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The Health and Capacity to Work of Older Men and Women in Canada

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We address the health capacity to work among Canadian older workers using two complementary methods, aggregate mortality risk and individual health indicators. We find that men in 2012 would need to work more than five additional years between ages 55-69 to keep pace with how much men in 1976 worked, holding health capacity constant. For working women, the comparable result is only two years more work. Most of these gaps arose before the mid-1990s, as employment advances have offset mortality improvements since then. Regionally, more than half the Ontario-Atlantic employment difference among older men is rooted in health differences.

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1. Introduction

Life expectancy of older Canadians is expanding rapidly. Over the 50-year period from 1961 to 2011, the expected remaining years of life of a 65-year-old Canadian increased by over five years.[1] In just the last decade, men have gained more than two years of expected post-65 life. At the national level, these trends continue to raise policy questions about the fiscal cost of greater public expenditures on both pensions and healthcare. But at the individual and family level the trend toward longer lifespans raises more pointed questions: how should any extra longevity be split between work and non-work? If more work is desired, is there capability to work longer?

In this study we explore the relationship between older workers' health and their employment. While lifespans have increased over time, it is an open question whether these increases in lifespan represent an increase in potential working lives. Available evidence suggests that the health of older Canadians has improved over time (Ramage-Morin et al. 2010). This suggests extra years of life are not entirely spent in declining health as the treatment of chronic diseases improves. Consistent with improvements in health at each age, Carrière and Galarneau (2012) have shown that today's older Canadians expect to work longer than older Canadians in the 1990s, even after accounting for events like illness that might push workers to retire involuntarily. Our aim in this study is to describe and quantify the health

[1] From the Canadian Human Mortality Database (2015), for those having attained age 65 the male life expectancy rose from 13.59 in 1961 to16.93 in 2001 and 18.93 in 2011. The corresponding figures for females are 16.31, 20.37 and 21.80.

capacity to work among older individuals using mortality risk along with detailed health conditions to measure health.

To address the question of health capacity and work we employ two complementary measures of health capacity. The first is age-sex specific mortality risk. While obviously a coarse measure of health, mortality data are available for long time periods and are also comparable across jurisdictions. We follow up by using a regression-based approach employing detailed microdata survey responses on health conditions. The microdata on health conditions is subtler than mortality, but not available over long time spans.

The paper builds on the foundation set by Milligan and Schirle (forthcoming). We go beyond that earlier work in several important ways. First, in our characterization of changes in the employment-mortality profile, we introduce an analysis of women's employment and mortality. Second, we introduce regional comparisons of health capacity to work, allowing an assessment of regional tradeoffs between health capacity and employment that yield substantial insight into the determinants of cross-region employment differences at older ages. Third, we consider deeper measures of aggregate labour supply in our analysis by considering both employment and hours worked. Fourth, our analysis of individual employment and health characteristics employs an improved modeling strategy, incorporates more recent data, and uses a more complete set of health measures and personal characteristics than was possible in earlier work.[2]

We also contribute more generally to the literature on labour supply and health at older ages. There is an extensive U.S. empirical literature linking older individuals' health and labour market attachment. Currie and Madrian (1999) offer an earlier review of this literature and point to the importance of social institutions such as the expansion of public pensions that mediate the relationship between health and work. Milligan and Wise (2015) and Coile et al. (forthcoming) use similar methodology on employment rates and mortality risk to make international comparisons, finding large differences in the uptake of capacity to work across countries.

For Canada, a link between health and older individuals' labour market attachment is also clear from available studies. For example, Au et al. (2005) have shown that health has a significant effect on employment probabilities for Canadian men and women aged 50-64, using longitudinal data from the National Population Health Survey. Schirle (2010) uses longitudinal data from the Canadian Survey of Labour and Income Dynamics to account for health and pension incentives, and finds that

[2] The analysis in Milligan and Schirle (forthcoming) used a restricted and limited specification, as that analysis was part of a cross-country project that required some cross-country uniformity in methodology. As one example, Milligan and Schirle (forthcoming) used a linear probability model whereas the analysis here uses probit estimation. Our current model also includes a richer set of covariates, adding several health conditions, the total number of conditions, finer education categories, regional effects, and year effects to the model

poor health significantly increases the likelihood of entering retirement among men and women aged 50-68. Available Canadian evidence, however, has not considered how the relationship between health and work has changed over the span of decades.

Our research follows three steps. First, we provide a brief descriptive summary of the improvements in mortality and the patterns of elderly employment. Second, we document the relationship between age- and sex-specific employment rates and mortality rates to characterize historical changes in this relationship and differences across sex and regions. Third, we employ microdata to estimate employment probabilities as a function of observed health characteristics among near-retirees. The model results are used to simulate employment for older workers and obtain an estimate of the health capacity to work.

The analysis provides the following key insights. We show that older men and women in 2012 could work an additional 5 years and 2 years, respectively, if they worked at the same rate per unit of mortality risk as their counterparts in 1976. These increases in work in the 55-69 age window amount to gains over the status quo of 65 percent for men and 28 percent for women. The result is largely attributed to the evolution of the employment-mortality relationship before the mid-1990s, as employment has increased to keep pace with mortality improvements since then. Simulations that account for health conditions further indicate substantial unused work capacity. For example, the results suggest the employment rates of men aged 60-64 could be 29 percentage points higher than observed, and the employment rates of women aged 60-64 could be at least 34 percentage points higher. Finally, our analysis shows that a substantial share of regional differences in employment rates can be accounted for by health differences, in that the lower employment rates for older workers in some regions reflect in part worse health.

The paper proceeds as follows. In section 2 we discuss the main data sources for this paper. In section 3 we describe general trends in older Canadians' employment and mortality. In section 4 we assess the relationship between mortality and employment. In section 5 we further explore the health capacity of older individuals to work using health microdata. Finally, we offer some concluding remarks.

2. Data

In this study we bring together data from various sources on employment, mortality, and health.

The employment data for the first part of our analysis come from the Labour Force Survey (LFS). The LFS is a monthly household survey, collecting information on household members' labour market activity and demographics. Methods for collecting the main labour market information have not changed substantially since 1976. In what follows, we primarily use the confidential files of the LFS, available through the Research Data Centres Program.

We use the LFS data up to 2012 to form age- and sex-specific employment rates, based on an indicator for whether an individual is currently employed. For women, a much larger proportion have never worked in the labour market. So, for women we use the same employment measure, but focus on a subsample of women who report having worked in the labour market since turning age 45. We make this adjustment to the female analysis because of the prevalence of women with little labour market history, particularly in earlier years analyzed.[3] This is an innovation relative to other work using this method.[4] In addition to the employment rates, we also measure average usual hours worked to examine a continuous and intensive measure of labour supply.[5] This allows us to examine whether intensive-margin responses are in play alongside the extensive-margin responses examined using employment rates.

When measuring mortality rates, the bulk of our data come from the Canadian Human Mortality Database (2015), which offers temporally consistent series of key

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[3] In the LFS, individuals who are not employed report whether they worked in the last year, more than one year ago, or never worked. Our subsample excludes women who report they never worked. For women that worked more than one year ago, we use individuals' reported year last worked to exclude those who last worked before age 45. We do this to capture a group of women with at least some work history when their children are typically not infants, recognizing our inability to capture the degree of women's long-term career attachment with the limited information in the LFS.

[4] Milligan and Wise (2015) give the most comprehensive treatment to the mortality-employment relationship, but the analysis there was limited just to males.

[5] We use the LFS variable for usual hours worked at all jobs, noting the sample of men includes those with zero hours when obtaining the average hours. For women, we use the sample that requires some work history after age 45, and include women with zero hours in the average presented.

mortality indicators up to 2011 by age, year, and sex. We augment this with recently released data from Statistics Canada (2016) lifetables to extend the analysis to 2012.[6]

Finally, for our examination of individual employment and health conditions, we make use of the confidential microdata files of the Canadian Community Health Survey (CCHS). Beginning in 2001, the CCHS collects information related to health status, health care utilization, and health determinants. It also collects some information about the labour market attachment of individuals, their highest level of education, and their personal characteristics. For the first three cycles of the survey, data were collected every two years (2001, 2003, and 2005). Since 2007, the CCHS data have been collected yearly. We make use of all available files 2001-2014. Many questions were available intermittently (often considered part of modules that provinces could opt into) so we restrict ourselves to using information available in each survey year.

From the CCHS, employment status is measured using an indicator of whether the person worked at (or was absent from) a job or business the previous week. We also examine whether the work was full time or part time (based on usual hours of work). With respect to health, we are able to indicate the prevalence of health conditions and account for the number of conditions, but not the severity of those

[6] We checked our data construction for 2012 by imposing our methods on 2011 data and comparing to the available 2011 data from the Canadian Human Mortality Database. The match was extremely close.

conditions. We make use of other health indicators, including self-reported health status (excellent, very good, good, fair or poor), obesity, and smoking.

Our main CCHS estimates examine men and women aged 50-74, grouped in 5-year age groups. Sample sizes are modest, so that examining (for example) the prevalence of health conditions at a sex-age-year level is too noisy to be informative or useful. Instead, we develop our estimates by pooling together several years of the CCHS. In all estimates presented in this paper, we have restricted our sample to individuals for whom responses to the variables of interest are available.

3. Trends

The first step in our analysis is to examine descriptive data on the trends in employment and mortality among the near-elderly and elderly. For employment we use the LFS, incorporating data from 1976 to 2015. For mortality, we use data up to 2012, the most recent year currently available.

In Figure 1 we plot the employment rates of men and women since 1976, at ages 60-64 and 65-69. Two distinct patterns emerge: for women, there has been a gradual increase in employment rates since the mid-1990s; for men, employment rates fell substantially until the mid-1990s and then steadily rose thereafter, tracing a U-shape path. For these age groups, there is little business cycle fluctuation evident. For older women, the increase in employment rates in part reflects emerging cohort differences in lifetime employment patterns—women reaching older ages in the mid-1990s were much more likely to have had a substantial paid work career than earlier cohorts of women. No similar cohort effect influences men (see Schirle 2008).

Studies have suggested several factors influence the retirement and employment decisions of older individuals, including public pensions (as in Baker et al. 2003, Baker and Benjamin 1999a, 1999b), employer-sponsored pensions (as in Stock and Wise 1990, Pesando and Gunderson 1988, 1991, Pesando, Gunderson and Shum 1992, and Schirle 2010), and preferences for leisure with one's spouse in retirement (Schirle 2008). Health status also appears as an important factor in work and retirement decisions (Au et al. 2005, Schirle 2010).

In Figure 2 we plot the mortality rates of men and women at each age from 50 to 75 in the years 1976, 1994, and 2012. The lines for men are solid; the lines for women are dashed. For both men and women, there are clear and large improvements in mortality at each age over time. The mortality rates for men are much larger than for women, but men are catching up—by 2012 mortality for men had fallen below the rates observed for women in 1976. The changes in mortality rates are most stark for men at older ages---the mortality rate of men at age 70 fell from 4.3 percent in 1976 to only 1.9 percent in 2012, for a drop of 56 percent. For women, both the absolute and percentage drop in mortality are lower, but still substantial.

At age 70, the drop in the mortality rate was one percentage point between 1976 and 2012, or 45 percent of the 1976 mortality rate.

In summary, Canadians have seen steady improvements in mortality rates for several decades, which has led to expanded lifespans. One way to fund the additional consumption requirements associated with the longer lifespans is through additional work at older ages. To some extent, this is happening. The employment rates of older Canadians—both men and women—have grown substantially since the mid-1990s. For the men, this represented recovery to employment rates previously seen in earlier decades while for women the growth in employment rates was breaking new ground. The interesting question that emerges is whether the observed increase in employment rates since the mid-1990s has been sufficient to offset the decrease in mortality rates—are Canadians responding to longer lifespans by working more when healthier? The next section offers a quantitative assessment of this question.

4. The Mortality-Employment Relationship

Having documented the employment and mortality trends, the second step in our analysis is to combine the age- and sex-specific employment and mortality rates to trace the evolution of the employment-mortality relationship. We adapt the methodology developed in Milligan and Wise (2015) and used in Milligan and Schirle (forthcoming). The core of the strategy is to compare employment rates across years at given levels of mortality risk. That is, given the risk of mortality was 2.8 percent at age 65 for males in 1976, we find the age at which mortality risk in 2012 was also 2.8 percent and compare employment rates.

This strategy employs mortality risk as a proxy for health, and death is clearly a very coarse proxy. The limitations of this coarse approach provide us with the motivation for the much richer analysis in the next section, which uses the depth of health information available in the CCHS to study health and employment. However, Milligan and Wise (2015) argue that, while coarse, the mortality risk approach still provides an informative view on the health-employment relationship for two reasons, both relating to measurement. First, because both employment and mortality are relatively easy to measure, much longer comparable time series can be put to use. In contrast, the richer information in health surveys is often unavailable for earlier decades. This is true in Canada, with the CCHS only available since 2001. Second, the ease of measurement also enables international comparison. Even when detailed health surveys are available, question coverage and interpretation present serious challenges to comparability across countries and cultures (Juerges 2007, Kapetyen, Smith and Van Soest 2007). In contrast, mortality data is arguably not subject to measurement or cultural biases.

To note, changes in employment for a given level of mortality risk might not all reflect lost work capacity. If health conditions subtler than death evolve differently than mortality across ages, the potential work capacity revealed in our mortality-employment exercise may not be realizable. If so, the extra years of potential work capacity would not be realizable because the subtler health conditions present a barrier to extended employment. Again, this motivates the CCHS analysis in the next section that does account for diverse and subtler health measures.

Figure 3 presents the employment-mortality relationship for women and men between 1976 and 2012. For women, as mentioned earlier, we use a sample that conditions on previous employment (after age 45) in order to focus on women who have engaged in work outside the home. The upper line in each graph is 1976 and the lower line is 2012. Reading the gap between the years vertically, one can assess the change in employment rates at any given level of mortality risk.

These graphs can best be understood by following the lower 2012 line from age 55 to age 69. For men, the employment gap at age 55 in 2012 compared to the equivalent-mortality employment rate in 1976 directly above is 11.4 percentage points. By age 65, this gap grows to 49.2 percentage points, before closing somewhat at age 69. Table 1 summarizes these age-specific employment rate gaps, and presents the natural summary statistic—the sum of the gaps in employment rates across all ages from 55 to 69. For the comparison of 1976 to 2012, the total sums to 5 years for men and 2 years for women. This sum can be interpreted as the number of additional years those in 2012 would work if they worked at the same rate per unit of mortality risk as did their counterparts in 1976 over the 55-69 age range. When compared against the actual amount of work (in years) between ages

55 and 69, this represents an increase of 65.5 percent for men over the 7.8 actual total for 2012, and a 28.0 percent increase for women.[7]

In Figure 4, we repeat the analysis using an hours measure in place of the binary employment indicator. For women, we again condition the sample on having worked in the past. This continuous measure allows us to see if the pattern is different when allowing for an intensive margin response—for example, working fewer hours per week in a partial labour force withdrawal. The results in Figure 4 indicate a similar impact on hours as for employment for men and for women. Looking at calculations like in Table 1, the increase in hours worked over ages 55 to 69 for men would be 85 percent, and 35 percent for women. So, allowing for an intensive response raises the percentage increase in work if people in 2012 worked as much as those in 1976 conditional on health. This suggests that the response we observe is not just people pulling out of the labour market entirely, but also includes some adjusting from more to fewer hours worked.

To examine the time path of the mortality-employment relationship, we repeat the calculations made in Table 1 for employment for every year between 1976 and 2011, using 2012 as the base comparison year each time. For example, the male 1985 calculation tells us how much more men in 2012 would work over ages 55-69

[7] The total of the age-specific employment rates across the age 55-69 span gives a measure of the take up of work capacity over this age range. Full capacity would be characterized by a 1.0 employment rate in each of the years; adding to 15 years of total work. So, the 7.76 actual total years for 2012 means that 52 percent (7.76/15) of the available capacity was being used in 2012.

if they worked as much as the men in 1985 for each level of mortality risk. By repeating this analysis for each year between 1976 and 2011, we form and graph a time series separately for men and women in Figure 5.

The downward slope of the graph in Figure 5 from 1976 to the mid-1990s reflects the fact that mortality was improving at the same time as employment rates were declining (for men) or staying flat (for women). So, the employment trends were reinforcing the mortality trends on the employment-mortality relationship. In contrast, since the mid-1990s, the relative flatness of the lines in Figure 5 reflects the fact that employment expansions have almost completely offset the impact of mortality improvements over this era in their impact on the employment-mortality relationship. This offset is one of our major findings in this paper.

To provide a deeper context for these results, we now make use of this analytical framework to compare men and women directly, to look across Canadian provinces, and to compare to the United States. We do this by starting with Ontario males in the 2000s as the base case. We use the entire decade of the 2000s in order to provide sufficient sample sizes for the provincial analyses. For each of the comparisons, we take the comparison group and ask how much more Ontario males in the 2000s would work between the ages of 55 and 69 if they worked the same as the comparison group, at each level of mortality risk. We perform calculations like in Table 1 and then plot the result in Figure 6 for each comparison group. Positive values indicate that Ontario males would have to work more to meet the employment-mortality standard of the comparison group; negative values indicate that Ontario males would work less to meet the employment-mortality standard of the comparison group.

The first comparison in Figure 6 is to 1970s Ontario males. We find that 2000s male Ontarians would have to work 5.59 years more between ages 55 and 69 to match the employment-mortality relationship of 1970s Ontario males. This is similar to the 5.08 we found in Table 1 for 2012 vs 1976 for all Canadian males. Next we compare our 2000s Ontario males to females, also drawn from 2000s Ontario using our 'previous work' criterion to form the female sample. We find that males work 4.98 years more in Ontario in the 2000s compared to females, at comparable levels of mortality risk. This suggests that older female workers have more unused work capacity using this measure than older male workers.

We next look at differences between Ontario and other Canadian provinces in the next four bars, all for 2000s males. This is an interesting comparison because there are substantial differences in employment rates across regions in Canada. For 60 year old males in the 2000s, the employment rate was 0.676 in the prairies but just 0.459 in the Atlantic provinces. Our analysis allows us to examine how much of this difference is driven by health differences compared to other determinants (for example policy differences or preference differences).

The differences across provinces are fairly small compared to the first two bars on Figure 6. The 1.93 year difference for Ontario compared to the prairie provinces shows Ontarians would have to work about two years more over the 55 to 69 age range to match the employment-mortality pattern of the Prairies. For the Atlantic provinces, the small -0.7 year difference is of interest since the employment rates for Ontarian men are much higher. Over the 55 to 69 age range, the average Ontarian in the 2000s worked 7.28 years, 1.61 years more than in Atlantic Canada. The -0.7 difference in Figure 6 shows that only 42 percent of the 1.61 year gap would be closed if Atlantic Canadian men in the 2000s worked as much as Ontarian men, conditional on mortality rates. The reason that less than half of the gap would be closed is that mortality rates are higher in the Atlantic provinces. So, more than half of the gap in employment rates in the Atlantic provinces at these ages reflect differences in underlying health, leaving only 42 percent to be explained by policy or other factors.

The final bar in Figure 6 repeats the analysis with a comparison to males from the United States in the 2000s, finding that Ontarians would need to work 2.39 more years between ages 55 to 69 to match American male work effort, given mortality risk.[8] The actual gap in work between ages 55 and 69 is only 0.74 years, so the better health of Ontarians compared to Americans over these ages would allow the Ontarians to out-work Americans, if they worked as much as Americans conditional on health.

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[8] U.S. employment rates are constructed from the Current Population Survey (March Supplements) and the Human Mortality Database (2015).

These comparisons in Figure 6 reveal several interesting features of the employment-mortality relationship in Canada. First, the differences through time are much larger than the differences in Canada across regions. Second, females—even when excluding those who have never worked—work substantially less per unit of mortality risk than do males. Third, health is a strong determinant of the variation in employment rates observed across regions in Canada. Finally, older American males work more than older Canadian males in spite of having worse health as measured by mortality risk.

Overall, the employment-mortality analysis in this section has yielded three important insights. First, through time there have been substantial drops in employment rates when holding mortality risk constant. Taking mortality risk as a proxy for health (a proposition we relax in the next section), this suggests a substantial increase in the health capacity to work at older ages compared to the 1970s. But, most of this increase in capacity happened up to the mid-1990s. While employment and mortality trends worked against each other in the period up to the mid-1990s, the period since the mid-1990s has shown remarkable stability in the employment-mortality relationship as employment rates rose to match the improvements in mortality rates. Finally, comparing across different groups reveals that health differences across regions are important determinants of regional differences in employment rates.

As discussed at the outset of this section, the use of mortality risk as a proxy for health suffers to the extent that subtler health indicators evolve differently than mortality risk. For that reason, we extend our analysis in the next section to a much richer source of health information using microdata on individual health and employment outcomes to deepen our analysis of the health-employment relationship.

5. Health capacity for employment: microdata

In this section we address the relationship between health and employment at older ages using microdata from the Canadian Community Health Survey. We begin by reviewing summary statistics on the evolution of health and employment by age group between 50 and 74. We then estimate models of employment as a function of observed health characteristics, separately for men and women. Using these models, we simulate employment for older workers in order to characterize the extent that the drop-off in work at older ages is related to observed health deterioration.

We begin with the descriptive summary. In Tables 2 and 3 (a and b) we describe the health and other characteristics of men and women, respectively, using the 2001-2014 CCHS. For both men and women there are some health conditions that clearly become more prevalent with age. For example, the prevalence of heart disease among men quadruples between the ages of 50-54 and 70-74 (Table 2a). The prevalence of high blood pressure among men more than doubles between ages 50-54 and 70-74. Among women, the prevalence of urinary incontinence increases from 4.2% at ages 50-54 to 10.6% at ages 70-74 (Table 3a). For men (and women), the likelihood of reporting poor or fair health rises with age, from 11.9% (12.8%) at ages 50-54 to 20.6% (20.8%) at ages 70-74. Notably, the extent to which the prevalence of these conditions increases with age is less than the extent to which mortality rates increase with age (Figure 2). This might suggest mortality rates overstate the worsening of health with age. However, it is important to recognize the prevalence of health conditions does not fully describe the severity of those conditions, which we expect to increase with age.

From Tables 2a and 3a, we also see that some conditions are not as clearly related to age. For example, the likelihood of being obese declines with age and the likelihood of being overweight does not have a clear age gradient (appearing to increase slightly for women). This is consistent with research suggesting an increased risk of mortality associated with obesity, but a reduced risk of mortality associated with being overweight (see Orpana et al. 2009). Similarly, the likelihood of being a smoker declines with age, representing the higher risk of mortality associated with smoking.

The employment rates of men fall rapidly after ages 50-54 (Table 2b). Among those remaining employed, a larger share is working part time with age. For women (Table 3b) we see similar declines in employment with age, and even larger shifts toward part time employment at older ages (as a share of all employment). In Tables 2b and 3b, we see several other characteristics that differ by age that would correlate to one's employment outcomes. First, the oldest groups in our sample are substantially less educated. Among 70-74 year old men (women), 33% (38%) had not graduated high school. Among 50-54 year old men (women), only 14% (12%) had not graduated high school. Age differences in the likelihood of women to complete a university degree is most remarkable, as 22% of women aged 50-54 and 10% of women aged 70-74 completed university. We also see that older groups are more likely to be immigrants to Canada, and to be white (describing one's cultural/racial origin). Gender differences in mortality materialize as gender differences in the likelihood of being married—for men the likelihood of being married increases with age, while for women it declines significantly.

Empirical strategy

As mortality rates offer limited information about the health capacity of individuals to work, we now turn to using a broader set of health measures and relate individuals' employment status to their health conditions to estimate unused work capacity. We adopt methods similar to those of Cutler et al. (2014), who simulate the work capacity of 62-64 year olds in the United States. They begin by estimating the relationship between individuals' status in the labour force (participant, retired, or disabled) and individuals' health conditions and demographics (including education, race, ethnicity, marital status, and region) using a multinomial logit model and a sample of men or women aged 57-61. The results are used to form a prediction of the older group's labour force status. The analysis assumes the relationship between individuals' health and status in the labour force remains stable as individuals age.

We proceed by estimating the following equation using a probit model and samples of men or women aged 50-54 in the CCHS (2001-2014):

$$Employed_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it}$$

whereby we've considered 3 groups of characteristics: X_{1it} represents a large set of indicators for the prevalence of health conditions and behaviours including smoking and obesity (presented in Tables 2a and 3a), X_{2it} is a set of indicators for self-assessed health whereby individuals report their health as poor, fair, good, very good or excellent, and X_{3it} is a set of other individual characteristics including education, marital status, race (cultural origin), immigrant status, region of residence, and a set of year indicators. We also considered employment status in three groups—non-employment, employment full-time, and employment part-time—and estimated the model using an ordered probit model. Though not presented in this paper, we have found results are similar when a linear probability model is used instead of a probit model, or a multinomial logit model is used instead of the ordered probit model. We note that Milligan and Schirle (forthcoming) estimated a similar model using a linear probability model for employment status, a smaller set of health conditions, and fewer years of data.

The estimated coefficients are then used to predict the employment rates of men and women at older ages conditional on their health and characteristics. The predicted employment rates represent the potential capacity for work among older men and women. We use the term unused capacity to represent the difference between the observed employment rates of a group and their predicted potential capacity for work.

In what follows, we first present the main results of our estimation and the resulting simulations of work capacity. We then consider whether there are differences in unused work capacity across education groups and across regions. Finally, we recognize the assumption that the relationship between employment and health remains stable with age is a contentious one, and consider the implications of choosing different reference groups.

Probit Estimates

In table 4, we present the results (marginal effects and standard errors) of estimating the probit models of employment for men and women aged 50-54 when all covariates are included in the specification. Most health conditions have the expected negative effect on the likelihood of employment, though few conditions appear individually statistically significant. Note that when we considered each group of characteristics separately in the employment probit, several health conditions appeared to have larger effects, particularly the number of health conditions one has.[9] The inclusion of the self-assessed health indicators diminishes the magnitude of the effects of health conditions.

For men, reporting poor health is associated with a 22 percentage point lower likelihood of being employed at ages 50-54. Being a smoker significantly reduces men's likelihood of employment. However, the only health conditions that appear to have a sizeable and significant effect on men's employment are stroke and diabetes when insulin is used. Similarly, poor health reduces women's likelihood of being employed by 37 percentage points at ages 50-54. Stroke, ulcers, COPD, and the need for asthma medication are also important predictors of employment for women aged 50-54.

Aside from one's self-assessed health, education appears as one of the clearest predictors of one's employment status. Men aged 50-54 with a university degree are 1.4 percentage points more likely than men aged 50-54 with a high school degree to be employed. Men with grade 8 or less, however, are 8.6 percentage points less likely to be employed. For women, the employment-education gradient is much steeper. Women aged 50-54 with a university degree are 7 percentage points more likely employed than those with a high school degree, and those with grade or less are 16.5 percentage points less likely employed. Marital status also

[9] These results are presented in Appendix Tables A1 and A2 for men and women, respectively. We also note that the estimated effect of education and marital status on employment is smaller when health conditions and self-assessed health are included as covariates in the model.

matters. Men who are married are 8.8 percentage points more likely employed while women who are married are 2.9 percentage points less likely employed.

In addition to the probit model, we estimated an ordered probit model to predict men's and women's likelihood of full-time, part-time or non-employment. The results are presented in Appendix Table A3. The resulting coefficients are consistent with the results presented for the probit model.

Simulation results

We begin by using the employment probit results for men aged 50-54 (Table 4) to simulate employment rates for older men in Canada, representing their potential capacity for work when the reference group is men aged 50-54. Differences between this potential capacity and observed employment rates at older ages then represent an unused capacity for work at older ages.

The results of this first simulation are presented in Figure 7, panel A. The employment rate of men aged 50-54 is 87 percent. For 55-59 year old men, the observed employment rate is 76 percent. Using men aged 50-54 as the reference group, we expect a potential capacity for work of 85 percent among men 55-59. The difference, 9 percentage points, represents an unused capacity for work. Our simulations suggest that the potential capacity for work gradually falls by ages 70-74 (reaching 81 percent), however observed employment rates fall much more rapidly with age.

We then evaluate the unused work capacity of older women when using men at age 50-54 as the reference group (Figure 7 panel B). Here, because women's employment rates are generally lower than men's, we see an unused capacity for women at ages 50-54, at 8 percentage points. Women's potential to work appears to decline more with age than for men, as the potential capacity is estimated at 85% at ages 50-54 and falls to 76% at ages 70-74. In Figure 7 panel C, we simulate the employment rates of older women when using women aged 50-54 as the reference group. We see a similar age gradient to the potential capacity to work, however a smaller estimate for potential capacity and unused capacity results.

The estimates presented in Figure 7 are robust to various choices for the probit model specification. If we limit ourselves to using only a set of health indicators in our specification (as in specification 2 of Appendix Table A1), the estimated potential capacity for work (not shown here) among at ages 55-64 is nearly identical to that shown in Figure 7, and slightly higher at ages 65-69 and 70-74 (by two percentage points for men, and four percentage points for women). When a linear probability model is used instead of a probit, results are nearly identical to that shown in Figure 7.

In Table 5 we present the results of simulations based on an ordered probit model, allowing for a distinction between full time and part time employment. In Panel A we present the results for men, with men aged 50-54 used as the reference group.

Panel B, with results for women, uses women aged 50-54 as the reference group. The resulting estimates for the total unused capacity for work is very similar to the estimates in Figure 7. Among men, we expect most of the potential capacity for work to represent full time work, with only a small portion of older men employed part time. Consider, for example men aged 65-69: while 79% are have the potential work full time, only 20% are observed working full time. Moreover, among 65-69 year old men, a large share are observed working part-time while our simulations suggest fewer would work full time if working to their potential capacity. For women aged 65-69, more women are observed working part time (8%) than full time (7.5%). The potential capacity for work suggests more women aged 65-69 could be working part time (14%) and full time (58%).

Our inclusion of demographics in the probit model allows for employment opportunities to vary by education, but does not allow for the effects of health on employment to vary by education. We have also conducted the simulations by first estimating the employment probit models separately by education group and find that the unused capacity for work is smallest among those with the least education (less than high school graduation).[10] There are not, however, large differences in unused capacity between those with high school graduation, post-secondary education, or university graduates.

[10] Simulation results are presented in Appendix tables A4 and A5.

In Figure 8, we explore differences in the unused work capacity to work among men, across regions. In this set of simulations, the reference group is men aged 50-54 in Ontario. What we see is that the unused capacity for work at older ages is similar across regions, but clearly dependent on the reference group used in the simulations. Consider the Atlantic provinces, for example. Here, the simulation's resulting unused capacity estimates suggest that the employment rates of men aged 50-54 in the Atlantic provinces could be 7 percentage points higher. This is not to say that the employment opportunities are readily available for men in the Atlantic provinces, rather this suggest that if the employment opportunities were there then we expect these men have the capacity to fill those jobs. At ages 65-69, the unused capacity to work among Atlantic men rises to 57 percentage points. This is 5 percentage points higher than the capacity among men age 65-69 in Ontario, and 14 percentage points higher than the capacity among men aged 65-69 in the Prairies. Notably, British Columbia's estimates suggest an unused capacity for work at ages 55-59 that is quite similar to Ontario, but unused capacity is much larger after age 65. This captures post-retirement health as well as migration toward BC. The simulations also demonstrate the sensitivity of results to the reference group chosen. If, for example, men aged 50-54 in the Prairies were used as the reference group, we would see all unused capacity estimates rise by a small amount. However, similar relative differences in unused capacity across provinces would remain.

Finally, we wish to reinforce the implications of reference group choices by considering the implications of using other age groups to simulate unused work capacity. In Table 8 we present unused capacity estimates for men in Canada, by age group, but vary the reference age group used in the simulations. The first panel replicates the results presented in Figure 7 panel A, whereby men aged 50-54 are used as the reference group to simulate unused work capacity for men at older ages. In the next panel (B), we use men aged 55-59 as the reference group. As a result, the unused capacity for men at ages 60-64 is estimated to be 19 percentage points (rather than 29 percentage points that results when men aged 50-54 are the reference group). Part of the difference in unused capacity reflects a stronger negative effect of health on the likelihood of employment as one ages. It is difficult, however, to separately identify the effects of health and socioeconomic status, and part of the differences across age groups will simply reflect a tendency toward early retirement regardless of health. Interestingly, the change in unused work capacity between ages 50-54 and ages 70-74 (about 64 percentage points) does not depend on the age group used as the reference group in the simulations.

Overall, the simulations presented in this and the previous section offer similar estimates regarding the capacity for older men in Canada to work at older ages. For example, applying the estimates in Figure 7panel A (with an age 50-54 comparison group) in a manner similar to that presented in Table 1 (with a 1976 comparison group), the simulations suggest men in Canada have the capacity to work 4.6 years more between the ages of 55 and 69 than they are currently working. The historical employment-mortality relationships suggested men have the capacity to work 5 years more between ages 55 and 69. For women, historical changes in women's labour market attachment clearly complicate the analysis, but results are comparable across methods. The simulations presented in Figure 7 panel C suggest a greater capacity for women to work at older ages (5 years between ages 55 and 69) than estimates based on employment-mortality relationships from 1976 (2 years).

6. Conclusion

In this study we have explored the relationship between older Canadians' labour market activity and their health, in an effort to gauge the health capacity to work among older men and women in recent years. We approached the problem using two distinct, but complementary methods. First, we examined the relationship between employment rates and mortality rates. We considered how this has changed over time and differs across sex and regions. Second, we use microdata to estimate the relationship between employment and health conditions among men and women nearing retirement and use those estimates to simulate the work capacity of older men and women.

Both approaches suggest substantial health capacity to work among older men and women in Canada. Our results suggest that if men's 1976 relationship between employment and mortality still held in 2012, men's employment rates would be higher in 2012, implying a 65 percent increase in the years of work between the ages of 55 and 69. The simulations we present offer results of similar magnitudes for men, suggesting the employment rates of men aged 60-64 could be 29 percentage points higher in recent years. Regionally, health differences appear to be a substantial driver of observed employment differences for older men across provinces in Canada. Taking Ontario and the Atlantic provinces as an example, more than half of the employment gap is accounted for by differences in health as measured by mortality risk.

For women, our estimates suggest historical increases in employment at older ages (conditional on reporting some employment after age 45) have not kept pace with the mortality improvements. Our assessment of changes in the employment-mortality relationship since 1976 suggest women in 2012 could work 2 more years between the ages of 55 and 69, a 28 percent increase on the status quo. Our simulations suggest a larger unused capacity for work among women, with results suggesting women's employment rates at ages 60-64 could be up 43 percentage points higher in recent years.

It is important to emphasize the limits of our study. Unfortunately, we are unable to observe individuals' true ability to work at older ages. To the extent that our health measures understate the severity of conditions at older ages this leads us to overstate capacity for work. Moreover, estimates of older individuals' health capacity to work are heavily dependent on the reference group used in the analysis.

Interpretation of estimates also requires caution. While our estimates may suggest a capacity for older individuals to work, relative to a given reference group, we cannot speak to the opportunities for older individuals to work. Moreover, we do not incorporate the diversity of health experiences at older ages into our analysis. Many elderly individuals face activity limitations that prevent them from working. Perhaps more importantly, our estimates do not suggest that individuals should be working more at older ages, only that they appear able to.

That said, our work does have implications for long-run pension policy and older-worker labour market measures in Canada. Discussions in these areas should accommodate the possibility, reinforced with our evidence here, that the bounty of longer lifespans brings with it the capacity to work longer.

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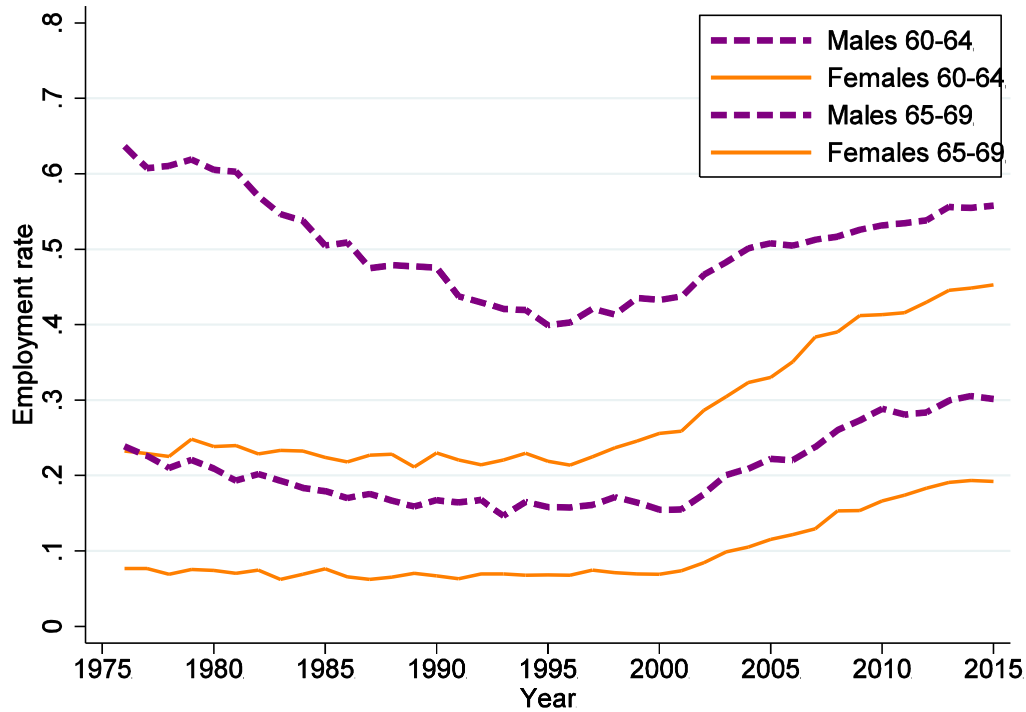

Figure 1. Employment rate by age group, 1976-2015
Source: Authors' tabulations using the Labour Force Survey.

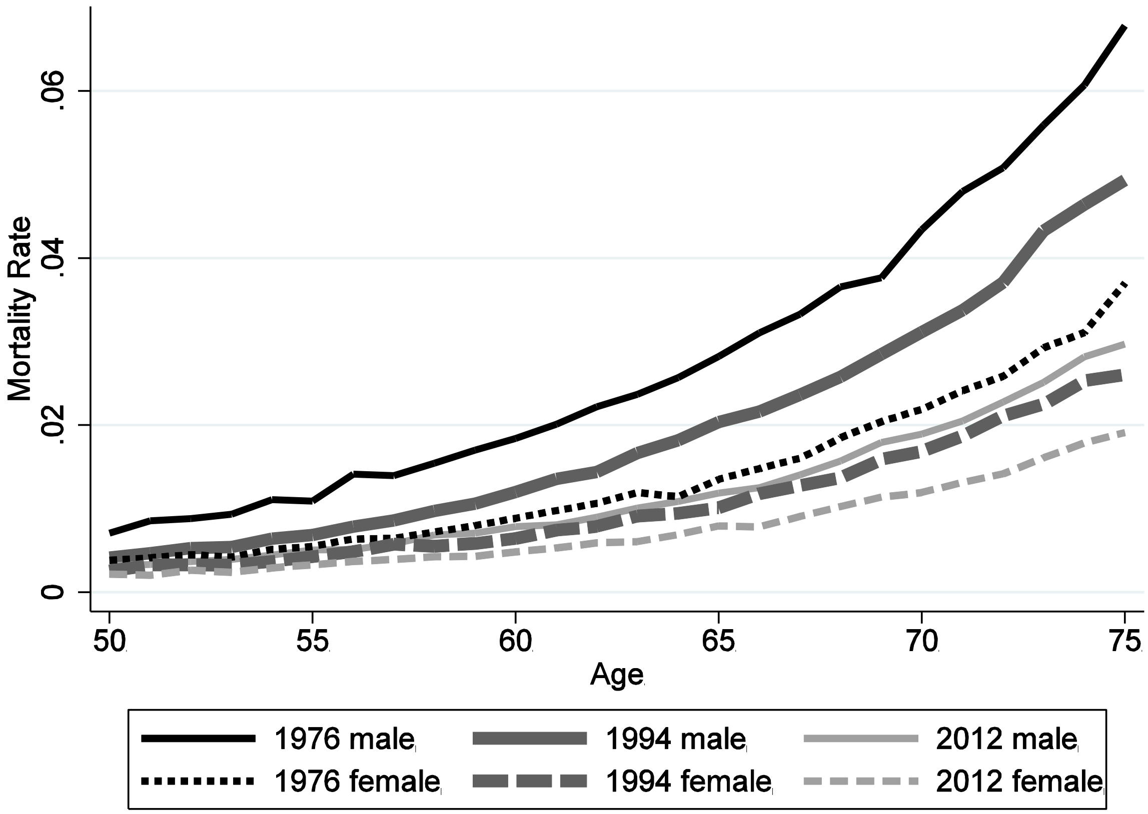

Figure 2. Mortality by age and sex select years.
Source: Tabulations by authors using Canadian Human Mortality Database and Statistics Canada (2016).

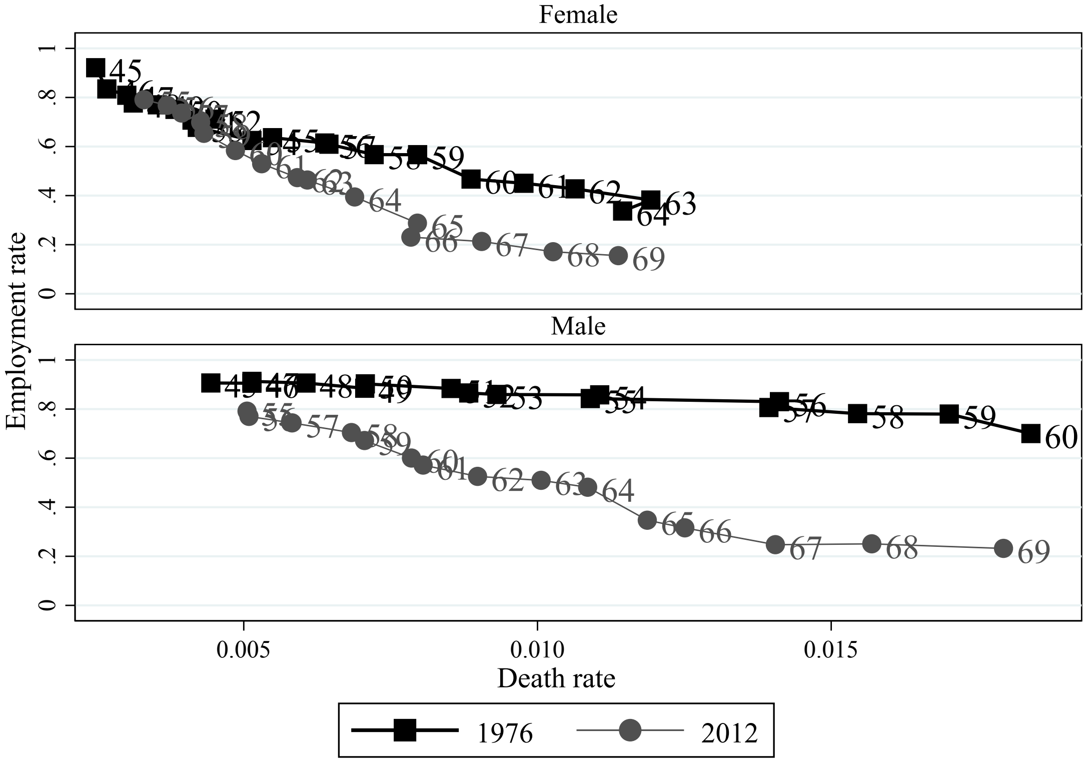

Figure 3: Mortality and Employment
Notes: Sources are Canadian Human Mortality Database and Labour Force Survey

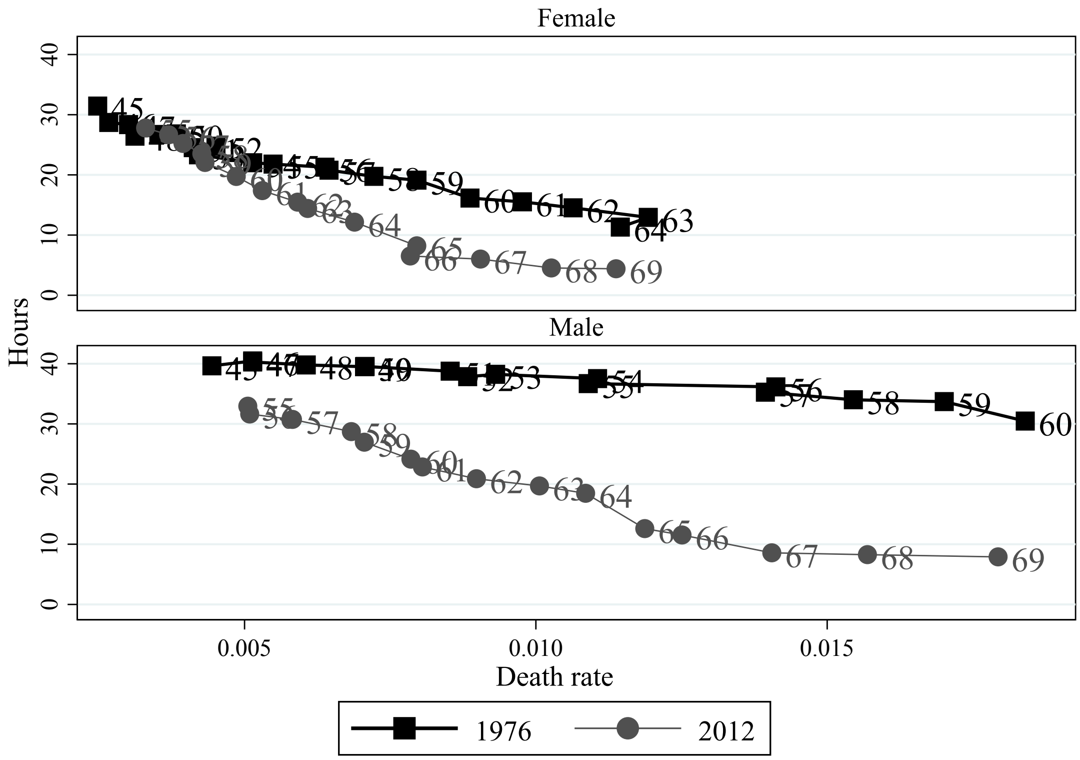

Figure 4: Mortality and Hours
Notes: Sources are Canadian Human Mortality Database and Labour Force Survey

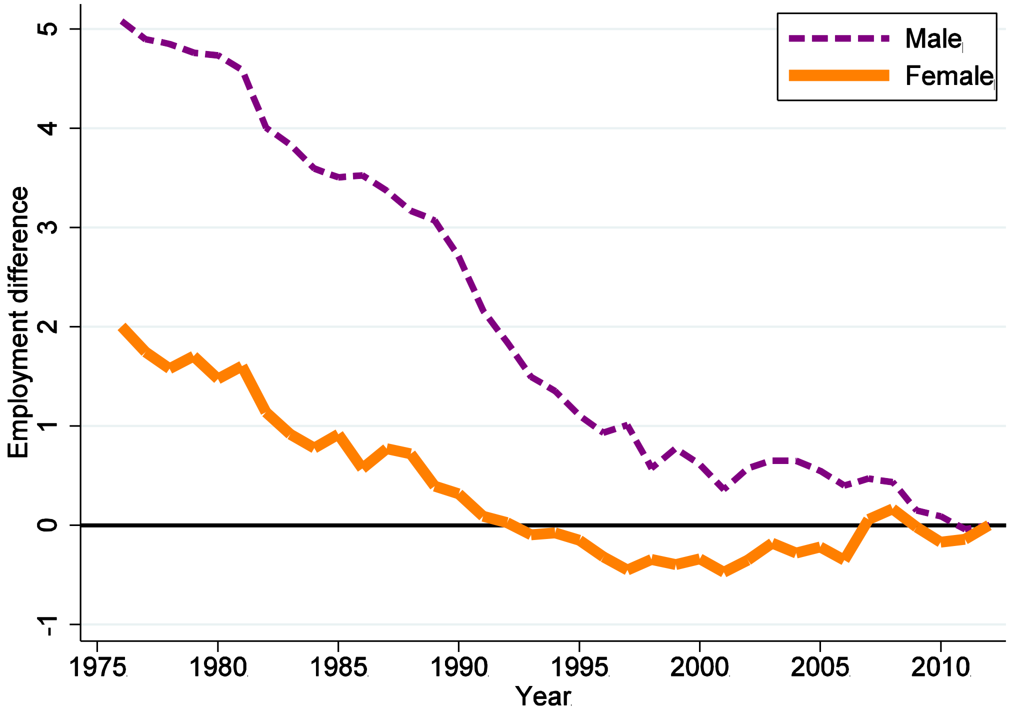

Figure 5. Counterfactual work compared to 2012
Notes: Authors' tabulations using Canadian Human Mortality Database, Statistics Canada (2016) life tables, and Labour Force Survey. For each year we calculate how many years of work would result if those in 2012 worked the same amount as those in the year shown, at each level of mortality risk. This is calculated as the sum across ages 55-69 in the difference between the lines in graphs like Figure 3. More detail on the calculation is provided in the text.

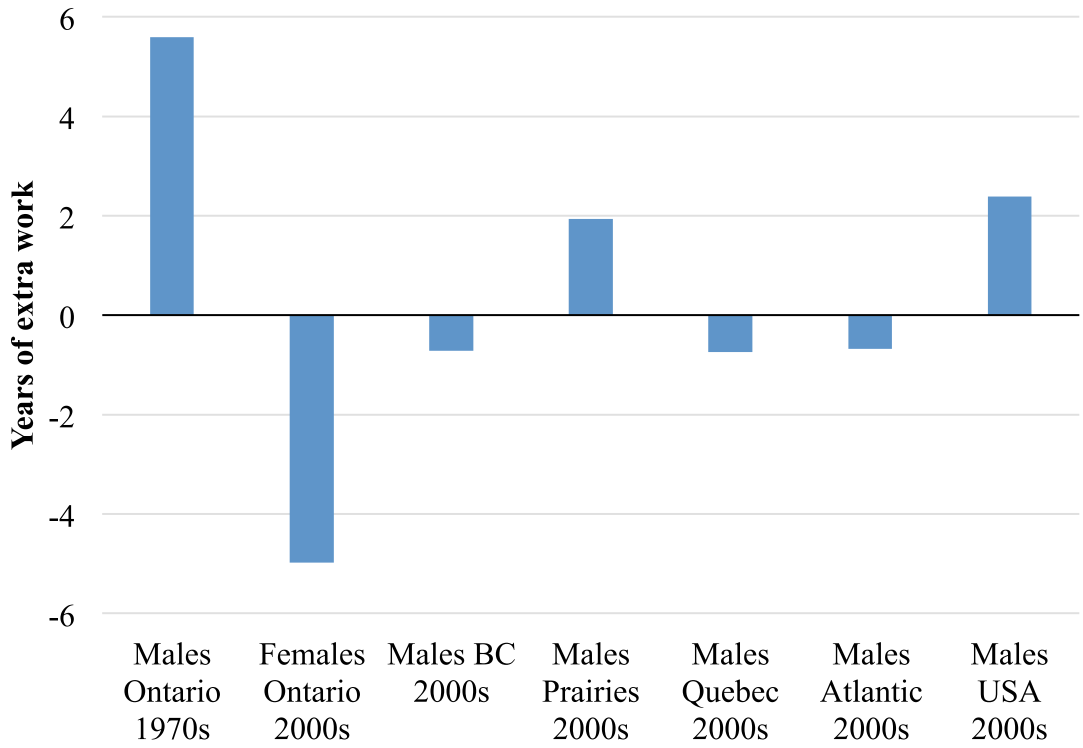

Figure 6. Potential years of extra work for Ontario males in 2000s
Notes: Authors' tabulations using Statistics Canada (2016) life tables and Labour Force Survey. For each bar we calculate how many extra years of work would be needed by Ontario males in the 2000s if they worked the same at each level of mortality as the indicated group. This is calculated as the sum across ages 55-69 in the difference between employment-mortality lines in graphs like Figure 3. More detail on the calculation is provided in the text.

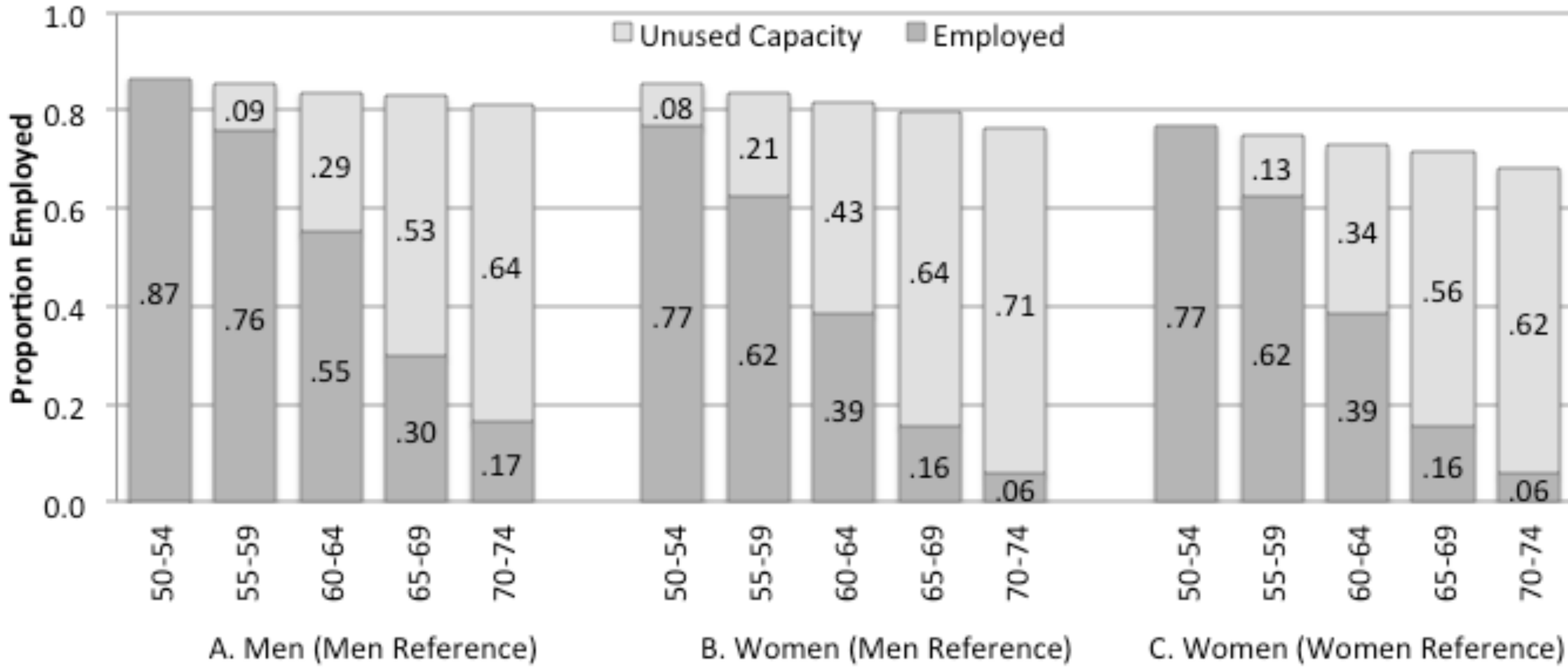

Figure 7. Simulation results – observed employment and unused capacity to work among men and women.
Note: The reference group refers to sample used to predict the relationship between employment and health. The probit model estimates underlying these simulations are presented in Table 4. A and B use the probit estimates for men aged 50-54, C uses the probit estimates for women aged 50-54.
Source: Authors' tabulations using the CCHS 2001-2014.

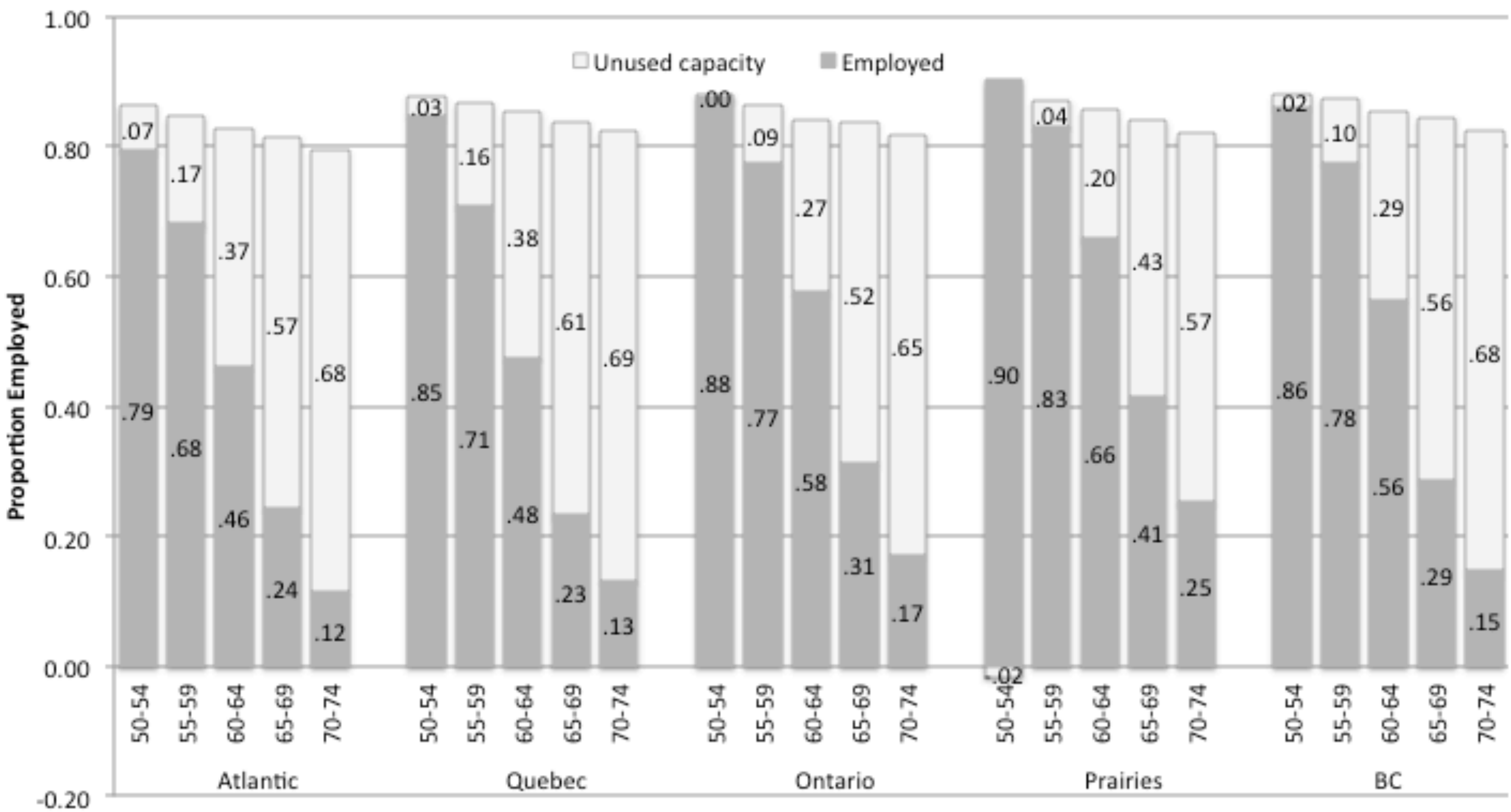

Figure 8. Simulation results – observed employment and unused capacity to work among men, by region
Note: The reference group used to predict the relationship between employment and health is Ontario men aged 50-54.
Source: Authors' tabulations using the CCHS 2001-2014.

Table 1: Mortality and Employment Rates, 2012 and Comparable Employment Rates 1976, by Age

	Males				Females			
Age	Death Rate 2012	Employment Rate 2012	Comparable Employment Rate 1976	Additional Employment Capacity	Death Rate 2012	Employment Rate 2012	Comparable Employment Rate 1976	Additional Employment Capacity
55	0.0051	0.791	0.905	0.114	0.0033	0.791	0.774	-0.017
56	0.0051	0.770	0.905	0.135	0.0037	0.768	0.759	-0.008
57	0.0058	0.743	0.908	0.164	0.0039	0.736	0.734	-0.002
58	0.0068	0.704	0.890	0.186	0.0043	0.698	0.675	-0.024
59	0.0071	0.672	0.885	0.213	0.0043	0.654	0.672	0.018
60	0.0079	0.600	0.892	0.292	0.0049	0.584	0.641	0.057
61	0.0081	0.572	0.890	0.318	0.0053	0.530	0.630	0.100
62	0.0090	0.525	0.863	0.338	0.0059	0.473	0.626	0.153
63	0.0101	0.509	0.859	0.349	0.0061	0.463	0.622	0.158
64	0.0109	0.481	0.858	0.377	0.0069	0.394	0.585	0.191
65	0.0119	0.347	0.839	0.492	0.0080	0.288	0.567	0.279
66	0.0125	0.316	0.836	0.521	0.0078	0.231	0.567	0.336
67	0.0141	0.247	0.804	0.557	0.0091	0.213	0.464	0.251
68	0.0157	0.251	0.781	0.530	0.0103	0.171	0.437	0.266
69	0.0179	0.232	0.727	0.495	0.0114	0.155	0.401	0.246
Total		7.761		5.082		7.149		2.004

Notes: Shown is the data corresponding to Figure 3. For each employment-mortality pair at a given age in 2012, the corresponding (comparable) employment rate in 1976 is found by going up to the 1976 line and recording the employment rate at that mortality rate level.

Table 2.a. Descriptive statistics, Health, Men, CCHS, 2001-2014

	50-54	55-59	60-64	65-69	70-74
Asthma	0.049	0.054	0.052	0.059	0.064
Asthma - Meds	0.035	0.042	0.040	0.048	0.051
Arthritis	0.146	0.201	0.250	0.287	0.326
Backpain	0.235	0.241	0.247	0.236	0.226
High blood pressure	0.205	0.267	0.344	0.410	0.438
COPD	0.025	0.036	0.049	0.059	0.067
Diabetes	0.072	0.106	0.140	0.178	0.199
Insulin	0.016	0.021	0.026	0.038	0.036
Heart disease	0.048	0.085	0.118	0.160	0.202
Cancer	0.016	0.021	0.040	0.052	0.069
Ulcer	0.031	0.034	0.033	0.033	0.034
Stroke	0.006	0.011	0.021	0.027	0.039
Urinary disease	0.012	0.019	0.033	0.052	0.077
Bowel disease	0.027	0.028	0.029	0.030	0.031
Underweight	0.008	0.008	0.008	0.007	0.008
Normal weight	0.316	0.321	0.315	0.315	0.356
Overweight	0.426	0.415	0.433	0.463	0.456
Obese	0.250	0.256	0.244	0.215	0.180
BMI	27.29	27.30	27.26	27.21	26.74
Smoker - Daily	0.220	0.198	0.163	0.125	0.091
Smoker - Occasional	0.036	0.033	0.026	0.022	0.018
Excellent	0.207	0.188	0.177	0.162	0.141
Very Good	0.366	0.353	0.333	0.323	0.303
Good	0.309	0.314	0.316	0.336	0.350
Fair	0.085	0.104	0.128	0.134	0.157
Poor	0.034	0.041	0.046	0.046	0.049
N	29,801	30,902	28,716	21,942	17,077

Note: Sample includes men in each age group, 2001-2014 CCHS.

Table 2.b. Descriptive Statistics, Characteristics, Men, 2001-2014

	50-54	55-59	60-64	65-69	70-74
Employed	0.866	0.760	0.552	0.298	0.166
Full time	0.829	0.704	0.464	0.203	0.087
Part time	0.038	0.056	0.087	0.095	0.078
Grade 8 or less	0.040	0.060	0.092	0.129	0.187
Gr. 9-13, not grad.	0.102	0.108	0.122	0.132	0.143
HS graduate	0.177	0.165	0.159	0.145	0.131
Some Post-Sec.	0.054	0.054	0.051	0.047	0.048
Post-Sec. Cert/Dip	0.383	0.370	0.344	0.322	0.295
University	0.245	0.244	0.232	0.226	0.197
Married	0.790	0.809	0.807	0.823	0.813
White	0.804	0.812	0.826	0.821	0.824
Immigrant	0.233	0.240	0.254	0.278	0.297
ATL	0.074	0.080	0.083	0.081	0.077
QC	0.246	0.253	0.257	0.257	0.253
ON	0.376	0.378	0.369	0.383	0.377
Prairies	0.164	0.157	0.153	0.140	0.149
BC	0.137	0.130	0.137	0.138	0.143
Territories	0.003	0.002	0.002	0.001	0.001

Note: Sample includes men in each age group, 2001-2014 CCHS.

Table 3.a. Descriptive statistics, Health, Women, 2001-2014

	50-54	55-59	60-64	65-69	70-74
Asthma	0.088	0.089	0.092	0.084	0.085
Asthma - Meds	0.070	0.074	0.077	0.070	0.073
Arthritis	0.232	0.310	0.379	0.444	0.498
Backpain	0.235	0.248	0.259	0.255	0.258
High blood pressure	0.181	0.256	0.341	0.422	0.495
COPD	0.038	0.048	0.060	0.066	0.074
Diabetes	0.055	0.075	0.102	0.123	0.138
Insulin	0.010	0.016	0.023	0.024	0.024
Heart disease	0.027	0.046	0.067	0.090	0.131
Cancer	0.021	0.032	0.036	0.044	0.051
Ulcer	0.033	0.038	0.042	0.042	0.043
Stroke	0.007	0.010	0.017	0.021	0.027
Urinary disease	0.042	0.053	0.063	0.085	0.106
Bowel disease	0.064	0.066	0.068	0.077	0.074
Underweight	0.025	0.023	0.024	0.020	0.028
Normal weight	0.472	0.433	0.410	0.409	0.415
Overweight	0.284	0.318	0.327	0.366	0.364
Obese	0.220	0.226	0.239	0.205	0.193
BMI	26.15	26.45	26.63	26.52	26.23
Smoker - Daily	0.188	0.164	0.135	0.111	0.089
Smoker - Occasional	0.033	0.031	0.024	0.018	0.018
Excellent	0.217	0.206	0.184	0.164	0.133
Very Good	0.366	0.356	0.334	0.330	0.306
Good	0.288	0.289	0.314	0.339	0.354
Fair	0.094	0.108	0.125	0.129	0.156
Poor	0.034	0.040	0.042	0.038	0.052
N	34,620	36,690	34,701	27,169	22,757

Note: Sample includes women in each age group, 2001-2014 CCHS.

Table 3.b. Descriptive Statistics, Characteristics, Women, 2001-2014

	50-54	55-59	60-64	65-69	70-74
Employed	0.769	0.623	0.385	0.157	0.059
Full time	0.635	0.475	0.257	0.075	0.019
Part time	0.134	0.148	0.129	0.082	0.040
Grade 8 or less	0.042	0.068	0.105	0.141	0.205
Gr. 9-13, not grad.	0.085	0.098	0.128	0.156	0.176
HS graduate	0.216	0.205	0.199	0.188	0.187
Some Post-Sec.	0.058	0.056	0.049	0.049	0.048
Post-Sec. Cert/Dip	0.379	0.378	0.341	0.324	0.281
University	0.220	0.195	0.177	0.142	0.104
Married	0.741	0.730	0.699	0.646	0.571
White	0.802	0.812	0.831	0.829	0.844
Immigrant	0.228	0.246	0.251	0.261	0.254
ATL	0.076	0.083	0.085	0.084	0.077
QC	0.260	0.257	0.263	0.254	0.265
ON	0.377	0.372	0.379	0.381	0.380
Prairies	0.153	0.151	0.145	0.141	0.145
BC	0.132	0.135	0.127	0.139	0.131
Territories	0.002	0.002	0.001	0.001	0.001

Note: Sample includes women in each age group, 2001-2014 CCHS.

Table 4. Employment Probit Model Results

	Men		Women	
	ME	SE	ME	SE
Number conditions	-0.008	(0.017)	-0.025	(0.014)
Asthma	0.003	(0.027)	0.075	(0.027)
Asthma, medication	0.001	(0.025)	-0.070	(0.026)
Arthritis	-0.040	(0.020)	-0.001	(0.017)
Backpain	-0.011	(0.019)	0.016	(0.017)
High blood pressure	0.007	(0.019)	0.029	(0.017)
COPD	0.006	(0.022)	-0.041	(0.022)
Diabetes	-0.008	(0.024)	0.029	(0.023)
Insulin used	-0.047	(0.025)	-0.030	(0.032)
Heart disease	-0.014	(0.020)	0.006	(0.025)
Cancer	-0.029	(0.028)	0.045	(0.024)
Ulcer	-0.002	(0.022)	-0.041	(0.029)
Stroke	-0.077	(0.030)	-0.147	(0.038)
Urinary disease	-0.009	(0.029)	-0.032	(0.022)
Underweight	-0.029	(0.023)	-0.059	(0.021)
Overweight	0.014	(0.008)	0.011	(0.010)
Obese	0.009	(0.009)	-0.005	(0.010)
Daily smoker	-0.026	(0.007)	-0.014	(0.009)
Occasional smoker	-0.034	(0.015)	-0.022	(0.019)
SAH Very good	0.001	(0.010)	0.000	(0.011)
SAH Good	-0.032	(0.011)	-0.034	(0.012)
SAH Fair	-0.111	(0.012)	-0.132	(0.015)
SAH Poor	-0.224	(0.020)	-0.370	(0.021)
Grade 8 or less	-0.086	(0.014)	-0.165	(0.018)
Gr. 9-13, not grad.	-0.052	(0.012)	-0.100	(0.015)
Some Post-Sec.	-0.014	(0.013)	0.016	(0.016)
Post-Sec. Cert/Dip	-0.004	(0.009)	0.038	(0.010)
University	0.014	(0.012)	0.073	(0.012)
Married	0.088	(0.006)	-0.029	(0.009)
White	0.037	(0.012)	0.037	(0.014)
Immigrant	-0.015	(0.010)	-0.030	(0.011)
ATL	-0.061	(0.009)	-0.054	(0.010)
QC	-0.030	(0.009)	-0.028	(0.010)
Prairies	0.018	(0.010)	0.028	(0.011)
BC	-0.018	(0.010)	-0.018	(0.013)
Terr	0.053	(0.016)	0.122	(0.026)
Year effects	Yes		Yes	

Notes: Sample includes men or women aged 50-54, 2001-2014 CCHS. Number of conditions accounts for the conditions listed plus bowel disease

Table 5. Simulation Results, Using Ordered Probit

A. Men					
	50-54	55-59	60-64	65-69	70-74
Observed					
Full time	0.829	0.704	0.464	0.203	0.087
Part time	0.038	0.056	0.087	0.095	0.078
Predicted					
Full time	0.828	0.816	0.799	0.790	0.772
Part time	0.038	0.039	0.041	0.042	0.045
Unused Capacity					
FT+PT	0.000	0.095	0.288	0.534	0.651
B. Women					
	50-54	55-59	60-64	65-69	70-74
Observed					
Full time	0.635	0.475	0.257	0.075	0.019
Part time	0.134	0.148	0.129	0.082	0.040
Predicted					
Full time	0.634	0.616	0.593	0.582	0.548
Part time	0.134	0.135	0.137	0.139	0.141
Unused Capacity					
FT+PT	-0.001	0.129	0.345	0.563	0.630

Note: The reference group used to predict the relationship between employment and health is (A) Men or (B) Women, aged 50-54 from the 2001-2014 CCHS. Ordered probit results are presented in Table A3.

Table 6. Simulation Results, Alternative Age Reference Groups

A. Reference: Male age 50-54, Canada					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.87	0.76	0.55	0.30	0.17
predicted	0.87	0.85	0.84	0.83	0.81
unused capacity	0.00	0.09	0.29	0.53	0.64

B. Reference: Male age 55-59 Canada					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.87	0.76	0.55	0.30	0.17
predicted	0.77	0.76	0.74	0.74	0.71
unused capacity	-0.09	0.00	0.19	0.44	0.55

C. Reference: Male age 60-64 Canada					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.87	0.76	0.55	0.30	0.17
predicted	0.57	0.56	0.55	0.55	0.54
unused capacity	-0.29	-0.20	0.00	0.25	0.37

D. Reference: Male age 65-69 Canada					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.87	0.76	0.55	0.30	0.17
predicted	0.33	0.32	0.31	0.30	0.28
unused capacity	-0.53	-0.44	-0.24	0.00	0.11

Note: The reference group used to predict the relationship between employment and health is men (A) aged 50-54, (B) aged 55-59, (C), aged 60-64, or (D) aged 65-69, as indicated, from the 2001-2014 CCHS.

APPENDIX TABLES

Table A1. Employment Probit Model Results, Men

	(1)		(2)		(3)		(4)	
	ME	SE	ME	SE	ME	SE	ME	SE
Number conditions	-0.039	(0.017)	-0.005	(0.018)			-0.008	(0.017)
Asthma	0.038	(0.028)	0.006	(0.028)			0.003	(0.027)
Asthma, medication	-0.014	(0.026)	-0.002	(0.025)			0.001	(0.025)
Arthritis	-0.036	(0.019)	-0.044	(0.021)			-0.040	(0.020)
Backpain	0.003	(0.019)	-0.011	(0.020)			-0.011	(0.019)
High blood pressure	0.020	(0.019)	0.006	(0.021)			0.007	(0.019)
COPD	-0.003	(0.023)	-0.009	(0.024)			0.006	(0.022)
Diabetes	-0.015	(0.024)	-0.018	(0.026)			-0.008	(0.024)
Insulin used	-0.070	(0.026)	-0.044	(0.027)			-0.047	(0.025)
Heart disease	-0.024	(0.020)	-0.020	(0.021)			-0.014	(0.020)
Cancer	-0.034	(0.028)	-0.025	(0.029)			-0.029	(0.028)
Ulcer	-0.002	(0.023)	-0.016	(0.023)			-0.002	(0.022)
Stroke	-0.100	(0.031)	-0.088	(0.031)			-0.077	(0.030)
Urinary disease	-0.042	(0.031)	-0.022	(0.031)			-0.009	(0.029)
Underweight	-0.078	(0.028)	-0.050	(0.024)			-0.029	(0.023)
Overweight	0.030	(0.009)	0.025	(0.009)			0.014	(0.008)
Obese	0.012	(0.009)	0.017	(0.009)			0.009	(0.009)
Daily smoker	-0.063	(0.007)	-0.045	(0.007)			-0.026	(0.007)
Occasional smoker	-0.050	(0.015)	-0.047	(0.015)			-0.034	(0.015)
SAH Very good			0.002	(0.011)			0.001	(0.010)
SAH Good			-0.042	(0.011)			-0.032	(0.011)
SAH Fair			-0.134	(0.013)			-0.111	(0.012)
SAH Poor			-0.252	(0.021)			-0.224	(0.020)
Grade 8 or less					-0.132	(0.015)	-0.086	(0.014)
Gr. 9-13, not grad.					-0.071	(0.012)	-0.052	(0.012)
Some Post-Sec.					-0.016	(0.013)	-0.014	(0.013)
Post-Sec. Cert/Dip					-0.0004	(0.009)	-0.004	(0.009)
University					0.038	(0.012)	0.014	(0.012)
Married					0.116	(0.006)	0.088	(0.006)
White					0.040	(0.012)	0.037	(0.012)
Immigrant					-0.014	(0.011)	-0.015	(0.010)
ATL					-0.065	(0.009)	-0.061	(0.009)
QC					-0.015	(0.010)	-0.030	(0.009)
Prairies					0.029	(0.010)	0.018	(0.010)
BC					-0.011	(0.011)	-0.018	(0.010)
Terr					0.064	(0.016)	0.053	(0.016)
Year effects	No		No		Yes		Yes	

Notes: Sample includes men aged 50-54, 2001-2014 CCHS. Column 4 replicates the estimates presented in Table 4.

Table A2. Employment Probit Results, Women,

	(1)		(2)		(3)		(4)	
	ME	SE	ME	SE	ME	SE	ME	SE
Number of conditions	-0.029	(0.014)	-0.001	(0.014)			-0.025	(0.014)
Asthma	0.077	(0.029)	0.051	(0.028)			0.075	(0.027)
Asthma, medication	-0.076	(0.029)	-0.065	(0.027)			-0.070	(0.026)
Arthritis	-0.031	(0.017)	-0.030	(0.017)			-0.001	(0.017)
Backpain	0.000	(0.018)	-0.003	(0.018)			0.016	(0.017)
High blood pressure	0.007	(0.017)	-0.001	(0.018)			0.029	(0.017)
COPD	-0.080	(0.023)	-0.066	(0.022)			-0.041	(0.022)
Diabetes	-0.032	(0.025)	-0.013	(0.025)			0.029	(0.023)
Insulin used	-0.073	(0.038)	-0.007	(0.034)			-0.030	(0.032)
Heart disease	-0.042	(0.026)	-0.018	(0.025)			0.006	(0.025)
Cancer	-0.025	(0.027)	0.032	(0.025)			0.045	(0.024)
Ulcer	-0.088	(0.028)	-0.075	(0.029)			-0.041	(0.029)
Stroke	-0.205	(0.041)	-0.176	(0.039)			-0.147	(0.038)
Urinary disease	-0.055	(0.022)	-0.047	(0.022)			-0.032	(0.022)
Underweight	-0.092	(0.021)	-0.069	(0.022)			-0.059	(0.021)
Overweight	0.005	(0.010)	0.008	(0.010)			0.011	(0.010)
Obese	-0.032	(0.010)	-0.017	(0.010)			-0.005	(0.010)
Daily smoker	-0.044	(0.009)	-0.025	(0.009)			-0.014	(0.009)
Occasional smoker	-0.017	(0.020)	-0.012	(0.020)			-0.022	(0.019)
SAH Very good			-0.005	(0.012)			0.000	(0.011)
SAH Good			-0.057	(0.012)			-0.034	(0.012)
SAH Fair			-0.175	(0.015)			-0.132	(0.015)
SAH Poor			-0.405	(0.022)			-0.370	(0.021)
Grade 8 or less					-0.216	(0.020)	-0.165	(0.018)
Gr. 9-13, not grad.					-0.131	(0.014)	-0.100	(0.015)
Some Post-Sec.					0.012	(0.017)	0.016	(0.016)
Post-Sec. Cert/Dip					0.044	(0.010)	0.038	(0.010)
University					0.100	(0.013)	0.073	(0.012)
Married					0.006	(0.009)	-0.029	(0.009)
White					0.033	(0.015)	0.037	(0.014)
Immigrant					-0.032	(0.012)	-0.030	(0.011)
ATL					-0.050	(0.011)	-0.054	(0.010)
QC					-0.009	(0.011)	-0.028	(0.010)
Prairies					0.032	(0.012)	0.028	(0.011)
BC					-0.008	(0.014)	-0.018	(0.013)
Terr					0.132	(0.027)	0.122	(0.026)
Year effects	No		No		Yes		Yes	

Notes: Sample includes men aged 50-54, 2001-2014 CCHS. Column 4 replicates the estimates presented in Table 4.

Table A3. Ordered Probit Model Results

	Male		Female	
	Coef.	SE	Coef.	SE
Number of conditions	-0.027	(0.089)	-0.065	(0.047)
Asthma	0.019	(0.142)	0.238	(0.099)
Asthma, medication	0.028	(0.131)	-0.249	(0.095)
Arthritis	-0.205	(0.104)	-0.037	(0.057)
Backpain	-0.085	(0.098)	0.023	(0.058)
High blood pressure	0.012	(0.101)	0.094	(0.059)
COPD	-0.016	(0.118)	-0.137	(0.079)
Diabetes	-0.020	(0.125)	0.070	(0.078)
Insulin used	-0.261	(0.131)	-0.075	(0.113)
Heart disease	-0.075	(0.105)	-0.014	(0.089)
Cancer	-0.141	(0.146)	0.121	(0.084)
Ulcer	0.002	(0.115)	-0.153	(0.100)
Stroke	-0.420	(0.156)	-0.496	(0.144)
Urinary disease	-0.036	(0.145)	-0.121	(0.075)
Underweight	-0.179	(0.121)	-0.255	(0.069)
Overweight	0.071	(0.040)	0.039	(0.031)
Obese	0.043	(0.044)	0.003	(0.033)
Daily smoker	-0.126	(0.037)	0.013	(0.029)
Occasional smoker	-0.159	(0.075)	0.002	(0.067)
SAH Very good	0.000	(0.050)	-0.033	(0.035)
SAH Good	-0.119	(0.052)	-0.140	(0.039)
SAH Fair	-0.579	(0.062)	-0.491	(0.051)
SAH Poor	-1.257	(0.105)	-1.368	(0.076)
Grade 8 or less	-0.439	(0.074)	-0.598	(0.067)
Gr. 9-13, not grad.	-0.273	(0.060)	-0.344	(0.050)
Some Post-Sec.	-0.136	(0.072)	-0.010	(0.053)
Post-Sec. Cert/Dip	-0.010	(0.047)	0.108	(0.032)
University	0.005	(0.057)	0.244	(0.039)
Married	0.472	(0.031)	-0.197	(0.029)
White	0.223	(0.059)	0.070	(0.047)
Immigrant	-0.051	(0.049)	-0.100	(0.037)
ATL	-0.309	(0.045)	-0.160	(0.036)
QC	-0.172	(0.047)	-0.122	(0.034)
Prairies	0.044	(0.052)	0.008	(0.037)
BC	-0.151	(0.050)	-0.150	(0.042)
Territories	0.225	(0.080)	0.334	(0.079)
Year effects	Yes		Yes	

Notes: Dependent variable categories are not employed, part time employment, and full time employment. Sample includes men or women aged 50-54, 2001-2014 CCHS. Number of conditions accounts for the conditions listed plus bowel disease.

Table A4. Simulation Results, Men, by Education Group

A. Less than HS graduation					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.75	0.67	0.49	0.22	0.12
predicted	0.75	0.73	0.73	0.74	0.74
unused capacity	0.00	0.06	0.25	0.51	0.62

B. HS Graduates					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.88	0.75	0.56	0.29	0.16
predicted	0.88	0.87	0.86	0.87	0.85
unused capacity	0.00	0.12	0.31	0.57	0.70

C. Some PS, PS Cert/Dip.					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.88	0.77	0.55	0.30	0.17
predicted	0.88	0.86	0.85	0.85	0.85
unused capacity	0.00	0.10	0.31	0.55	0.67

D. University					
Men	50-54	55-59	60-64	65-69	70-74
employed	0.91	0.82	0.62	0.39	0.24
predicted	0.91	0.91	0.90	0.90	0.88
unused capacity	0.00	0.09	0.28	0.51	0.64

Notes: A probit model for employment is estimated for a sample of men aged 50-54 in each education group and includes the covariates found in Table 4 (other than education). The probit estimates for each education group are used to predict employment for individuals with the same education in each five-year age group.

Table A5. Simulation Results, Women, by Education Group

A. Less than HS graduation					
Women	50-54	55-59	60-64	65-69	70-74
employed	0.55	0.43	0.25	0.08	0.03
predicted	0.55	0.54	0.53	0.55	0.54
unused capacity	0.00	0.11	0.29	0.47	0.51

B. HS Graduates					
Women	50-54	55-59	60-64	65-69	70-74
employed	0.76	0.60	0.39	0.16	0.06
predicted	0.76	0.76	0.75	0.76	0.75
unused capacity	0.00	0.16	0.37	0.60	0.69

C. Some PS, PS Cert/Dip.					
Women	50-54	55-59	60-64	65-69	70-74
employed	0.80	0.67	0.43	0.19	0.08
predicted	0.80	0.79	0.79	0.79	0.78
unused capacity	0.00	0.12	0.35	0.60	0.70

D. University					
Women	50-54	55-59	60-64	65-69	70-74
employed	0.85	0.71	0.47	0.23	0.10
predicted	0.85	0.85	0.84	0.85	0.83
unused capacity	0.00	0.14	0.38	0.62	0.73

Notes: A probit model for employment is estimated for a sample of women aged 50-54 in each education group and includes the covariates found in Table 4 (other than education). The probit estimates for each education group are used to predict employment for individuals with the same education in each five-year age group.