Association between chronic disease and perceived unmet healthcare needs

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Running Title: Chronic disease and unmet healthcare needs

ABSTRACT:

Background: Despite effective treatment many Canadians with chronic medical conditions do not receive adequate care, which may be related to unmet healthcare needs including limited accessibility or availability of care. The objective of this study was to determine the association between chronic disease and self-perceived unmet healthcare needs.

Methods: We combined the 2001, 2003 and 2005 cross-sectional cycles of the Canadian Community Health Survey for adult respondents. Multivariate logistic regression was used to estimate the association between chronic disease (arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, stroke) and self-perceived unmet healthcare need in the prior 12 months, adjusting for socio-demographic variables, health behaviors and status, and survey cycle.

Results: Of the 360,105 adults, 12.2% reported an unmet healthcare need. Compared to those without chronic conditions, patients with at least one condition were more likely to report an unmet need (adjusted odds ratio [OR] 1.51; 95% CI: 1.45, 1.59). The likelihood of an unmet need increased with the number of chronic conditions (OR: 1.71; 95% CI: 1.56, 1.88 for 3 or more conditions). Patients with chronic disease were more likely to report an unmet need related to issues of resource availability/wait times (OR: 1.14; 95% CI: 1.06, 1.22).

Interpretation: Adults with chronic medical conditions, and an increasing number of conditions, are more likely to report an unmet health care need. Whether these unmet needs are associated

with worse outcomes, and whether interventions targeted to address these needs may improve outcomes for Canadians with chronic disease, remains to be determined.

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INTRODUCTION:

The economic and health impact of chronic medical conditions are a major concern in Canada and abroad.[1-6] Approximately 1 in 3 Canadians have one or more chronic diseases including diabetes, hypertension, arthritis, and heart disease [1, 4, 7] and the direct cost associated with management of these conditions exceeds $40 billion/yr.[5] Furthermore, people with chronic disease use a disproportionate amount of health care resources compared to those with no long-term health problems.[1, 3] This economic burden is further magnified among subjects with multiple chronic diseases, with health resource use and associated costs increasing with the number of conditions present.[8]

Consequently, improving care for patients with chronic disease has become a major focus.[9-14] Disease management programs, disease-specific treatments, and patient education efforts have been developed to prevent disease progression and improve management.[10, 12] Despite the availability of such resources, many Canadians still do not receive adequate care for long-term medical conditions.[15, 16] Approximately 1 in 3 Canadians with diabetes report not having recommended tests for effective diabetes care and 1 in 5 adults with hypertension are not receiving treatment for blood pressure control.[17, 18] One reason for this may be related to limited accessibility or other potential barriers to care.[19] Identifying these barriers is important from a health services delivery standpoint, as the elimination of modifiable barriers to care may ultimately improve health outcomes for Canadians with chronic disease.

Preliminary studies have shown that patients with chronic medical conditions are more likely to report a perceived unmet healthcare need – a commonly used indicator of inadequate access to

care.[19-23] However these studies have been limited by a broad definition of chronic disease and have not assessed whether the type or number of chronic conditions have an influence on reported barriers to care.[22] Furthermore, there is limited information on the types of unmet healthcare needs these populations experience. Given these knowledge gaps, the objectives of this study were to determine if there is an association between chronic medical conditions and unmet healthcare needs, and if an association does exist, to determine whether it varies by number and type of chronic condition present.

METHODS:

Study Population

We obtained data from the 2001, 2003, and 2005 cycles of the Canadian Community Health Survey (CCHS), a national cross-sectional survey conducted by Statistics Canada. This survey provides self-reported estimates of health determinants, health status and health care utilization at the health region level. The target population of the CCHS is household residents aged 12 years and older in the 10 provinces and 3 territories, but excludes those living on Indian reserves or Crown land, full-time members of the Canadian Forces, institutional residents, and some in remote areas of Canada. Details of the survey methodology have been previously published.[24] We limited our study population to adults (18 yrs and older).

Study Variables

Chronic Disease

Chronic medical conditions, as determined by self-report, included: arthritis, chronic obstructive pulmonary disease (COPD) or emphysema, diabetes, heart disease, hypertension, mood disorders, and stroke. The use of these conditions to define chronic conditions of interest was developed by the Health Council of Canada and represents the seven chronic medical conditions that have a high prevalence and/or high impact on health care utilization.[2, 3] No chronic disease was defined by the absences of these seven conditions. We further defined chronic disease based on the number of conditions reported by each respondent to identify those with multi-morbidity.

Perceived unmet healthcare needs

The outcome of interest was self-perceived unmet healthcare needs. Each respondent was asked, "During the past 12 months, was there ever a time when you felt you needed healthcare but didn't receive it?" If a respondent answered yes to this initial question, they were prompted with a follow-up question that asked: "Thinking of the most recent time, why didn't you get care?" Reasons for an unmet need were classified into four categories: accessibility, availability, acceptability, or personal choice, as modified from the previously described classification system developed by Chen and Hou [20] (Appendix 1).

Other variables of interest

Socio-demographic variables and health behaviors were selected based on the Health Behavior Model proposed by Anderson, [25] a framework to understand determinants that affect health services use and patient satisfaction. We considered the following variables: age, sex, marital status, education, household income, immigration status, residency type (urban or rural), aboriginal status, presence of a regular family doctor, perceived health status, body mass index (BMI), smoking and drinking status, and level of physical activity.

Statistical Analysis

We described respondents' socio-demographic information and health behaviors using proportions. The proportion of respondents reporting an unmet healthcare need, and the four specific types of need, were compared across number of chronic conditions using chi-squared tests. All descriptive statistics were weighted to reflect the Canadian population using sampling

weights provided by Statistics Canada. When combining data from different CCHS cycles we recalculated these sampling weights to account for the fact that respondents differed between cycles using an equation provided by Statistics Canada.[26] Finally, due to the multistage sampling methodology used in the CCHS surveys, bootstrapping techniques were used to obtain estimates of variance and confidence intervals (CI).

To determine the relationship between chronic disease and unmet healthcare needs, we used multivariate logistic regression with backward selection techniques. We identified potential effect modifiers a priori, and interaction terms were developed for chronic disease by age and chronic disease by sex. Model fit was assessed by the likelihood ratio test. Odds Ratios (ORs) for unmet needs were calculated for respondents with at least one of the chronic diseases compared to those with no chronic disease (reference group), adjusting for age and sex initially, and then including socio-demographic variables, health behaviors, health status, and survey cycle (to account for change across time). Age was categorized as (18-44 yrs, 45-64 yrs, 65+ yrs) and BMI was categorized into obese (BMI $\geq$ 30 kg/m^2) and non-obese ($<$ 30 kg/m^2). For household income the "missing" category was included in the model as a separate category due to the large number of respondents with missing data. Similar models were developed to assess the association between chronic disease and each type of unmet need (accessibility, availability, acceptability, personal choice) amongst subjects reporting an unmet need, as well as between number of chronic conditions (none, one, two or three or more) and unmet needs. Recognizing that respondents with and without chronic medical conditions vary substantially in terms of demographic variables and health care need, a sensitivity analysis was performed in which the study population was limited to those with chronic disease. Using respondents with one chronic

condition only as the reference category, we determined the effect of multiple chronic conditions on the odds of reporting an unmet need. Finally, subgroup analyses were performed to determine if similar associations were observed in hypertensive and diabetic populations.

For all statistical tests, $P < 0.05$ was considered statistically significant. All analyses were conducted at the Prairie Regional Data Centre in Calgary, Alberta using STATA 11.0 (Statacorp, College Station, TX). This study was approved by the Ethics Review Board of the University of Calgary and Statistics Canada.

RESULTS:

A total of 360,105 adult respondents from the 3 CCHS cycles were included in the analysis. The relative proportion of subjects with 1, 2, or 3 or more chronic conditions was 21.3%, 6.8% and 3.6% respectively (Table 1). Respondents with chronic disease were older, more likely to be female, had lower household incomes and levels of education compared with those with no chronic disease. Furthermore, the proportion of respondents with a regular family doctor was higher for adults with chronic disease and increased with the number of reported chronic conditions. Arthritis and hypertension were the most commonly reported chronic medical conditions (prevalence 17.8% and 15.5% respectively) followed by diabetes, heart disease, and mood disorders (Appendix 2).

Overall, 12.2% of adult respondents reported an unmet need (Table 2). The most commonly reported type of need was related to availability (52%) followed by personal choice (32.1%). Generally, proportion of unmet needs was significantly higher in subjects with chronic medical conditions compared to those without, and increased with the number of chronic conditions present (X^2 and test for trend: $p<0.001$). Amongst subjects with 1 chronic condition, 14.0% reported an unmet need. This increased to 16.2% amongst subjects with 3 or more chronic conditions. Similar trends were seen by type of need. Issues of accessibility and availability increased with number of chronic conditions, while need related to personal choice decreased.

Overall Association:

Compared to subjects with no chronic disease, the presence of at least one chronic condition was associated with an increased risk of an unmet need (Table 3). In a model

adjusted for socio-demographic and health status characteristics, patients with a chronic condition were 1.5 times more likely to report an unmet need (OR 1.51; 95% CI: 1.45, 1.59). There was no evidence of effect modification by age or sex. Amongst subjects reporting an unmet need (n=44,618), presence of one or more chronic conditions showed varying associations by type of unmet need. Respondents with chronic disease were more likely to report issues related to availability (OR: 1.14; 95% CI: 1.06, 1.22) while less likely to state barriers to care as a result of personal choice (OR: 0.83; 95% CI: 0.76, 0.90), compared to those with no chronic disease.

Type of Chronic Condition:

In analyses by type of condition, arthritis, heart disease, and mood disorders were all associated with an increased risk of unmet need (Table 4). Subjects with mood disorders were almost two times more likely to report an unmet need (adjusted OR: 1.94; 95% CI: 1.78, 2.12), while participants with diabetes or hypertension were less likely to report an unmet need (OR: 0.85; 95% CI: 0.76, 0.94 and OR: 0.96; 95% CI: 0.89, 1.04 respectively).

Number of Chronic Conditions:

Number of chronic conditions also influenced the association between chronic disease and unmet healthcare needs. Respondents with one medical condition only were 1.5 times more like to report unmet need (OR: 1.50; 95% CI: 1.43, 1.58) compared to those with no chronic conditions whereas respondents with 3 or more conditions were 1.7 times more likely (OR: 1.71; 95% CI: 1.56, 1.88) (Table 5).

Sensitivity Analyses:

Restricting the study population to those with chronic disease and using one chronic condition only as the reference showed similar results. Though slightly attenuated, the odds of an unmet need increased amongst subjects with 2 chronic conditions (OR: 1.11; 95% CI: 1.04, 1.17) and more so in those with 3 or more conditions (OR: 1.30; 95% CI: 1.18, 1.44). When looking at type of need amongst subjects with reported barriers to care, issues related to availability appear to increase with number of chronic conditions present. No trends were observed for need related to accessibility, acceptability, or personal choice (Appendix 3).

Similar trends were observed in analyses restricted to those with hypertension (n=68,301) and diabetes (n=22,282). Compared to participants with hypertension only, respondents with hypertension and one other condition were 1.4 times more likely to report an unmet need (OR: 1.37; 95% CI: 1.22, 1.54), whereas hypertensive subjects with three or more additional chronic conditions were 2.3 times more likely to report unmet need (OR: 2.33; 95% CI: 1.92, 2.83). Similar trends were observed amongst the diabetic population (Appendix 4).

INTERPRETATION:

Using a large population-based survey of Canadians we found that the presence of chronic disease was associated with an increased risk of unmet healthcare needs. Patients with chronic disease were 1.5 times more likely to report an unmet need mostly related to issues of resource availability and lengthy wait times. Furthermore, this association was modified by the type and number of chronic medical conditions present amongst adult respondents.

Our findings complement those from previous studies using population-based survey data [19-23] showing that patients with chronic disease have a higher proportion of unmet needs compared to those without. However, these studies limited their analysis to a broad definition of chronic disease, which included over 20 different conditions, and did not assess the independent effects of specific conditions on the association with unmet needs. A strength of our study was the ability to identify the differential impacts of disease type and number of conditions on the odds of reporting an unmet need, as well as further explore the types of unmet needs they were associated with. We found that perceived barriers to care changed with the number of reported chronic medical conditions. These novel results suggest there may be a cumulative effect of multi-morbidity on reported barriers to care. Chronic care models have emphasized the importance of coordinated care within the healthcare system and improved self-care for management of chronic disease.[10, 12, 14, 27] However, multi-morbidity often makes this task difficult from a system and patient perspective.[13, 28, 29] Bayliss et al. found that patients with multiple chronic conditions often report an overwhelming effect of one single disease condition interfering with their ability to appropriately manage other co-morbid conditions.[28] This may lead to a higher proportion of respondents with multiple conditions reporting barriers to care.

Findings from our restricted analysis support this notion. Though diabetes and hypertension were not independently associated with barriers to care, when assessed in combination with other conditions, the odds of an unmet need increased.

Similar to previous work, the most commonly reported reason for an unmet need related to service availability.[20, 22, 30] Though improving availability of care and decreasing service wait times continue to top the Canadian healthcare agenda, future work must determine if disparities related to availability are associated with worse outcomes in chronic disease populations, and whether interventions targeted to address these needs ultimately improve outcomes. The fact that respondents with chronic medical conditions are more likely to have a family doctor, compared to those with no disease, may suggest that the issue is not access to primary health care, but rather the quality or quantity of care they are receiving. Kasman proposed that lengthy wait times to see specialists may explain why barriers related to availability increase with number of chronic diseases.[21]

Further, when considering disease type, respondents with mood disorders and arthritis experienced an increased likelihood of having an unmet healthcare need, while those with diabetes and hypertension did not. This may be related to the symptomatic nature of arthritis and mood disorders, resulting in a perceived unmet need. It has been suggested that care for conditions with pain and subjective symptoms have fewer treatment options and may fail to meet the symptomatic and functional changes desired by the patient, which may lead to frustration and negative attitudes toward the health care system.[21, 31]

Our study should be interpreted in light of its limitations. First, exposure and outcome variables were obtained from self-reported survey data and thus issues related to reliability and validity must be recognized. Second, potential barriers to care were defined using one question with the CCHS. There may be several interpretations of this question of unmet needs. Specifically, a negative response might indicate a person felt they had no need for health care, while it might also capture those who need care but endured a lengthy wait for care.[21, 23] Despite this limitation, we have no reason to believe interpretation of this question would differ by chronic disease state. Finally, we limited our definition of disease to seven highly prevalent, high-impact chronic medical conditions, which may affect the generalizability of these findings. Given the differential impact we observed amongst the seven selected conditions within our study, further work is the required to determine if other chronic conditions negatively affect access to care.

In summary, our study provides a national perspective on the potential gaps in care that exist for patients with chronic disease. Using a large population-based sample, we demonstrate that adults with chronic disease and in particular those with multi-morbidity, are more likely to report a perceived barrier to care. Given the increased prevalence of chronic disease in the population, future studies should focus on clarifying details of the types of need these groups experience in addition to their impact on health outcomes and future need for more acute care services. These results represent important first steps in the process to ultimately improve management and health outcomes for the millions of Canadians living with chronic disease.

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CONTRIBUTOR STATEMENT:

Paul Ronksley was involved in the concept and design of the study. He was also responsible for drafting the manuscript, conducted the analysis, and interpreting the data. Dr. Claudia Sanmartin contributed to the concept and design, interpretation of data, and provided intellectual content. Similarly Drs. Quan, Ravani, Tonelli, and Manns contributed to the concept and design of the study and provided interpretation and intellectual content to subsequent drafts of the manuscript. Dr. Brenda Hemmelgarn also contributed to the study conception and design, data interpretation, and manuscript revisions. All authors read and approved the final draft. Dr. Hemmelgarn is study guarantor.

COMPETING INTERESTS:

None

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Table 1. Participant Characteristics

Variables	All (n=360,105)	No Chronic Disease (n=217,350)	1 Chronic Disease* (n=85,424)	2 Chronic Diseases (n=38,539)	3+ Chronic Diseases (n=18,792)	p value†
Male (%)	49.0	51.4	45.3	42.0	43.5	<0.001
Age, yrs (%)						
18-44 yrs	51.6	66.6	28.6	10.4	4.3	
45-64 yrs	32.6	27.4	45.2	41.1	35.2	<0.001
65+ yrs	15.8	6.0	26.3	48.5	60.6	
Rural Resident (%)	18.1	17.3	19.7	20.1	20.2	<0.001
Household Income (%)						
- <$50,000	9.0	9.0	9.3	8.6	8.2	
- $50-60,000	8.8	9.2	8.4	7.6	6.2	<0.001
- $60-80,000	14.6	16.0	13.3	10.1	7.7	
- >$80,000	25.7	29.5	21.6	13.3	7.9	
- Missing	41.9	36.4	47.3	60.3	70.1	
Marital Status (%)						
- Married / Common-law	64.5	63.2	68.6	65.7	60.8	
- Single	22.6	28.3	13.2	7.9	6.5	<0.001
- Other	12.9	8.5	18.2	26.4	32.7	
Level of Education (%)						
- Less than high school	19.6	14.0	25.9	37.7	45.3	
- High school graduate	18.9	19.6	18.3	16.9	14.6	<0.001
- Some post secondary	8.7	9.8	7.1	5.7	5.4	
- Post secondary graduate	52.8	56.6	48.8	39.7	34.6	
Obese (BMI ≥ 30) (%)	15.2	11.5	19.2	27.6	33.3	<0.001
Born outside of Canada (%)	22.7	22.5	22.7	24.3	23.6	0.009
Aboriginal Status (%)	2.3	2.2	2.5	2.3	2.6	0.002
Regular Family Doctor (%)	85.1	80.9	92.3	96.1	97.1	<0.001

Self-perceived Health (%)						
- Excellent	22.9	29.8	12.2	4.0	1.4	
- Very Good / Good	64.9	65.3	70.0	60.2	38.1	<0.001
- Fair / Poor	12.2	4.9	17.8	35.8	60.5	
Smoking Status (%)						
- Current	24.9	26.2	24.3	19.2	17.0	
- Former	41.1	37.9	45.7	49.9	54.7	<0.001
- Never	34.0	35.9	30.1	30.9	28.3	
Drinking Status (%)						
- Regular / Occasional	81.0	84.3	78.6	69.3	59.3	
- Former	12.1	9.1	14.8	21.7	30.2	<0.001
- Never	6.9	6.6	6.6	9.0	10.5	
Physical Activity Level (%)						
- Active	23.3	25.4	21.2	15.8	12.1	
- Moderate	24.7	25.2	24.6	22.6	18.9	<0.001
- Inactive	52.1	49.4	54.2	61.6	69.0	

* Chronic conditions include: arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, stroke

† Chi squared test by number of chronic medical conditions (3 degrees of freedom)

Abbreviations: BMI (Body Mass Index)

Table 2. Proportion of respondents with self-perceived unmet healthcare needs by number of chronic medical conditions

	All Participants	No Chronic Disease	1 Chronic Condition	2 Chronic Conditions	3+ Chronic Conditions	p value*
Unmet Health Care Need (%)	12.2	11.2	14.0	13.6	16.2	<0.001
Type of need: †						
Accessibility (%)	11.7	10.8	12.3	13.9	14.4	<0.001
Availability (%)	52.0	50.0	53.9	58.0	55.7	<0.001
Acceptability (%)	5.8	5.7	6.0	6.2	5.5	<0.001
Personal Choice (%)	32.1	35.3	28.5	24.5	25.1	<0.001

* p value for comparison of subjects with no chronic disease, 1, 2 or 3+ conditions (chi squared with 3 degrees of freedom)

† Amongst subjects reporting an unmet health care need

Test for trend also significant for unmet health care needs and all types of unmet needs.

Table 3. Odds of an unmet healthcare need by presence (vs. absence) of chronic disease

	Unadjusted OR (95% CI)	Age-Sex Adjusted OR (95% CI)	Multivariate Adjusted† OR (95% CI)
Chronic Disease present*	1.31 (1.27,1.35)	1.88 (1.81, 1.95)	1.51 (1.45, 1.59)
Type of Unmet Need (n=44,618)			
- Accessibility	1.22 (1.12, 1.34)	1.26 (1.14, 1.40)	1.04 (0.92, 1.17)
- Availability	1.23 (1.16, 1.30)	1.10 (1.03, 1.17)	1.14 (1.06, 1.22)
- Acceptability	1.06 (0.94, 1.19)	1.06 (0.92, 1.21)	1.15 (0.99, 1.32)
- Personal Choice	0.68 (0.66, 0.71)	0.79 (0.73, 0.86)	0.83 (0.76, 0.90)

* At least one highly prevalent/high-impact chronic condition (arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, stroke)

† Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, self-perceived health status, aboriginal status, immigration status, and survey cycle

Note: Reference group are participants with no self-reported chronic medical conditions.

Abbreviations: CI (Confidence Interval); OR (Odds Ratio)

Table 4. Odds of an unmet health care need for selected chronic disease states

	Unadjusted OR (95% CI)	Age-Sex Adjusted OR (95% CI)	Multivariate Adjusted* OR (95% CI)
Arthritis	1.44 (1.39, 1.49)	1.98 (1.90, 2.06)	1.51 (1.41, 1.61)
COPD / Emphysema	1.57 (1.40, 1.77)	2.06 (1.83, 2.32)	1.19 (0.99, 1.43)
Diabetes	0.96 (0.90, 1.02)	1.24 (1.16, 1.33)	0.85 (0.76, 0.94)
Heart Disease	1.17 (1.10, 1.24)	1.75 (1.64, 1.87)	1.16 (1.04, 1.30)
Hypertension	0.91 (0.87, 0.95)	1.20 (1.15, 1.26)	0.96 (0.89, 1.04)
Mood Disorder	2.89 (2.71, 3.07)	2.76 (2.59, 2.94)	1.94 (1.78, 2.12)
Stroke	1.29 (1.16, 1.44)	1.86 (1.66, 2.08)	1.16 (0.96, 1.40)

*Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, self-perceived health status, aboriginal status, immigration status, and presence of each co-morbid condition

Abbreviations: CI (Confidence Interval); OR (Odds Ratio)

Table 5. Odds of an unmet health care need by number of chronic diseases present*

	Unadjusted OR (95% CI)	Age-Sex Adjusted OR (95% CI)	Multivariate Adjusted† OR (95% CI)
No chronic disease	Reference	Reference	Reference
1 condition	1.29 (1.25, 1.34)	1.73 (1.66, 1.80)	1.50 (1.43, 1.58)
2 conditions	1.25 (1.20, 1.32)	2.16 (2.04, 2.28)	1.52 (1.41, 1.62)
3 or more conditions	1.54 (1.44, 1.65)	3.06 (2.89, 3.30)	1.71 (1.56, 1.88)

*Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, and stroke.

†Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, self-perceived health status, aboriginal status, immigration status, and survey cycle

Abbreviations: CI (Confidence Interval); OR (Odds Ratio)

Appendix 1. Categorization of types of unmet need

Type of Unmet Need
Accessibility
- Cost
- Transportation
Availability
- Waiting time too long
- Not available when requested
- Not available in area
Acceptability
- Dislike doctor/Afraid
- Language problems
- Didn't know where to go
Personal Choice
- Too busy
- Didn't get around to it/Didn't bother
- Felt it would be inadequate
- Decided not to seek care
- Personal/Family responsibilities

Appendix 2. Proportion of subjects with selected chronic medical conditions (n=360,105)

Chronic Medical Condition	Proportion (%)
Arthritis	17.8
COPD / Emphysema	1.4
Diabetes	5.0
Heart Disease	5.4
Hypertension	15.5
Mood Disorder	5.8
Stroke	1.2

Appendix 3. Type of need by number of chronic medical conditions* amongst respondents reporting an unmet healthcare need (n=44,618)

	Unadjusted OR (95% CI)	Age-Sex Adjusted OR (95% CI)	Multivariate Adjusted† OR (95% CI)
Accessibility:			
- None	Reference	Reference	Reference
- 1 condition	1.16 (1.04, 1.29)	1.19 (1.06, 1.34)	1.06 (0.93, 1.22)
- 2 conditions	1.33 (1.15, 1.54)	1.42 (1.21, 1.67)	1.02 (0.85, 1.22)
- 3+ conditions	1.39 (1.17, 1.65)	1.52 (1.25, 1.86)	1.05 (0.83, 1.33)
Availability:			
- None	Reference	Reference	Reference
- 1 condition	1.17 (1.09, 1.25)	1.08 (1.01, 1.15)	1.10 (1.02, 1.18)
- 2 conditions	1.38 (1.26, 1.51)	1.20 (1.08, 1.33)	1.26 (1.13, 1.41)
- 3+ conditions	1.25 (1.11, 1.42)	1.07 (0.93, 1.23)	1.17 (1.00, 1.35)
Acceptability:			
- None	Reference	Reference	Reference
- 1 condition	1.06 (0.93, 1.21)	1.06 (0.91, 1.22)	1.06 (0.91, 1.24)
- 2 conditions	1.10 (0.89, 1.35)	1.09 (0.87, 1.37)	1.05 (0.83, 1.34)
- 3+ conditions	0.97 (0.77, 1.21)	0.97 (0.73, 1.27)	0.89 (0.67, 1.18)
Personal Choice:			
- None	Reference	Reference	Reference
- 1 condition	0.82 (0.75, 0.89)	0.82 (0.75, 0.89)	0.86 (0.79, 0.94)
- 2 conditions	0.72 (0.65, 0.81)	0.72 (0.65, 0.81)	0.81 (0.71, 0.91)
- 3+ conditions	0.78 (0.65, 0.91)	0.78 (0.67, 0.91)	0.89 (0.76, 1.05)

*Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, and stroke.

†Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, self-perceived health status, aboriginal status, immigration status, and survey cycle

Abbreviations: CI (Confidence Interval); OR (Odds Ratio)

Appendix 4. Odds of an unmet healthcare need by number of additional chronic conditions present amongst hypertensive and diabetic participants

	Unadjusted OR (95% CI)	Age-Sex Adjusted OR (95% CI)	Multivariate Adjusted* OR (95% CI)
(n=68,301)			
Hypertension only	Reference	Reference	Reference
Hypertension + 1	1.26 (1.15, 1.38)	1.60 (1.45, 1.76)	1.37 (1.22, 1.54)
Hypertension + 2	1.58 (1.41, 1.76)	2.23 (1.99, 2.51)	1.52 (1.32, 1.75)
Hypertension + 3 or more conditions	2.49 (2.13, 2.91)	3.67 (3.12, 4.33)	2.33 (1.92, 2.83)
(n=22,282)			
Diabetes only	Reference	Reference	Reference
Diabetes + 1	1.13 (0.95, 1.34)	1.43 (1.19, 1.70)	1.15 (0.94, 1.41)
Diabetes + 2	1.41 (1.18, 1.68)	2.11 (1.74, 2.55)	1.48 (1.19, 1.84)
Diabetes + 3 or more conditions	2.34 (1.90, 2.87)	3.65 (2.92, 4.56)	2.39 (1.83, 3.13)

Chronic conditions include arthritis, chronic obstructive pulmonary disease/emphysema, diabetes, heart disease, hypertension, mood disorder, and stroke.

*Multivariate model adjusted for age, sex, household income, level of education, marital status, having a regular family doctor, self-perceived health status, aboriginal status, and survey cycle

Abbreviations: CI (Confidence Interval); OR (Odds Ratio)