.05, **P<0.01.

Table 4 – Trend of odds ratio of each chronic disease for life satisfaction.

Condition	Year of data set						
	2001–2	2003	2005	2007–8	2009–10	2012	2013–4
Anxiety disorder	NA	0.59**	**0.54****	**0.52****	**0.54****	**0.55****	**0.52****
Arthritis	NA	0.81**	0.76**	0.82**	0.77**	0.79**	0.83**
Asthma	NA	0.80**	0.93**	0.88**	0.88**	0.96	0.94
Back problem	NA	0.78**	0.73**	0.73**	0.64**	0.68**	0.70**
Bowel disorder/incontinence	NA	0.71**	0.83**	0.76**	0.84**	0.82**	0.82**
Cancer	NA	0.67**	0.87**	0.76**	0.70**	0.73**	0.64**
COPD	NA	0.52**	0.72**	0.66**	0.72**	0.67**	0.61**
Diabetes	NA	0.77**	0.77*	0.72**	0.71**	0.65**	0.71**
Effect of stroke	NA	**0.41****	**0.49****	**0.47****	**0.48****	**0.35****	**0.43****
Heart disease	NA	0.67**	0.71**	0.77**	0.74**	0.77**	0.72**
High blood pressure	NA	0.98	0.81**	0.94**	0.94**	0.90**	0.94**
Intestinal/stomach ulcers	NA	0.68**	0.76**	0.77**	0.70**	0.70**	0.68**
Migraine headaches	NA	0.73**	0.85**	0.74**	0.74**	0.68**	0.66**
Mood disorder	NA	**0.28****	**0.28****	**0.30****	**0.35****	**0.32****	**0.35****
Urinary incontinence	NA	**0.49****	0.68**	0.64**	0.70**	0.65**	0.63**
Observations		31,835	10,835	99,286	85,046	43,285	90,950

COPD, chronic obstructive pulmonary disease; OR, odds ratio.
Note that the lowest three ORs are bolded in each year.
*P<0.05, **P<0.01.

Osteoarthritis, and cancer had a great impact on the EuroQol five dimension scale (EQ-5D) and 36-Item Short Form Health Survey (SF-36), a simple generic HRQoL and a short form health survey, respectively. The Global Burden of Disease Consortium ranked OA as the 13th cause of disability out of 310 diseases and injuries.[27] Comorbid OA has also been linked to lower HRQoL in patients with diabetes[28] and increased extended rehabilitation after a stroke.[29] Another study by the US Burden of Disease Collaborators reported that ischemic heart disease, lung cancer, COPD, stroke, low back pain, major depressive disorder, and other musculoskeletal disorder are stably reported as risk factors contributing to disability-adjusted life years between 1990 and 2010.[30] A 2019 study highlights the prevalence of stroke with high burden to patients and impacting their quality of life.[31] However, less is known about the relationship between chronic diseases and HRQoL, LS, and PH within the Canadian context over time. A Canadian study identified sleep duration and insomnia as predictors of severe impairment of HRQoL in adults with chronic diseases.[32] In our study, results from the tendency of crude scores showed consistently low scores in people with the effect of stroke, urinary incontinence, COPD, and mood disorder with some fluctuations. Remarkably, people with the effect of stroke had low scores in all three outcomes. Stroke can cause a variety of symptoms, including problems with movement, balance, vision, swallowing, and communication,

Table 5 – Trend of odds ratio of each chronic condition for perceived health.

Condition	Year of data set						
	2001–2	2003	2005	2007–8	2009–10	2012	2013–4
Anxiety disorder	NA	0.54**	0.66**	0.54**	0.52**	0.55**	0.56**
Arthritis	0.49**	0.49**	0.53**	0.53**	0.53**	0.57**	0.56**
Asthma	0.53**	0.60**	0.62**	0.62**	0.76**	0.76**	0.78**
Back problem	0.53**	0.52**	0.62**	0.55**	0.53**	0.51**	0.51**
Bowel disorder/incontinence	0.43**	0.46**	0.49**	0.59**	0.61**	0.56**	0.60**
Cancer	**0.33****	**0.26****	0.36**	**0.35****	**0.35****	0.40**	**0.31****
COPD	**0.26****	**0.29****	**0.31****	**0.31****	**0.36****	**0.37****	**0.36****
Diabetes	0.36**	0.35**	0.40**	0.39**	0.39**	0.40**	0.40**
Effect of stroke	**0.32****	**0.34****	**0.31****	**0.37****	**0.38****	**0.30****	**0.34****
Heart disease	**0.33****	0.35**	**0.32****	0.39**	**0.38****	**0.38****	0.40**
High blood pressure	0.61**	0.67**	0.58**	0.65**	0.69**	0.66**	0.67**
Intestinal/stomach ulcers	0.52**	0.50**	0.57**	0.52**	0.52**	0.56**	0.56**
Migraine headaches	0.55**	0.59**	0.65**	0.63**	0.65**	0.64**	0.63**
Mood disorder	NA	0.35**	0.35**	0.39**	0.40**	**0.38****	0.39**
Urinary incontinence	0.54**	0.52**	0.65**	0.63**	0.61**	0.57**	0.58**
Observations	96,318	31,835	10,835	99,286	85,046	43,285	90,950

COPD, chronic obstructive pulmonary disease; OR, odds ratio.
Note that the lowest three ORs are bolded in each year.
*P<0.05, **P<0.01.

resulting in potential lost work productivity and lost wages, and high burdens on a person's quality of life. Thus, stroke is considered to be one of the most devastating neurological diseases.[33–35]

In the past decade, the number of stroke survivors has increased in Canada. The number of individuals with long-term stroke disability was slightly more than 300,000 in 2001; however, this number increased to 405,000 in 2013.[36] The same study projects that the number of people with stroke may increase to 726,000 by 2038.[36] This increase highlights the importance of better understanding the impact and burden that stroke has on the Canadian population and economy. The current direct and indirect stroke costs to the Canadian economy can be as high as $3.6 billion annually and will continue to increase in the future.[37] Our study showed that people with the effect of stroke have consistently lower HRQoL over ten years than those with other chronic conditions. In addition, the consistently low LS scores may be attributed to decreased productivity and lost wages associated with stroke effects. Considering the large number of people who experience the effect of stroke, their low HRQoL, and the high cost of stroke to the Canadian economy, more attention should be provided to stroke survivors to better understand and address their needs. The most recent Canadian Stroke Best Practice Recommendations for the Secondary Prevention of Stroke support the development of core elements for delivering secondary stroke prevention services to improve Canadian's quality of life.[38]

There are conflicting research studies between self-reported health outcomes and age. One US study found that self-reported poor health was common among adults older than 60 years, and these were associated with various socio-economic factors such as unemployment, low income, and low social support.[39] However, another study found that LS is relatively stable throughout adulthood and a steep decline is not observed until after 70 years of age.[39] These findings highlight the importance of assessing the burden of diseases while controlling for age effect. After controlling for age and gender effects, the high burden was found in arthritis, back pain, and mood disorder on the HUI; in anxiety disorder, the effect of stroke, and mood disorder on LS; and in cancer, COPD, and effect of stroke on PH. The risks of those chronic conditions are highly correlated with age. Thus, the difference between the tendencies of raw scores and regression coefficients could be largely explained by age.

The results also showed that the scores, especially HUI_3, fluctuate over time in people with any kind of chronic diseases. The minimum clinically significant difference on HUI_3 was reported as 0.03, and an article has reported significant improvement/deterioration using two time points.[40] One study reported that there was a statistically significant and clinically important reduction in the mean HUI3 score in those who had suffered a stroke between 1996 and 2005 Canadian data sets.[41] In our study, there were similar significant differences on HUI_3; for example, the mean HUI_3 score in people with effect of stroke in 2005 was 0.55, while it was 0.65 in 2008. However, this trend did not persist in the following years, thus making it difficult to conclude whether there was an improvement or deterioration of HRQoL for people with effect of stroke based on our data. Mo et al.[13] evaluated the impact of the chronic disease on HUI_3 score using the CCHS 2000–2001 data set. Although their results are mostly consistent with ours, given that those three outcomes fluctuate over time, our study emphasizes the importance of using survey data sets with multiple time points to observe whether an actual improvement occurred on health outcomes. Although data from one year shows a significant effect on HRQoL, LS, or PH, it may change over time, as demonstrated in our study. This is an important consideration for government, policy makers, and other stakeholders

when evaluating the impact of health programs used to improve chronic disease outcomes. There are many interventional programs developed and guidelines established to improve health outcomes for people with those chronic diseases in Canada. Some studies showed that their interventional programs improved HRQoL in those who had a stroke, COPD, urinary incontinence, and mood disorder.[15,42–50] However, the overall effectiveness of these programs is low because there have not been any significant improvements to the trends of those outcomes.

The results of this study are a first step for stakeholders to understand the needs of people with chronic diseases. Policies and interventional health programs need to be designed to maximize the benefit to the end users. Measuring the changes in HRQoL, LS, and PH scores over time will provide relevant information on the overall effectiveness of these programs to improve a person's health and its ability to decrease or limit the costs to the healthcare system.

Limitations

There are several limitations in this study. First, owing to the self-reported nature of the CCHS, the presence of the chronic condition cannot be confirmed in the CCHS data set. Thus, the numbers of samples with chronic illnesses might be over-reported/underreported. The results of the reliability between self-reported medical conditions have been varied in the literature depending on the target population and diagnosis.[51,52] Second, this study did not take the severity of disease into the models. Although our data did not show apparent improvement in any diseases, the mortality of many diseases has been improved. Thus, it might be possible that the improvement of health outcomes was concealed by those who have survived from severe diseases. The individual disease needs to be assessed, including severity information over time in future research. Third, the health outcomes in this study were generic tools rather than disease-specific tools. This ensures that the data were comparable across diseases and healthy peers. However, those may not be sensitive enough to detect disease-specific improvements. Finally, the health outcomes are correlated with the SES. However, Strine et al.[15] reported that adjusting for sociodemographic characteristics did not change the association between chronic illnesses and life dissatisfaction. Thus, we believe that although SES may affect the health outcomes, it is trivial compared with the influence of chronic diseases.

Conclusion

Based on the results, arthritis, back pain, and mood disorder have large burden on the HUI_3 score, while LS and PH were affected by the effect of stroke, mood disorder, and COPD. Although the scores of HUI and percentage of better outcomes on LS and PH have fluctuated year by year, it seems that arthritis, back pain, mood disorder, the effect of stroke, and COPD have a high burden on health outcomes compared with other chronic conditions. Future research needs to assess the detail of the burden of those diseases, and policy makers may need to provide more support to those who have high burden chronic diseases.

Author statements

Ethical approval

Secondary analysis using Statistics Canada data does not require an ethics review at our institution.

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Competing interests

The authors stated that they had no interest which might be perceived as posing a conflict or bias.

Author contributions

K.U. and B.N-.K. participated in the study design. K.U. collected data for this study. K.U. and B.N-.K. participated in the analysis and wrote this manuscript with contributions from A.K.C.L. All authors reviewed the final version of the manuscript and support this publication.

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