The Influences of Health on Labour Market Outcomes in Canada:

Analyses from the 2014 Canadian Community Health Survey

By

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Abstract

This thesis addresses the effects of seventeen chronic health conditions as defined by the 2014 Canadian Community Health Survey on labour market outcomes as measured by their labour force status: employed full-time, employed part-time, and not working. The estimation employed a multinomial logistic regression, which was then used to estimate the marginal effects of each health condition, as well in simulations that predicted probabilities of each employment outcome in the presence and absence of each condition. Further probabilities were estimated to differentiate the effects of major health conditions among demographic variables and levels of educations. Findings include that women are relatively more likely than men to exit full-time employment after the onset of a health condition; additionally, those who are younger and have higher levels of education are also more likely to maintain a full-time employment status relative to individuals who are older or less educated, and there are no differences in the impact of health conditions between immigrants and the native-born.

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I. Introduction

The relationship between labour force outcomes and individual health has been well documented in modern economic literature; however, the specific effects can vary across time periods, population groups, and of course by the illness under review. In this study, we will consider numerous health conditions as reported by Canadians in the 2014 Canadian Community Health Survey and estimate their effects on labour force outcomes – specifically on their likelihood of working part-time, full-time, or not at all. In particular, we seek to identify to what degree an individual's chronic health issues influence their labour force status, as measured by the relative probabilities of displaying a particular labour force status relative to their healthy counterparts.

A greater understanding of the interactions between health and labour force outcomes has numerous policy implications; first, it allows the consideration of public health as an economic factor tied to an individual's cumulative welfare. When poor health is recognized as an erosion of human capital it follows that individual's experiencing this deterioration face limitations on their ability to work, earnings potential, and overall wellbeing. Second, the health effects on employment outcome can be studied from a macroeconomic perspective; it is not unreasonable to suspect employees experiencing major health conditions are less productive than they would otherwise be. Additionally, individuals who are restricted from employment due to health conditions can precipitate lower levels of employment that are neither efficient nor desirable.

In this thesis we will first establish context for the ongoing study of health and labour market participation – with a particular emphasis on the effects of mental illness. We will

then outline our data taken 2014 Canadian Community Health Survey, as well as our model, a multinomial logistic regression across three employment states. We will present findings for seventeen health conditions including mental illness, cancer, and chronic fatigue; our focus will be the disproportionate effects of health conditions on older and less educated Canadians.

II. A Review of the Literature

In their 2006 Australian study, Cai and Kalb reinforced the expectation of a positive relationship between individual health and labour force participation. Additionally, their analysis identified distinct effects that varied by age and sex groups and served as a basis for the control variable effects analyzed in Section V. Their estimation included controls for the potential estimator bias resulting from the simultaneity between health and labour force participation, however they found such methods had a limited effect on findings.

Among socio-demographic variables, differentials have been seen among different ages; particularly among youth and older adults. These effects have been the basis for further studies relating the education and employment of youth to their overall health, relative to the health of the general population. For example, Robert, Lesieur, Kergoat, Dutertre, and Chauvin (2015) found that youth in France who were not in employment, education, or training (NEET) were more than twice as likely to have depression, as well as other increased risk factors such as having a chronic illness or being overweight/obese (Robert et al., 2015).

Studies examining NEET youth in Canada have found similar results. In a 2015 study by Henderson, Hawke, and Chaim, it was found that youth categorized as NEET were more likely to be exposed to crime, substance use, and violence, with greater risks being attributable to men relative to women. This becomes relevant to our research when we discuss some results across different age groups in Section V; we will see that youth are more like to be not working relative to older Canadians, and as Henderson et al.

demonstrate, the effects of not working can be particular severe for youth, and hence for society at large.

Another major demographic characteristic in existing literature is health differences by sex. Latif (2009) studied the link between diabetes and employment in Canadian workers, with different results for males and females. His results indicate a statistically significant negative effect for diabetes on female employment, but no statistically significant effect for males. This mirrors some of the results we will see in Section IV and V; women are more likely to exit full-time work relative to men with the same health conditions.

Further, Berkowitz and Johnson (1974) also identified a differential effect of poor health on reduced labour force participation in the United States by ethnicity. Specifically, they reported that black Americans faced a larger reduction in employment due to health factors than their white counterparts; the authors argued this was due to limited downward mobility in the labour market for many blacks, a situation that was less likely among whites. This paper attempts to expand on the ethnicity effect introduced by Berkowitz and Johnson by using a control variable for immigration status to Canada and simulating the effects of key health conditions for both immigrants and native-born Canadians.

Similar conclusions also appeared with respect to part-time work and self-reported health. Cho (2018) found that Americans reporting positive health outcomes were more often working part-time, while those reporting negative outcomes were more often working full-time. In terms of demographic differences, it was found that white and black workers were more likely to report good health than other racial groups; additionally, men working part-time experienced a more significant effect on self-perceived health than women (Cho, 2018).

Clarke et al. (2015) examined the likelihood of staying in the labour force among cancer patients and survivors in the United States, and also saw significant differences related to ethnicity. In this case, black and Hispanic workers reported worse health than whites, however whites were more likely to exit the labour force. The authors suggest this may be related to individuals' dependence on employer-provided health insurance and other services.

The topic of health effects on labour force participation was expanded by a 2012 Australian study performed by Schofield et al (2012). In their study, the authors related chronic mental health conditions to both employment status and the likelihood of income poverty. Specifically, they identified that individuals out of the labour force with depression or other mental health conditions were 12.5% and 20.1% (respectively) more likely to be in income poverty relative to an individual without a chronic health condition out of the labour force for other reasons.

The Schofield et al. study directed attention to individuals at or approaching retirement age – the sample used included Australians aged 45 to 64 years old. In this paper, we seek to relax these age restrictions to identify if similar effects emerge and if those effects vary significantly among different age groups. While we did not examine income poverty, it does appear as an area for potential future study.

Another Australian study from Fritjers, Johnston, and Shields (2014) sought to quantify the severity of mental illness via an index of common diagnosable symptoms. By assigning a numerical value to an individual's mental health, they were able to conclude that a single standard deviation reduction in one's mental health results in a 30-percentage point decline in employment. Additionally, this decline in employment was not accompanied by an

increase in the likelihood of being fired, indicating that the decline arises from people voluntarily leaving the workforce. Additional investigation by Mitra and Jones (2017) in the United States found that the onset of a mental health condition increased one's likelihood to exit the labour force by between 7 and 18 percentage points; conversely, recovery from a mental health condition increased one's likelihood of entering the labour force by between 6 and 21 percentage points.

In a later paper, Schofield et al. (2013) examined the effects of multiple comorbid health conditions on employment status and noticed, as expected, the presence of multiple conditions further reduces likelihood of being employed. For example, an individual with one chronic health condition had a 59% chance of being employed relative to a healthy individual, while an individual with four or more chronic conditions had just a 14% chance of being employed. While the compounding effects of multiple conditions were not studied in this paper, they are an important consideration when analyzing individuals' health and wellbeing.

If we seek to minimize the negative impacts of health-based unemployment, it is essential to review the efficacy of policies designed to combat this problem. Romppainen, Saloniemi, Kinnunen, Liukkonen, and Virtanen (2014) tested the viability of health care programs targeted at individuals who were unemployed due to health conditions in Finland. By working with a doctor, psychologist, and employment coach the individuals in the sample were encouraged to re-enter the labour force and their progress and outcomes were reported. Although the authors found that there was virtually no beneficial effect to targeted health care programs, they stressed that this was likely due to the highly individualized

nature of health conditions and the employment decision, wherein a single aggregated health care policy would have just limited appeal to the sample individuals.

Even with the challenges of targeted health policy to combat health-based unemployment, it can be shown that being employed has a significantly positive effect on an individual's health, similar to how those with less severe health conditions are more likely to re-enter the labour force. These were precisely the results presented by Schuring, Mackenbach, Voorham, and Burdorf (2011); those with more severe health conditions are less likely to re-enter the labour force but re-entering the labour force in fact improves one's health. This is perhaps symptomatic of barriers to entry in the labour market – i.e. which aspects of working are prohibitive to those with health conditions and can they be adjusted to decrease unemployment due to poor health.

The findings within the context of individuals' employment statuses and health conditions can be also be extended to the macroeconomic environment. It has been found that early retirement due to depression has lowered Australia's GDP (2009) by AUD1.7 billion (Schofield et al., 2011). This study has linked health conditions to both individual income and poverty as well as lost taxation revenue and increased transfer payments by governments. The estimation used in this paper has not been extended beyond the health and employment relationship, but extensions into the macroeconomy serve as potential continuations of this research.

III. An Outline of the Data and the Empirical Methodology

In this section, we discuss our data and look at various descriptive characteristics of the chosen sample and outline the empirical methodology used to examine our research question.

III.1. Data

The data we use are drawn from the public-use micro files (PUMFs) of the 2014 Canadian Community Health Survey (CCHS) prepared by Statistics Canada. Beginning with an initial group of 63522 individuals, several filters were applied before arriving at the sample used to conduct the empirical analyses in this thesis. Since we look at the labour force status of individuals, we dropped those under the age of 18, or above 64, as well as all students to isolate potential labour force participants; this resulted in a final sample size of 35,554 individuals. Since the focus of this paper is on how labour force status is affected by an individual's health, controlling for demographics and human capital, our discussion here will focus on variables and factors that reflect these effects.

Table 1: Age distributions of men and women

Age	Male	Female	Total	Cumulative Frequency
18 - 19	314	207	521	*1.47%*
20 - 24	1046	965	2011	*5.66%*
25 - 29	1321	1620	2941	*8.27%*
30 - 34	1333	1758	3091	*8.69%*
35 - 39	1620	1930	3550	*9.98%*
40 - 44	1643	1826	3469	*9.76%*
44 - 49	1399	1515	2914	*8.20%*
50 - 54	2035	2583	4618	*12.99%*
55 - 59	2740	3329	6069	*17.07%*
60 - 64	2817	3553	6370	*17.92%*
	16268	19286	35554	

Note: ages are represented in the sample data as midpoints of intervals; e.g. the value 22 corresponds to ages 20-24, 57 describes ages 55-59

Table 1 shows the age and gender distributions of the final sample. It is skewed towards older groups, likely due to the effects of an aging population as well as the filter applied to exclude current students, most of whom would be between the ages of 18 and 25. Additionally, there is also an overrepresentation of female respondents relative to males; as the CCHS is a voluntary survey this may indicate the women are more willing to discuss their health and lifestyle characteristics than men.

Table 2: Education and employment status by sex

Level of Education	Male	Female
Some secondary schooling	12.85%	9.79%
Secondary school graduate	22.21%	21.59%
Some post-secondary school	4.03%	3.79%
Post-secondary graduate	60.92%	64.83%
	100%	*100%*
Employment Status	**Male**	**Female**
Full-time employed	67.28%	50.10%
Part-time employed	4.54%	11.72%
Not employed	28.18%	38.18%
	100%	*100%*

Note: values expressed as relative frequencies of each sex's total

When we examine the educational characteristics of the sample in Table 2, we see the majority of both male and female respondents possess a post-secondary degree; although there are relatively more women than men at this level. Further, men are relatively more prevalent in the lowest level of education (some secondary schooling), potentially indicating a divide in the educational opportunities between the sexes and serving as a catalyst for differences in severity of health conditions, level of medical attention, and self-reporting characteristics.

However, these roles are reversed when it comes to employment: males are far more likely to be full-time employed than females, an effect that may arise from women's disproportionate burden of unpaid household work and care of dependents. Interestingly we also observe a high proportion of women working part-time relative to men. While these women are in the labour force, their reduced workload is likely symptomatic of other domestic factors.

To consider the effects of health conditions on employment we must identify the prevalence of such conditions to establish context for further analysis. In Table 3 we see a large set of respondents listing back problems, high blood pressure, arthritis, and mental illness. In contrast, low levels of reporting are displayed for cancer, chronic fatigue, and heart disease, among others.

Table 3: The incidence of selected health conditions

Health Condition	Relative Frequency	Observations
Mental illness	0.1460	35554
Asthma	0.0865	35513
Back problems	0.2376	35554
Arthritis	0.1764	35450
High blood pressure	0.1710	35451
Migraines	0.1189	35512
COPD, emphysema, and bronchitis	0.0405	26944
Diabetes	0.0647	35510
Heart disease	0.0370	35474
Cancer	0.0156	35504
Ulcers	0.0266	35460
Effects of stroke	0.0083	35524
Urinary incontinence	0.0352	32985
Bowel disorder	0.0608	35471
Chronic fatigue	0.0201	35479
Multiple chemical sensitivities	0.0349	35463
Limited functioning in daily life	0.0882	35521

Note: values are percentages in decimal form of relative incidence of each condition in the sample; for a full description of variables and the survey questions posed in their derivation, see appendix

Although we can examine the effect of all health condition variables on employment status, our focus will be on those with a high magnitude of effect regardless of their relative incidence. For example, we will assign greater focus to chronic fatigue because, although it affects a relatively low portion of respondents, it has a large effect (as shown in Table 6). Similarly, back problems and arthritis are both extremely widespread health conditions, but they will not be the subject of much focus since their effects on employment status are relatively small.

III.2. Description of the Empirical Model

Labour force status is, by nature, a qualitative variable, representing the presence or absence of a particular labour force outcome. This would suggest that a multinomial logistic regression model is the appropriate approach to estimate the likelihood of a particular labour force outcome, given the presence or absence of certain health conditions. The discussion of the multinomial logit model in this section is based on Greene (2018, pp. 829-833). The multinomial logit can be written algebraically as:

$$log\left(\frac{\pi_{ij}}{\pi_{im}}\right) = \beta_{j0} + \sum \beta_{ij} X_{ik} + u_i \quad (1)$$

where $\frac{\pi_{ij}}{\pi_{im}}$ is the probability of labour force status *j* relative labour force status *m* occurring for individual *i*. β_{j0} represents a constant present for all individuals and $\sum \beta_{ij} X_{ik}$ is the sum of all k present health conditions and control variables (X_{ik}) and their effects on employment status (β_{ij}) for any given individual; u_i is a random error term for each individual.

The probability of observing any outcome, given a vector of individual characteristics is:

$$\pi_{ij} = \frac{exp\left(\beta_{j0} + \sum \beta_{jk} X_{ik}\right)}{\sum exp(\beta_{j0} + \sum \beta_{jk} X_{ik})} \quad (2)$$

where, using the Theil normalization (that is, using the first category as the benchmark for comparison), we have $\beta_{10} = 0$, and $\beta_{1k} = 0$ for all k. Note however that the signs of the coefficients in (1) are not necessarily indicative of the direction of the marginal effects – that is, the impact on absolute probabilities. In particular, the effect of X_k on the probability of being in any category π_j is given by:

$$\frac{\partial \pi_j}{\partial X_k} = \pi_j(\beta_{jk} - \beta^*) \quad (3)$$

where β^* is the weighted average of all coefficients. It is evident from (3) that although β_{jk} might be positive (for instance), the marginal effect need not.

The estimates of equation (1) allow us to obtain the relative risk ratios (or odds ratios) for full-time or part-time employment, which tell us how the odds of each change in respond to changes in the explanatory variables. As well, we can obtain the marginal effects given by (3). We can also directly predict probabilities given any vector of individual characteristics, using (2). In fact, since many of the predictions relevant in this paper involve dummy variables, marginal effects are more appropriately obtained using (2) instead of (3).

Ideally, we would want to be able to distinguish between those who are in part-time and full-time employment, those that unemployed, and those that do not participate in the labour force. However, the available data restricts us to three labour force categories: those employed full-time, those employed part-time, and those who are not employed. We are not able to distinguish between those who are not working but are active in the labour market, and those who have withdrawn from the labour force. As a result, we cannot assess how various health conditions affect the likelihood of being active in the labour market, and of withdrawing from it. Nonetheless, this study can still shed light on how health conditions affect the likelihood of full-time and part-time employment, and of not working. This in itself is useful information, since each has different implications for the income status and hence well-being of individuals.

We examined at seventeen health conditions (listed in Table 3) in this study, and these were modelled as binary variables, coded as 0 for the absence of the health condition, and 1 for

its presence. Additional control variables were included to capture the effects of sex, age, education, and immigration status.

Estimation results included estimates of relative risk ratios (Table 4) and the directions of marginal effects (Table 5) for both full and part-time employment, with being not employed used as the reference case; these are reported in Section IV. Further, the proportional effects on each labour force outcome (full-time employed, part-time employed, not employed) for each health condition were measured in Table 6. We then selected three health conditions with particularly severe effects on employment: mental illness, cancer, and chronic fatigue. The effects on employment status for each of these health conditions was measured for males and females, immigrants and native-born Canadians, as well as various education levels and ages; these results are presented in Section V.

IV. Results

IV.1. Relative Risk Ratios

Our estimates of the multinomial logit model using robust standard errors are presented in Table 4. Since the coefficients of the model itself are not of particular interest, we present the estimates in terms of relative risk ratios; these would correspond to the odds ratios in a simple two-outcome logit model. There are two such ratios for each health condition reported in Table 4: the probabilities of full-time employment and part-time employment, each relative to the probability of not working. Furthermore, since these models provide outcome specific coefficients for all variables, this generates a very large volume of output, especially since we consider seventeen health conditions, with controls for other individual characteristics; hence, only selected output is presented in this table.

We note from Table 4 that the largest effect for each health condition was usually a decrease in the likelihood of working full-time relative to not working (the base outcome); for example, an individual with mental illness is only 53% as likely to be employed full-time as another individual without a mental illness. As well, not all health conditions have a statistically significant effect on the relative risk ratios associated with the full-time employment outcome, but many do. Among the statistically significant estimates, those that have the largest effect are those associated with mental illness, cancer, chronic fatigue, those suffering from the effects of a stroke, or those who require help with the basic functions of daily life (referred to as limited functioning hereafter).

In terms of effects on part-time work, we see similar decreases, albeit smaller in magnitude and in some cases not statistically significant where their full-time counterparts were; this

can be seen in the cases of diabetes and the effects of stroke, among others. A common observation when comparing part-time and full-time ratios is decreases in the size of the change for the same health conditions (compared to the full-time effects). Consider the findings for cancer: those diagnosed are 67% as likely to work part-time as their healthy counterparts. While this decrease is noteworthy, it is smaller than the 58% effect on full time employment, indicating a propensity to continue to work in some capacity after the onset of a given health condition, be it due to preference or necessity.

Table 4: Estimates of the model: relative risk ratios

	Employment Status			Employment Status	
Health Condition	Full-time employed	Part-time employed	Health Condition	Full-time employed	Part-time employed
Mental illness	0.5326	0.7053	Cancer	0.5836	0.6684
	-13.93	*-4.85*		*-5.15*	*-2.23*
Asthma	1.012*	0.9387*	Ulcers	0.8287	0.6201
	0.21	*-0.67*		*-2.00*	*-2.75*
Back problems	0.9586*	1.0824*	Effects of stroke	0.5216	0.7735*
	-1.17	*1.35*		*-3.55*	*-0.92*
Arthritis	0.8610	0.8790	Urinary incontinence	0.8028	0.9014*
	-3.94	*-2.08*		*-2.72*	*-0.86*
High blood pressure	0.9224	0.8295	Bowel disorder	0.9824*	0.9229*
	2.16	*-2.88*		*-0.28*	*-0.80*
Migraines	1.0739*	1.0291*	Chronic fatigue	0.5352	0.7803*
	1.46	*0.37*		*-5.31*	*-1.48*
COPD, emphysema, and bronchitis	0.6771	0.8832*	Multiple chemical sensitivities	0.9934*	1.0168*
	-4.70	*-0.94*		*-0.08*	*0.14*
Diabetes	0.7748	.9052*	Limited functioning in daily life	0.2122	0.4141
	-4.65	*-1.05*		*-25.01*	*-9.37*
Heart disease	0.7291	0.7468	N/A		
	-4.38	*-2.17*			

Note: upper values in each segment are relative risk ratios (RRRs) for each health condition on full-time and part-time employment, with being not employed as the base case; italicized numbers below these values indicate z-scores for each RRR prediction; RRRs marked with an asterisk (*) indicates they are not significant at the 5% level

The differences between part-time and full-time employment reductions can vary dramatically across different health conditions; these are shown as the differences between full-time and part-time ratios in Table 4. The largest differentials can be seen in the cases of mental illness and limited functioning, with differences of 17 percentage points (0.5326 – 0.7053) and 20 percentage points (0.2122 – .04141) respectively. In these cases, we can clearly see a greater effect on full-time employment than part-time; however, there are also health conditions that display the opposite. For example, individuals with high blood pressure and ulcers are in fact experience a lesser reduction in their likelihood of working full-time than part-time, with differences of 10 and 21 percentage points respectively. Lastly, we also have health conditions with approximately uniform effects across both types of employment, as is the case with arthritis and heart disease.

IV.2. Marginal Effects

We turn next to the marginal effects of each health condition on the probability of each of our three labour force outcomes; the directions of these effects are presented in Table 5. They show that, in general, the onset of health conditions has a negative effect on both full-time and part-time employment, but a positive effect on being not employed (i.e. health conditions reduce one's likelihood to work), a result which is in line with expectations. Similar to the relative risk ratios, the majority of significant marginal effects are on the probability of working full-time, with the impact on the probability of working part-time being much smaller. For example, we can observe a statistically significant negative marginal effect for mental illness on full-time employment, as well as a corresponding positive effect on not being employed.

Table 5: The marginal effects of selected health conditions on employment status

Health Condition	Employment Status			Health Condition	Employment Status		
	Full-time employed	Part-time employed	Not employed		Full-time employed	Part-time employed	Not employed
Mental illness	-	+*	+	Cancer	-	-*	+
	-12.91	*0.28*	*13.87*		*-4.34*	*-0.49*	*5.30*
Asthma	+*	-*	+*	Ulcers	-*	-	+
	0.48	*-0.80*	*0.00*		*-0.92*	*-2.16*	*2.63*
Back problems	-*	+*	+*	Effects of stroke	-	+*	+
	-1.74	*1.87*	*0.65*		*-3.30*	*0.45*	*3.48*
Arthritis	-	-	+	Urinary incontinence	-	+*	+
	-3.37	*-0.70*	*4.05*		*-2.54*	*0.21*	*2.66*
High blood pressure	-*	-	+	Bowel disorder	-*	-*	+*
	-1.14	*-2.25*	*2.73*		*-0.01*	*-0.73*	*0.46*
Migraines	+*	-*	-*	Chronic fatigue	-	+*	+
	1.42	*-0.18*	*-1.38*		*-4.94*	*0.70*	*5.26*
COPD, emphysema, and bronchitis	-	+*	+	Multiple chemical sensitivities	-*	+*	+*
	-4.46	*0.80*	*4.50*		*-0.13*	*0.18*	*0.04*
Diabetes	-	+*	+	Limited functioning in daily life	-	+*	+
	-4.29	*0.54*	*4.41*		*-22.76*	*0.27*	*26.93*
Heart disease	-	-*	+	N/A			
	-3.56	*-0.82*	*4.54*				

Note: upper values in each segment are the marginal effects for each health condition on employment status; italicized numbers below these values indicate z-scores for each marginal effect prediction; marginal effects marked with an asterisk (*) indicates they are not significant at the 5% level

However, we do not have a significant marginal effect with respect to part time work – a phenomenon that is repeated in virtually all health conditions except for arthritis. This ambiguity in the directional effects on part-time employment is likely because of differing responses among individuals with health conditions that limit full-time employment. More specifically, an individual with a restrictive health condition who chooses to stop working full time can either decide to continue to work part-time (resulting in a negative full-time

effect and a positive part-time effect) or choose to not work at all (negative full-time effect, positive effect on not employed category). Similarly, individuals with a restrictive health condition that work part-time will realistically not increase their workload to full-time; their options are either to continue to work part-time or not work at all (negative effect on part-time, positive effect on not employed category). We see based on individual preference and current employment status the onset of a health condition can either increase or decrease an individual's likelihood to work part time – this results in the ambiguous part-time marginal effect predictions shown in Table 5.

IV.3. Predicted Impacts on the Employment Probabilities

The marginal health effects presented in Table 5 correspond to derivatives of probabilities with respect to each health condition, and these are useful in that they tell us the directional effect on the likelihood of being in full or part time employment and being diagnosed with a health condition. However, this interpretation of the marginal effects is not useful for assessing how large such effects are since each of our health variables is a dummy variable. For this reason, we present in Table 6 predicted proportionate differences in absolute probabilities of each employment status for those with and without a given health condition. A comparison of proportionate effects is more meaningful than a comparison of differences in absolute probabilities, since a given change in the absolute probability is quantitively more significant when the absolute probability is low to begin with than when it is high.

As an illustration, consider again mental illness; by simulating predicted probabilities it was found that the likelihood of being employed full-time for an individual without a mental illness is 0.58, in contrast to a likelihood of 0.46 for an individual with a mental illness (for a full list of simulation results, see appendix). This is a 0.12 or a 12-percentage

point difference and translates into a 0.21 or 21 percent difference between a person with mental illness relative to one without this condition. Specifically, an individual with a mental illness is approximately 20% less likely to be employed full time than an individual that is otherwise healthy.

Table 6: The proportional effects on the probabilities of part-time and full-time employment of selected health conditions

Health Condition	Employment Status		
	Full-time employment	Part-time employment	Not employed
Mental illness	-20.51%	-0.73%	35.59%
Asthma	0.92%	-6.12%	-0.01%
Back problems	-2.17%	9.73%	1.22%
Arthritis	-4.48%	-3.75%	8.30%
High blood pressure	-1.55%	13.44%	5.46%
Migraines	2.38%	-1.18%	-3.49%
COPD, emphysema, and bronchitis	-14.34%	8.46%	19.77%
Diabetes	-8.61%	4.07%	13.03%
Heart disease	-9.54%	-9.91%	17.84%
Cancer	-17.15%	-9.73%	30.02%
Ulcers	-3.72%	-28.70%	12.91%
Effects of stroke	-22.26%	7.95%	33.85%
Urinary incontinence	-7.25%	1.80%	11.24%
Bowel disorder	-0.04%	-6.08%	1.52%
Chronic fatigue	-21.37%	7.68%	32.67%
Multiple chemical sensitivities	-0.55%	1.85%	0.15%
Limited functioning in daily life	-50.18%	-15.06%	94.43%

Note: proportional effects are calculated by the relative difference between predicted probabilities for each employment status among those who have and do not have a given health condition

In terms of effects on full-time employment, we can see consistently negative effects with the highest magnitudes being attributable to limited functioning, suffering from the effects of a stroke, chronic fatigue, mental illness, and cancer. These correspond to a proportional increase in the likelihood of not working, indicating an outward migration of full-time workers from the labour force or into a state of unemployment when they develop a relatively severe health condition.

Interestingly, we again see ambiguous effects on part-time employment; some health conditions in fact increase the likelihood of an individual to work part-time. These include back problems, high blood pressure, and chronic fatigue. We propose two possible explanations for this observation: first, the presence of these conditions might be severe enough to prevent someone from working full-time but, not so severe as to prohibit them from working entirely; and second, that these conditions disproportionately affect individuals who do not have the means to stop working due to health complications (e.g. those with lower income, single income households, or those who are relatively young).

Table 7: Health condition variables categorized by magnitude of proportional effect

Magnitude of Proportional Effect				
<5% (E)	5-10% (D)	10-20% (C)	20-30% (B)	>30% (A)
Migraines	Asthma	High BP	Ulcers	**Mental illness**
Multiple chemical sensitivites	Back problems	COPD, emphysema, and bronchitis		**Cancer**
	Arthritis	Diabetes		Effects of stroke
	Bowel Disorder	Heart disease		**Chronic fatigue**
		Urinary incontinence		Limited functioning

Note: variables selected for further analysis are displayed in bold

As our focus is on the magnitude of these proportional effects, we chose to categorize each of the seventeen health conditions in terms of the severity of their effects. These results are presented in Table 7, with Category A being the most severe (with proportional changes to any employment status of more than 30%) to Category E being the least severe (proportional changes being less than 5%). These categories served as the basis for which health conditions were subjected to further analysis, with the goal of providing the most insight to conditions that have the largest effect on employment.

Specifically, we will examine mental illness, cancer, and chronic fatigue as they have some of the largest effects among the observed health conditions. The effects of these conditions were measured across sex, immigration status, education level, and age; results are presented in Section V.

V. The Impact of Selected Health Conditions by Gender and Immigrant Status

Based on the magnitude of proportional effects determined in the general estimation results, three health conditions from Category A were selected for further analysis. Among these conditions (mental illness, cancer, and chronic fatigue), proportional effects were measured separately for men and women, immigrants and native-born Canadians, levels of education, and age groups.

V.1. Mental Illness

By examining the proportional effects presented in Table 8, we can observe differences in the impact of mental illness among the sexes; for example, it can be seen that women experience a larger negative effect on full-time employment than men, however men have a greater increase in the likelihood of not working given they are diagnosed with a mental illness.

Dividing these proportional effects by males versus females helps us gain more information on the ambiguous effects on part-time employment. Here we can see men are more likely to work part-time given they have a mental illness, while women have the opposite result (although the effect is of relatively low magnitude). This could indicate differences in work habits between men and women under health-related stresses as well as conflicting expectations for the two sexes; consider that while women are less likely to be working full-time, they are also more likely to exit full-time employment when diagnosed with a mental illness.

We can further examine the behaviours of immigrant versus native born Canadians, which are largely the same in this case. This not only implies similar responses to a diagnosis of

mental illness, but also a similar response rate to the related survey questions. Given that mental illnesses are highly stigmatized, it would be not entirely unexpected to see one group with different effects resulting from differences in reporting. For example, if immigrants were less likely to report mental illness than native born Canadians, then the proportional effect on employment due to mental illness would likely be different between the two groups.

As an individual's level of education rises, we observe that the negative effect from mental illness declines such that an individual with only some secondary school education has a far greater likelihood of not working full-time than does a post-secondary graduate. A similar effect is displayed in terms of part-time work: as education rises, the decreases in the likelihood of working fall. This may be due in part to the quality of jobs held by individuals; jobs with higher educational requirements often have better employee benefits such as the option to take a leave of absence or paid time off for illness.

We see several distinct responses to mental illness across age groups. First consider an individual who is relatively young, say 20 years of age. The individual experiences a negative proportional effect of 6.9% on their likelihood of working full-time, however the magnitude of the effect itself is far lesser than for the entire sample (20.5%, according to Figure 6). Additionally, younger individuals see a positive 20% shift towards part-time work, likely due to the necessity to work being stronger at lower age levels. We do however see a major increase in the probability of not working (64%), potentially signalling a sensitivity towards high youth unemployment relative to the general population.

Table 8: The effects of mental illness on employment status by schooling and demographic characteristics

	Employment Status					
	Full-time employed		Part-time employed		Not employed	
	Mental illness	No mental illness	Mental illness	No mental illness	Mental illness	No mental illness
Male	0.5381	0.6587	0.0445	0.0428	0.4174	0.2995
		-18.31%		*3.86%*		*39.35%*
Female	0.3955	0.5135	0.1171	0.1195	0.4873	0.3669
		-22.98%		*-1.97%*		*32.80%*
Immigrant	0.4599	0.5790	0.0831	0.0837	0.4570	0.3373
		-20.56%		*-0.80%*		*35.49%*
Native-born	0.4608	0.5796	0.0842	0.0848	0.4550	0.3356
		-20.50%		*-0.72%*		*35.60%*
Some secondary schooling	0.3776	0.4990	0.0860	0.0906	0.5364	0.4104
		-24.33%		*-5.08%*		*30.70%*
Secondary school graduate	0.4147	0.5365	0.0858	0.0885	0.4996	0.3750
		-22.69%		*-3.10%*		*33.22%*
Some post-secondary schooling	0.4523	0.5733	0.0850	0.0860	0.4627	0.3407
		-21.11%		*-1.08%*		*35.78%*
Post-secondary school graduate	0.4902	0.6091	0.0838	0.0830	0.4260	0.3079
		-19.52%		*0.95%*		*38.36%*
Age 20	0.8163	0.8769	0.0500	0.0417	0.1337	0.0814
		-6.91%		*19.99%*		*64.22%*
Age 30	0.7270	0.8115	0.0649	0.0556	0.2091	0.1330
		-10.41%		*16.73%*		*57.27%*
Age 40	0.6129	0.7215	0.0770	0.0708	0.3101	0.2077
		-15.05%		*8.64%*		*49.35%*
Age 50	0.4816	0.6072	0.0864	0.0852	0.4320	0.3076
		-20.69%		*1.40%*		*40.45%*
Age 60	0.3490	0.4765	0.0814	0.0955	0.5613	0.4280
		-26.75%		*-14.78%*		*31.13%*

Note: decimal numbers indicate probabilities of each employment state given the health condition and control variable; the italicized percentages below measure the proportional change between those with a mental illness and those without with respect to their probable employment status; negative percentages indicate a decreased chance for that employment status, whereas positive percentages indicate an increased change of a given employment status

As we simulate higher ages, we see several notable relationships; first, the proportional change in the likelihood of working both full-time and part-time drops for older individuals, likely indicating many older individuals opt for early retirement when diagnosed with a mental illness rather than remain in the labour force in a part-time capacity. However, we also see the proportional effect on not being employed is smaller for older individual's with mental illness than for the young. This is at least partially due to the higher likelihood for older individuals to be not working regardless of their health status; if there is already a strong tendency to not work then the proportional effects from mental illness will be reduced.

V.2. Cancer

When we examine the proportional effects of cancer on our various control groups (presented in Table 9), we can see a virtually unambiguous drop in employment for both full and part-time categories. In terms of a sex difference, we see women's relative change in likelihood is largely than men's; however, this may be a result of healthy men having a higher probability of working full time, so that a roughly equivalent absolute change results in a larger relative change on women's employment.

Similar to our findings in terms of mental illness, we see no difference between the employment probabilities of immigrants versus native-born Canadians. This again indicates that illness reporting, if understated, is at least understated to similar degrees among the two groups.

Table 9: The effects of cancer on employment status by schooling and demographic characteristics

	Employment Status					
	Full-time employed		Part-time employed		Not employed	
	Cancer	No cancer	Cancer	No cancer	Cancer	No cancer
Male	0.5438	0.6437	0.0400	0.0429	0.4161	0.3134
		-15.52%		*-6.71%*		*32.80%*
Female	0.4046	0.4997	0.1065	0.1190	0.4890	0.3813
		-19.04%		*-10.48%*		*28.22%*
Immigrant	0.4676	0.5648	0.0752	0.0833	0.4572	0.3518
		-17.20%		*-9.79%*		*29.94%*
Native-born	0.4685	0.5655	0.0762	0.0844	0.4552	0.3501
		-17.14%		*-9.72%*		*30.04%*
Some secondary schooling	0.3856	0.4851	0.0780	0.0898	0.5364	0.4251
		-20.52%		*-13.06%*		*26.17%*
Secondary school graduate	0.4226	0.5223	0.0778	0.0879	0.4997	0.3898
		-19.09%		*-11.54%*		*28.18%*
Some post-secondary schooling	0.4601	0.5589	0.0770	0.0856	0.4629	0.3555
		-17.68%		*-10.00%*		*30.20%*
Post-secondary school graduate	0.4978	0.5947	0.0758	0.0828	0.4264	0.3225
		-16.29%		*-8.46%*		*32.21%*
Age 20	0.8179	0.8666	0.0450	0.0427	0.1371	0.0906
		-5.63%		*5.36%*		*51.29%*
Age 30	0.7307	0.7987	0.0574	0.0564	0.2119	0.1449
		-8.51%		*1.87%*		*46.25%*
Age 40	0.6191	0.7068	0.0693	0.0713	0.3116	0.2219
		-12.42%		*-2.76%*		*40.44%*
Age 50	0.4898	0.5919	0.0781	0.0849	0.4321	0.3231
		-17.25%		*-8.11%*		*33.74%*
Age 60	0.3579	0.4623	0.0814	0.0944	0.5607	0.4433
		-22.59%		*-13.77%*		*26.49%*

Note: decimal numbers indicate probabilities of each employment state given the health condition and control variable; the italicized percentages below measure the proportional change between those with cancer and those without with respect to their probable employment status; negative percentages indicate a decreased chance for that employment status, whereas positive percentages indicate an increased change of a given employment status

Another theme continues from our analysis of mental illness: as education increases, the negative employment effects of illness (in this case cancer) are diminished. For example, an individual with cancer and only some secondary school education experiences a 20.5% decrease in their likelihood of working full time, while an individual also with cancer but who has graduated from a post-secondary institution sees only a 16% decrease. This relationship also holds for part-time work, where proportional effects on employment again decrease as education increases; additionally, higher education levels are associated with a higher proportional change in the likelihood of not working. This finding reinforces our hypothesis wherein more educated individuals have more employment options when diagnosed with a major health condition, such as leaves of absence, PTO for illness, among others. Additionally, an educated individual is generally at a higher income level, resulting in more accumulated wealth and the ability to leave the workforce entirely, be it for a temporary period or as an early retirement.

If we once again examine the effect of age, we see a generally expected trend: older people are more likely to leave the work force, possibly because of they are closer to retirement and likely hold greater stocks of accumulated wealth. We can see an interesting ambiguity within the effects on part-time work; younger individuals are more relatively more likely to work part-time if they have cancer, but that drops to a negative effect as the individual gets older. This is again likely a phenomenon based on the means of the patient – perhaps a young person with cancer would like to be out of the labour force, but simply cannot afford to do so due to a lack of benefits at work or savings to sustain a life without employment income.

V.3. Chronic Fatigue

The incidence of chronic fatigue has an unambiguously negative effect on full-time employment, although that effect is worse for females relative to males (see Table 10). This has been a common observation throughout this section and generally arises due to the lower probabilities of women being full-time employed relative to men regardless of health condition. For example, in the case of chronic fatigue we see for both males and females an absolute decrease in probabilities of approximately 12%, while the relative change is measured as larger for women because their beginning probabilities were lower than men's. Unlike with the previous two examples, there is a strong positive effect on part-time employment for virtually all groups, rather than the ambiguity we have previously seen. This suggests that while chronic fatigue has a major impact on full-time employment, for most individuals it is not entirely prohibitive in terms of labour force participation. Additionally, it should be noted that we again see no measurable immigration effect on employment status.

We also see proportional changes that mirror the findings from our mental illness and cancer simulations. Specifically, in terms of education we observe higher educated individuals exiting full-time employment with a greater frequency than their less employed counterparts. This corresponds to a relative increase in part-time work and being not employed, indicating that some individuals are willing to work part-time while some exit the labour force entirely.

Again, we see the same results with respect to age: older individuals with chronic fatigue are more likely to exit full-time work and less likely to begin part-time work, likely due to some ability to retire early or forgo income for extended periods of time. However, we also

Table 10: The effects of chronic fatigue on employment status by schooling and demographic characteristics

	Employment Status					
	Full-time employed		Part-time employed		Not employed	
	Chronic Fatigue	No Chronic Fatigue	Chronic Fatigue	No Chronic Fatigue	Chronic Fatigue	No Chronic Fatigue
Male	0.5220	0.6441	0.0485	0.0428	0.4296	0.3131
		-18.96%		*13.24%*		*37.19%*
Female	0.3793	0.4999	0.1261	0.1187	0.4946	0.3814
		-24.12%		*6.21%*		*29.69%*
Immigrant	0.4440	0.5650	0.0895	0.0832	0.4664	0.3518
		-21.41%		*7.62%*		*32.59%*
Native-born	0.4448	0.5657	0.0908	0.0843	0.4644	0.3500
		-21.36%		*7.69%*		*32.67%*
Some secondary schooling	0.3633	0.4852	0.0923	0.0896	0.5444	0.4252
		-25.14%		*3.03%*		*28.05%*
Secondary school graduate	0.3994	0.5225	0.0922	0.0877	0.5084	0.3898
		-23.55%		*5.13%*		*30.42%*
Some post-secondary schooling	0.4363	0.5592	0.0916	0.0854	0.4721	0.3554
		-21.97%		*7.27%*		*32.82%*
Post-secondary school graduate	0.4736	0.5950	0.0905	0.0826	0.4360	0.3224
		-20.41%		*9.45%*		*35.25%*
Age 20	0.8012	0.8679	0.0554	0.0425	0.1434	0.0896
		-7.68%		*30.35%*		*60.02%*
Age 30	0.7093	0.7998	0.0701	0.0563	0.2205	0.1439
		-11.31%		*24.62%*		*53.17%*
Age 40	0.5943	0.7076	0.0837	0.0711	0.3220	0.2213
		-16.01%		*17.66%*		*45.52%*
Age 50	0.4644	0.5923	0.0931	0.0848	0.4425	0.3229
		-21.61%		*9.82%*		*37.06%*
Age 60	0.3350	0.4623	0.0961	0.0943	0.5689	0.4433
		-27.53%		*1.90%*		*28.31%*

Note: decimal numbers indicate probabilities of each employment state given the health condition and control variable; the italicized percentages below measure the proportional change between those with chronic fatigue and those without with respect to their probable employment status; negative percentages indicate a decreased chance for that employment status, whereas positive percentages indicate an increased change of a given employment status

see a 60% increase in the likelihood of a 20-year old individual not working, not unlike our simulations for mental illness; we observe an absolute percentage point increase of 6% in the probability of not working. Similar to the differential effect of chronic fatigue among men and women, this large proportional effect (60%) arises from a relative low probability of not working among young people, so that an absolute change that is on par with other age groups is perhaps overstated in terms of relative changes.

VI. Conclusions

This thesis sought to examine the effects of major health conditions on Canadians' employment outcomes; with this goal in mind we examined the effects of seventeen health conditions on the likelihood to be working full-time, part-time, or not at all. We saw most estimates indicate the presence of any of our health conditions reduces the likelihood of working; this is true for both full-time and part-time employment. This effect is continued in the estimated marginal effects; all significant estimates resulted in negative directions for each health condition on both types of employment. Further, we can see a positive effect for all significant estimates on the likelihood of not working. These are findings are intuitive yet important for establishing context; the onset of a health condition reduces the individual's chances of working and increases their chances of not working.

When we examined the size of these positive and negative effects, we were able to view our health conditions in greater detail. As expected, our proxy variable for general disability (limited functioning) and suffering from the effects of a stroke had the largest effect, while some other major illnesses followed; these were mental illness, cancer, and chronic fatigue. Other notable conditions we did not examine further included chronic obstructive pulmonary disorders (COPD), emphysema, and chronic bronchitis, which had a large negative effect on full time employment; and general back problems, which while it affects roughly one quarter of the population it did not have a large impact on full-time employment (although it did increase the likelihood of part-time employment).

Examining our three specific health conditions allowed for the identification of some trends common to each. In terms of a gendered effect, we see across mental illness, cancer, and chronic fatigue that relatively speaking, women face a greater reduction to the likelihood

of full-time employment than men. As discussed in Section IV, this can partially be attributed to similar changes in absolute probabilities being relatively more dramatic on women because of their lower probabilities for full-time employment regardless of health condition; however, it still does raise issues for further investigation.

An initial question we had at the outset of this paper was whether there were differences in reporting and effects of health conditions between immigrant and native-born Canadians. Based on our estimated probabilities it would appear that the two groups have no significant differences (at least in terms of mental illness, cancer, and chronic fatigue), with near identical probabilities of being in each employment state as well as highly similar effects for all three illnesses.

We observed results generally in line with expectations in terms of both age and education. Specifically, younger individuals are more likely to continue working after the onset of a health condition, likely due to financial necessity. Similarly, those who are more educated will face a lesser reduction in their likelihood of working both full-time and part-time. In fact, in many cases the onset of a health condition has a positive effect on part-time employment for educated individuals, likely due to the reduction of hours or workload at the same job due to health-related reasons. We speculate this is perhaps because of more generous benefits in workplaces with higher educational requirements resulting in increased flexibility while suffering from an illness or disability.

It has been found that there are large differences between health conditions in terms of their effects on employment for the afflicted. It was also noted that the literature finds that employment status has implications for an individual's income status and well being. This presents a decision for policymakers in terms of the allocation and intensity of health-

related programs. Additionally, it has been shown that the negative effects of health conditions can be at least partly mitigated by increases in individual education levels. This suggests that while many illnesses (e.g. cancer) are beyond policymakers' ability to eradicate, the development of education in the general populace and addition of varied social services could perhaps limit their negative effects.

It is in the interest of governments to limit the negative effects of illness on the labour market for two reasons: first, individual welfare is reduced not just by the experience of being ill, but also by the economic consequences of being unable to work. The combination of health and labour-related factors drastically reduces the wellbeing of the individual; in other words, having a health condition affects multiple facets of one's life, creating further issues in other areas. Second, negative health affects represent a loss in productivity and a reduction in the quality of human capital in the aggregate labour environment; this inevitably weakens a country's macroeconomy via the deprivation of skilled and productive labour.

This study has some limitations in both its data and empirical methods; chiefly among these are the potential inaccuracies in self-reported health (as is the case with the CCHS) as well potential estimator bias associated with the simultaneity of health and labour force status. Further, because of data limitations, our use of dummy variables in modelling individual health does not allow for the consideration of severity of illnesses, only their presence. Future research would benefit from an investigation of the severity of illness, as well as controls for estimator bias as a result of simultaneity.

VII. References

Berkowitz, M., & Johnson, W. G. (1974). Health and Labor Force Participation. *The Journal of Human Resources*, *9*(1), 117-128.

Cai, L., & Kalb, G. (2006). Health status and labour force participation: evidence from Australia. *Health Economics, 15*. doi:10.1002/hec.1053

Cho, Y. (2018). Part-time employment and worker health in the United States. *The Social Science Journal*, *55*, 97-107. doi:10.1016/j.soscij.2017.09.004

Clarke, T. C., Christ, S. L., Soler-Villa, H., Lee, D. J., Arheart, K. L., Prado, G., Martinez, C. M., & Fleming, L. E. (2015). Working with cancer: health and employment among cancer survivors. *Annals of Epidemiology*, *25*, 832-838. doi:10.1016/j.annepidem.2015.07.011

Henderson, J. L., Hawke, L. D., & Chaim, G. (2017). Not in employment, education or training: Mental health, substance use, and disengagement in a multi-sectoral sample of service-seeking Canadian youth. *Children and Youth Services Review*, *75*, 138-145. doi:10.1016/j.childyouth.2017.02.024

Greene, W. H. (2018). *Econometric Analysis*. New York: Pearson

Frijters, P., Johnston, D. W., & Shields, M. A. (2014). The effect of mental health on employment: Evidence from Australian panel data. *Health Economics, 23*, 1058-1071. doi:10.1002/hec.3083

Latif, E. (2009). The impact of diabetes on employment in Canada. *Health Economics*, *18*, 577-589. doi:10.1002/hec.1390

Mitra, S., & Jones, K. (2017). The impact of recent mental health changes on employment: new evidence from longitudinal data. *Applied Economics*, *49*(1), 96-109. doi:10.1080/00036846.2016.1192274

Robert, S., Lesieur, S., Kergoat, V., Dutertre, J., & Chauvin, P. (2015). Health characteristics of young people not in employment, education or training in France in 2011. *European Journal of Public Health*, *25*(3).

Romppainen, K., Saloniemi, A., Kinnunen, U., Liukkonen, V., & Virtanen, P. (2014). Does provision of targeted health care for the unemployed enhance re-employment? *BMC Public Health*, *14*(1200). doi:10.1186/1471-2458-14-1200

Schofield, D. J., Shrestha, R. N., Percival, R., Passey, M. E., Callander, E. K., & Kelly, S. J. (2011). The personal and national costs of mental health conditions: Impacts on income, taxes, government support payments due to lost labour force participation. *BMC Psychiatry*, *11*(72). doi:10.1186/1471-244X-11-72

Schofield, D. J., Callander, E. J., Shrestha, R. N., Percival, R., Kelly, S. J., & Passey, M. E. (2012). The association between labour force participation with being in income poverty amongst those with mental health problems. *Aging and Mental Health*, *17*(2), 250-257. doi:10.1080/13607863.2012.727381

Schofield, D. J., Callander, E. J., Shrestha, R. N., Passey, M. E., Percival, R., & Kelly, S. J. (2013). Multiple chronic health conditions and their link with labour force participation and economic status. *PLoS ONE*, *8*(11). doi:10.1371/journal.pone.0079108

Schuring, M., Mackenbach, J., Voorham, T., & Burdorf, A. (2011, July). The effect of re-employment on perceived health. *Journal of Epidemiology and Community Health*, *65*(7), 639-644. doi:10.1136/jech.2009.103838

VIII. Appendix

Predicted probabilities for each employment outcome given an individual has been diagnosed with a health condition. These results are the basis for the proportional effects presented in Figure 6

		Employment Status		
Health Condition	Prevalence (Yes/No)	Full-time employed	Part time employed	Not employed
Mental illness	Yes	0.4607	0.0841	0.4553
	No	0.5795	0.0847	0.3358
Asthma	Yes	0.5683	0.0793	0.3524
	No	0.5631	0.0845	0.3524
Back problems	Yes	0.5542	0.0901	0.3557
	No	0.5665	0.0821	0.3514
Arthritis	Yes	0.5437	0.0819	0.3744
	No	0.5692	0.0851	0.3457
High blood pressure	Yes	0.5569	0.0761	0.3670
	No	0.5657	0.0863	0.3480
Migraines	Yes	0.5754	0.0832	0.3415
	No	0.5620	0.0841	0.3538
COPD, emphysema, and bronchitis	Yes	0.4849	0.0911	0.4191
	No	0.5661	0.0840	0.3499
Diabetes	Yes	0.5186	0.0874	0.3941
	No	0.5674	0.0839	0.3487
Heart disease	Yes	0.5120	0.0761	0.4120
	No	0.5660	0.0845	0.3496
Cancer	Yes	0.4684	0.0761	0.4555
	No	0.5654	0.0843	0.3503
Ulcers	Yes	0.5431	0.0604	0.3965
	No	0.5641	0.0847	0.3512
Effects of stroke	Yes	0.4388	0.0908	0.4705
	No	0.5644	0.0841	0.3515
Urinary incontinence	Yes	0.5240	0.0856	0.3904
	No	0.5650	0.0841	0.3509
Bowel disorder	Yes	0.5633	0.0793	0.3574
	No	0.5635	0.0844	0.3521
Chronic fatigue	Yes	0.4447	0.0906	0.4647
	No	0.5656	0.0841	0.3502
Multiple chemical sensitivities	Yes	0.5615	0.0855	0.3530
	No	0.5646	0.0840	0.3524
Limited functioning in daily life	Yes	0.2927	0.0734	0.6339
	No	0.5876	0.0864	0.3260