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Health Capacity to Work at Older Ages
Evidence from Canada

Kevin Milligan and Tammy Schirle

2.1 Introduction

Health and longevity have improved substantially and continuously in Canada since the 1970s. Public pensions in Canada have not kept pace with these changes up to now.[1] In the 1980s, for example, the earnings-related Canada and Quebec Pension Plans facilitated earlier retirement by introducing an early retirement option as young as age sixty so that Canadians no longer had to wait until age sixty-five to take up benefits. More recently, the federal government had announced that the age of eligibility for Canada's public pensions delivered in the form of demogrants (Old Age Security) and related income-tested senior benefits (the Guaranteed Income Supplement) would increase from age sixty-five to age sixty-seven, affecting people born in 1958 and later. This policy change was canceled in 2016, before it was implemented.

But to what extent are older individuals able to work longer? In this study we are concerned with measuring individuals' health capacity for work. As health improves and people live longer, to what extent are they able to work

Kevin Milligan is professor of economics in the Vancouver School of Economics, University of British Columbia, and a research associate of the National Bureau of Economic Research. Tammy Schirle is associate professor of economics at Wilfrid Laurier University.

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1. See Milligan and Schirle (2008) for an overview of Canada's retirement income system.

more? Of course, one's capacity to work is not directly measurable. We take two separate and distinct approaches to measuring health capacity for work among older men and women in this study.

First, we use mortality as a rough proxy for health. We relate the age-specific employment rates of men and women to their mortality rates at each age fifty-five to sixty-nine in 2011, and then construct a simple counterfactual: for a given level of mortality, how much more did people work in 1976? The difference between our observed employment rates at each age and these counterfactual employment rates suggests the extent to which individuals may be capable of working more. Our analysis does not recommend that people necessarily should work more, recognizing that increasing leisure time among older individuals is expected as income rises and will greatly improve well-being. Furthermore, we emphasize the limitations of using mortality as a proxy for health. Most importantly, mortality does not account for the incidence of chronic diseases, disability, or other activity limitations, and the relationship between mortality and these conditions may have changed over time.

Second, we relate the employment status of men and women at ages fifty to fifty-four to the employment status of men and women at older ages reporting the same health conditions. Our methods follow Cutler, Meara, and Richards-Shubik (2012), which measures the relationship between employment and health among those in the younger age group and applies that same relationship to the older age group to predict employment. We then compare the predicted to the observed employment levels of the older age group to obtain a measure of the additional employment capacity among older individuals. Again, we emphasize that this exercise is not meant to suggest that individuals should be working more at older ages, only whether the potential to work more exists.

Third, we consider whether the health capacity of older individuals to work varies by education group. We begin by offering estimates following the Cutler, Meara, and Richards-Shubik (2012) methods above, but estimating the employment rates separately for each education group. We then explore recent trends in self-assessed measures of health by education group. One challenge (pointed out in Bound et al. [2014]) in examining trends by education over time is that the average level of education in the Canadian population has increased over time. As such, the portion of the population in each education category has also changed over time. To overcome this challenge, we create education quartiles and explore health trends within each quartile.

We find that there is substantial unused work capacity among seniors in Canada. The expansion of health and longevity has not been matched by increased work by any of our measures. The chapter proceeds as follows. First, we describe the basic time trends in health and labor force participation for older Canadians. We then present the results focused on mortality as a proxy for health and how it relates to employment. Next, we explore

the health and employment comparison of slightly younger and slightly older workers. Finally, we show the analysis by education groups and then conclude.

2.2 Trends in Labor Force Participation and Health

In Canada the labor force participation rates of older men and women display very different trends, presented in figures 2.1 and 2.2. For older men, there was a general decline in participation rates until the mid-1990s. For men age fifty-five to sixty-four, participation fell from 76 percent in 1976 to only 58 percent in 1995. For men age sixty-five and older, participation fell from 15 percent in 1976 and reached an historical low a bit later, at 9.4 percent in 2001. Thereafter, older men's participation rates have increased steadily, reaching 70 percent for men age fifty-five to sixty-four and 18 percent for men age sixty-five and older by 2014. The trends in male labor force participation changed despite no significant contemporaneous changes to pension policy in Canada.

Schirle (2008) has suggested a large part of the recent increase in older men's participation rates directly relates to increases in the participation rates of older women, as there may exist some complementarities in husbands' and wives' preferences for leisure time. The participation rates of older women age fifty-five to sixty-four have increased substantially over the 1976–2014 period (from 32 to 59 percent), with the largest increases occurring in the mid-1990s. For older women age sixty-five and older, rates

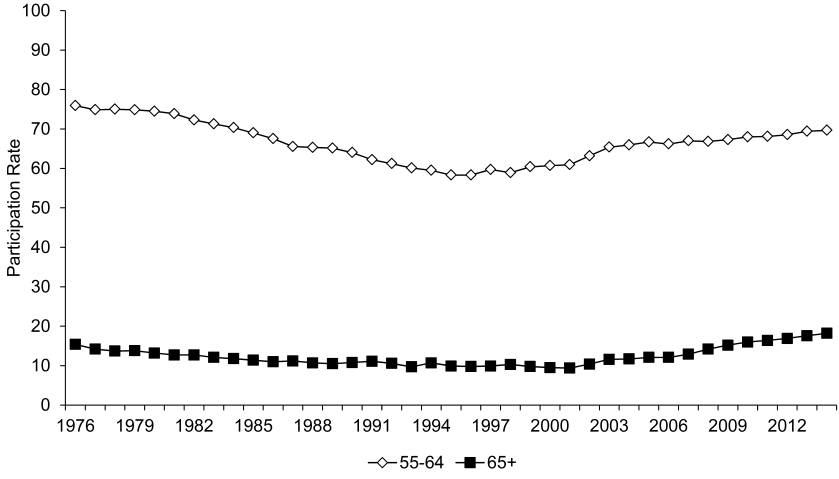

Fig. 2.1 Men's labor force participation, ages fifty-five to sixty-four and sixty-five and older (1976–2014)

Source: Statistics Canada Cansim Table 282–0002.

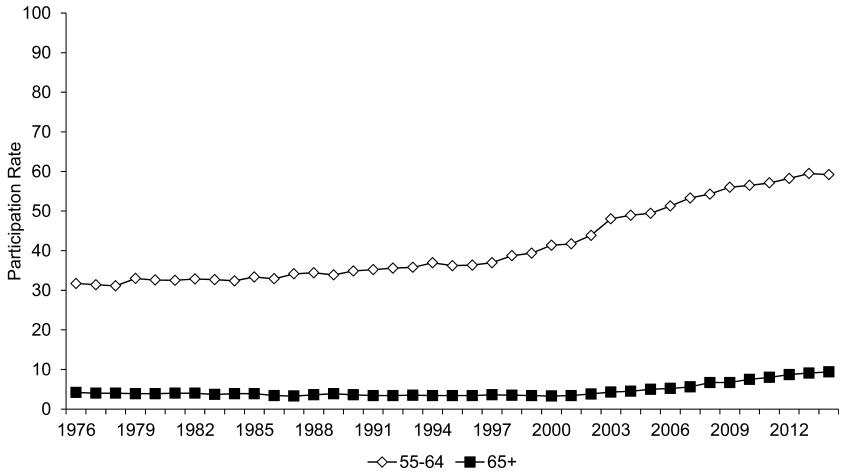

Fig. 2.2 Women's labor force participation, ages fifty-five to sixty-four and sixty-five and older (1976–2014)
Source: Statistics Canada Cansim Table 282–0002.

nearly tripled after 2000, moving from 3.3 percent in 2000 to 9.4 percent in 2014. Other Canadian research (including Au, Crossley, and Schellhorn 2005; Schirle 2010), has suggested that health is also an important factor affecting the decision to retire.

With respect to health measures, the data are more limited in measuring changes over extended periods of time. In figure 2.3, we present trends in the mortality rates of men from the ages of fifty to seventy-five for select years.[2] At all ages, the mortality rates of men have declined over time. In 1976, men age fifty-five had a mortality rate of 1.1 percent. By 2009, their mortality rate had fallen by more than half, to only 0.52 percent. In 2009, the mortality rate of 1.1 percent is not reached until age sixty-four. In figure 2.3 we also present the portion of men who report their health as fair or poor, in 1997–2001 and in 2007–2011. While this measure of health demonstrates a clear age gradient, we do not see the clear improvements in self-reported health that we could see in mortality over this shorter time period.

Similar to the experience of other countries, we see that the participation rates of older men fell until the last part of the century and then began to increase. At the same time, the participation rates of older women started to increase substantially at the end of the century. The age-specific mortality rates of men have steadily fallen over this time period. In the sections that follow, we explore the extent to which the trends in labor supply and health have moved together.

2. For the analysis of self-assessed health, we are constrained to the years available in the Survey of Labour and Income Dynamics.

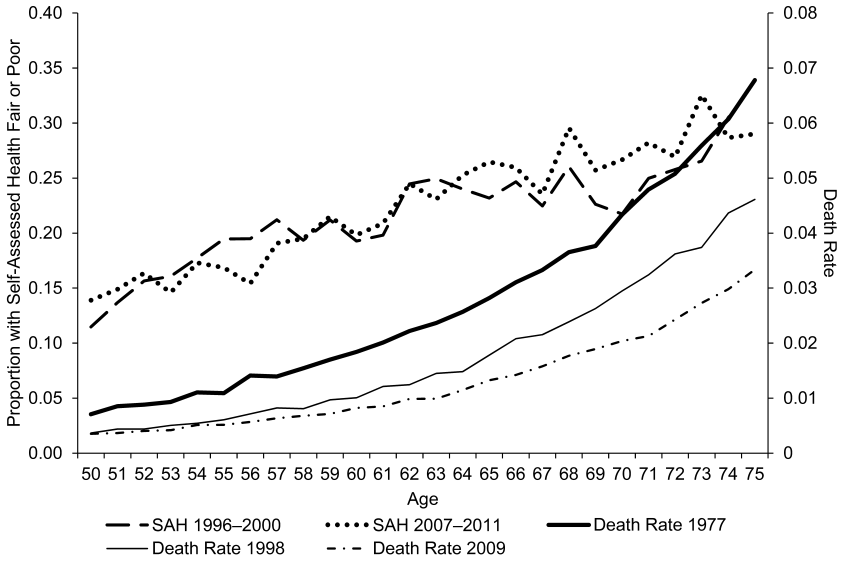

Fig. 2.3 SAH and mortality for men age fifty to seventy-five
Source: Survey of Labour and Income Dynamics and Human Mortality Database.

2.3 Estimating Health Capacity to Work Using the Milligan-Wise Method

We implement the methodology developed in Milligan and Wise (2015). We examine the relationship between employment and mortality at different points in time to characterize individuals' ability to work at older ages. In particular, we examine the extent to which individuals in 2011 were working given their mortality rates in 2011, and then compare the employment rates at comparable levels of mortality in previous years. By observing the historical patterns of employment and mortality across all available years, we create a consistent and comparable measure of the additional employment capacity that goes unused in the 2011 labor market.

It is important to recognize that mortality is a limited measure of health that does not account for the incidence of chronic diseases, disability, or other activity limitations. While improvements in mortality rates appear to align well with other indicators of health at older ages, it cannot offer a transparent measure of health capacity to work.[3] Focusing on mortality in this study, however, brings two benefits. First, using mortality allows us to produce results that are comparable across countries. Self-assessed measures

3. For example, health-adjusted life expectancy has improved at approximately the same rate as life expectancy in recent years (Statistics Canada 2012). Furthermore, the likelihood of seniors to be living in collective dwellings (primary health care and related facilities such as nursing homes) declined substantially over the 1981–2011 period (Milan, Wong, and Vézina 2014).

of health may lack comparability due to differences in language or culture (see, for example, Jürges 2007). Second, using mortality extends the time period available for analysis. Across time, more complete health data is only available in more recent years. In particular, Canadian data sources that can be used to create consistent national health measures over time only go back to 2001.[4] In contrast, mortality is available for Canada back to 1921.

The mortality data used in this analysis has been retrieved from the Human Mortality Database. Our employment data is from the Canadian Labour Force Survey (LFS).[5] The period we consider is 1976 through 2011, as these are the years for which we have both employment and mortality data available.

We conduct the analysis for men only, as the large increases in women's labor force participation over the entire time period make it difficult to interpret the results for women. While we expect the underlying relationship between women's health and women's capacity to work at older ages to be similar in nature to the relationship for men, differences in the propensity to work over one's lifetime across cohorts of women (see Schirle 2008) make historical health-work relationships more complex to analyze among women.

We begin by mapping the employment-mortality curves for 2011 and 1976 in figure 2.4, noting that 2011 will be used as the point of comparison in our analysis. Consider first the 2011 mortality-employment curve. In 2011, the mortality rate for fifty-five-year-old males was 0.005 (0.5 percent) and the employment rate for fifty-five-year-old males was 80.5 percent. Following the curve, as one ages the mortality rates are higher and the employment rates are lower. In 2011, the mortality rate for sixty-five-year-old men was 0.012 (1.2 percent) and the employment rate of sixty-five-year-old men was 36 percent.

In figure 2.4, the 1976 employment-mortality curve clearly lies above the 2011 curve. This tells us that for each possible mortality rate, the employment rates of men in 1976 were higher than the employment rates of men in 2011. The differences are quite large. In 2011, the employment rate of men with a mortality rate of 1.2 percent (at age sixty-five) was 36 percent. In 1976, the employment rate of men with a comparable mortality rate (at age fifty-five and a half) was 88 percent. This suggests that in 2011 the employment rates of men at age sixty-five could be substantially higher if employment had increased with improvements in mortality—by 52 percentage points. Similar comparisons between 2011 (as the reference point) and 1976 can be made for each mortality rate.

When aggregated across all mortality levels from ages fifty-five to sixty-

4. The CCHS is available since 2001, as described in the following section. Earlier surveys do not offer comparable measures over time.

5. Confidential microdata files made available through the Statistics Canada Research Data Centres program are used to construct age-gender-specific employment rates.

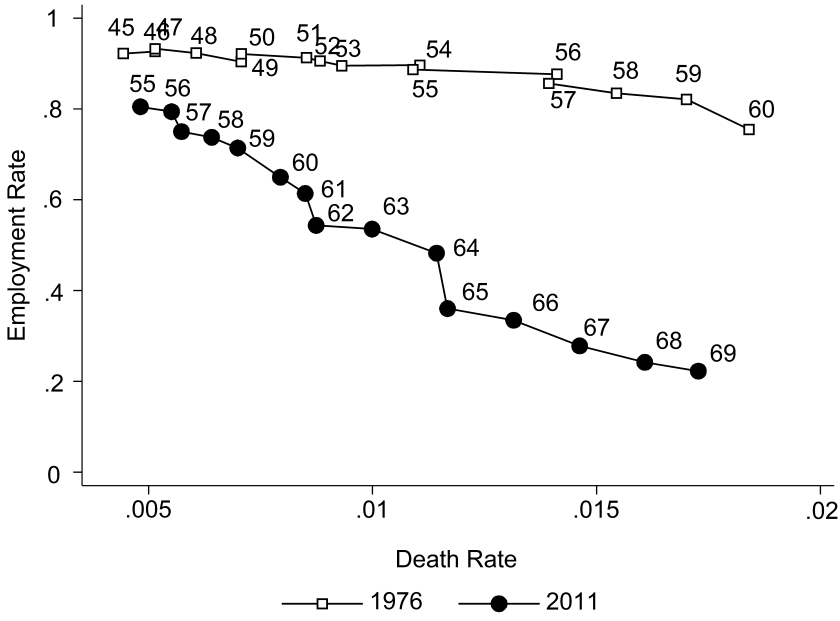

Fig. 2.4 Employment and mortality in 2011 and 1976
Source: Labour Force Survey and Human Mortality Database.

nine, we can calculate the total additional employment capacity between the two years. We present these results in table 2.1. Using 2011 as the reference year, we determine the extent to which men at each age from fifty-five to sixty-nine could be working more when compared to 1976. For example, given their mortality rate in 2011, an additional 12 percent of men age fifty-five could have worked, which implies an average 0.12 additional work years (one additional year for 12 percent of fifty-five-year-olds). Repeating this for each age and accumulating the amounts, we obtain the total potential additional employment capacity for older men in 2011, 5.31 years. This is a 65 percent increase over the 8.06 years that were actually worked between ages fifty-five and sixty-nine in 2011.

An important issue in implementing this method to measure additional employment capacity is that the choice of year to use for comparison to 2011 will matter. In figure 2.5, we present the employment-mortality curves for 2011 and 1995, the year in which the employment rates of older men in Canada reached an historic low. Since 1995, Canadian men have seen increases in employment and further reductions in mortality rates. The two employment-mortality curves are clearly not as distant as the 2011 and 1976 curves were in figure 2.4. As such, a measure of the potential additional employment capacity will be less when using 1995 rather than 1976 as the comparison.

Table 2.1 **Additional employment capacity (men)**

Age	Death rate in 2011 (%)	Employment rate in 2011 (%)	Employment rate in 1976 at same death rate (%)	Additional employment capacity (%)
55	0.48	80.50	92.46	11.96
56	0.55	79.41	92.90	13.49
57	0.57	75.00	92.68	17.68
58	0.64	73.76	91.68	17.93
59	0.70	71.41	90.58	19.16
60	0.79	64.96	91.64	26.68
61	0.85	61.37	91.31	29.94
62	0.87	54.34	90.79	36.45
63	1.00	53.54	89.58	36.04
64	1.14	48.22	88.53	40.31
65	1.17	36.01	88.45	52.45
66	1.32	33.44	87.98	54.54
67	1.46	27.79	84.67	56.88
68	1.61	24.17	82.93	58.77
69	1.73	22.24	80.85	58.61
Total years		8.0		5.3

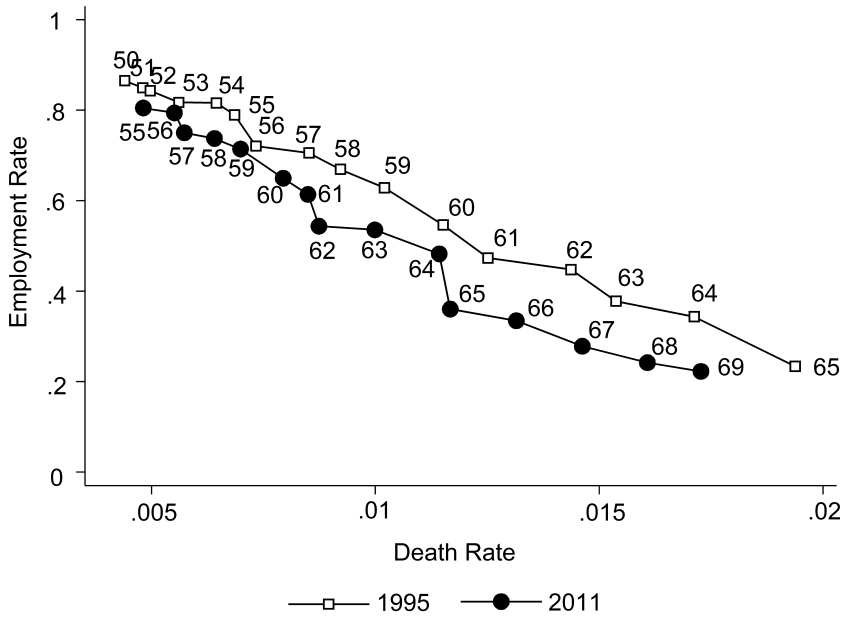

Fig. 2.5 **Employment and mortality 2011 and 1995**
Source: Labour Force Survey and Human Mortality Database.

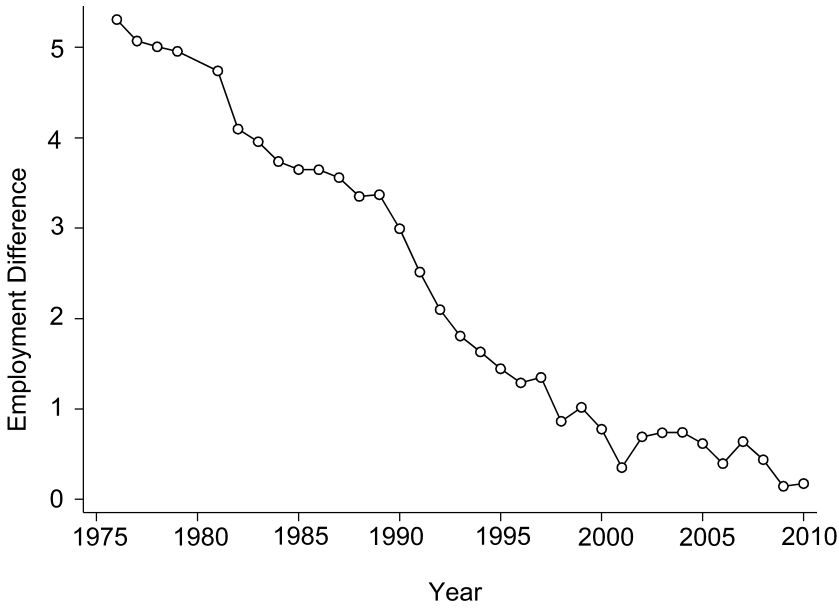

Fig. 2.6 Estimated additional employment capacity by year, compared to 2011
Source: Authors' calculations based on Labour Force Survey and Human Mortality Database.

To make this clearer, we present the total potential additional employment capacity for older men in 2011 as it depends on each comparison year 1976–2010 in figure 2.6. For each year, the graph shows on the y-axis the number of extra years of work if those in 2011 were to work at the employment rates prevalent in the year presented on the x-axis. So, the 1976 data point is set at 5.31 as explained above.

Throughout the first twenty years of the graph, employment was falling and mortality was improving. Both of these factors were therefore expanding unused work capacity; pushing in the same direction. This accounts for the steady change in work capacity from 1976 to 1995. In 1995, the work capacity relative to 2011 was 1.44 years, which is a change of 3.87 years of work from 1976.

After 1995, the employment rate of men at these ages started to increase. Mortality, on the other hand, continued its decline. So, the two factors are pushing against each other for work capacity—were men working enough to take up the new work capacity afforded through mortality improvements? The answer shown in the graph is that mortality improvements still outpaced employment in the 1995 to 2011 era, but the change was much slower than the 1976 to 1995 era. Between 1995 and 2011, work capacity expanded by 1.44 years.

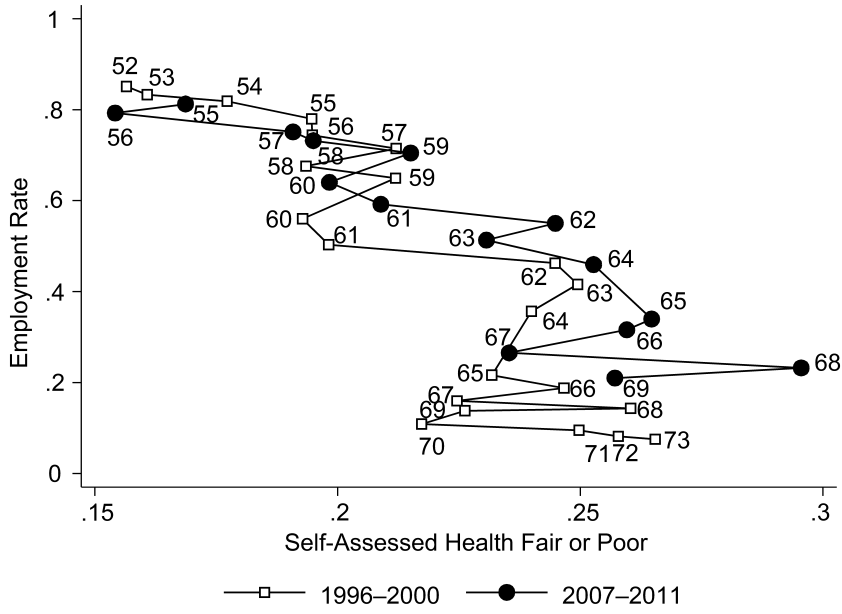

Fig. 2.7 Employment versus self-assessed health 1996–2000 versus 2007–2011
Source: Authors' calculations based on Labour Force Survey and Survey of Labour and Income Dynamics.

In figure 2.7, we repeat this exercise using the share of male respondents reporting their health to be "fair" or "poor" in place of mortality. These data are drawn from the Survey of Labour and Income Dyamics. Because of data availability, we can only start this in the late 1990s. Furthermore, because of sampling variation inherent to small sample sizes, we need to pool together several years in order to get a smooth curve. So, the figure shows two sets of years: 1996 to 2000 and 2007 to 2011. There appears to be little difference between the lines in figure 2.7. This is perhaps similar to what is seen in figure 2.5, since over this time period employment was growing at the same time as self-assessed health did not move much.

This section has explored the use of mortality to measure work capacity. By comparing the employment rates across years at a given level of mortality, we calculate an employment difference. By summing these employment differences across ages we arrive at a single measure of work capacity—the number of extra years that would be worked if employment matched the mortality-employment pattern of another year. We find that work capacity continued to improve over the entire period, but the pace of growth of the work capacity slowed substantially after 1995, as male employment started to grow.

This analysis does not suggest that older men necessarily should work more, or that all gains in mortality necessarily translate into work capacity.

Instead, we take this measure as an upper bound on the expansion of work capacity through time. This measure should be interpreted in the context of our other analysis below, which incorporates more subtle elements of health to measure work capacity.

2.4 Estimating Health Capacity to Work Using the Cutler et al. Method

Our second method of measuring health capacity to work follows the method developed by Cutler, Meara, and Richards-Shubik (2012), relating individuals' employment status to their health conditions. To begin, we estimate the following equation (for men and women separately) using samples of individuals age fifty to fifty-four:

$$\text{Employed}_i = \beta_0 + \beta_1 X_i + \beta_0 Z_i + \varepsilon_i,$$

where Employed is a dummy variable equal to one if person i is employed and zero otherwise. The set of covariates X_i includes various measures of health including self-assessed health (poor-excellent), reports of heart disease, stroke, cancer, diabetes, arthritis, obesity, back pain, and high blood pressure, and whether the person is a daily or occasional smoker. The set of covariates Z_i controls for demographic characteristics, including marital status, education, and cultural/racial origin (white or not white). A linear probability model is used to estimate the equation.

We also estimate a second version of the regression model where the covariates included in X_i are replaced with a single health index value. The index (referred to hereafter as the PVW health index) is constructed using the approach of Poterba, Venti, and Wise (2013). We construct a health index based on various indicators of health, including indicators for self-assessed fair or poor health, arthritis, back pain, heart disease, high blood pressure, diabetes, and cancer, and measures of body mass index ([BMI], based on self-reports of height and weight), the number of overnight visits to hospital, the number of doctor visits (general practitioner or other medical doctor), and the number of nurse visits.[6] To construct the indicator, we follow the work of Coile, Milligan, and Wise (chapter 12, this volume) and first obtain the first principal component of these indicators, which is the "weighted average of indicators where the weights are chosen to maximize the proportion of the variance of the individual health indicators that can be explained by this weighted average." The estimated coefficients are used to predict a percentile score for the health of each respondent, and this percentile score is used as the PVW health index.

The estimates of the regression are then used to predict the probability of employment conditional on health and demographic characteristics among those age fifty-five to seventy-four. The difference between observed

6. Note that US data allow for a more complete list of health indicators, including activity limitations, that we are unable to account for.

employment rates and predicted employment rates is then used to describe the potential additional employment capacity among older workers. It is important to recognize the assumptions underlying this analysis. First, we do not account for any unmeasured or omitted dimensions of health. If health declines more rapidly with age than what is reflected in our measures, then we will overestimate the additional employment capacity of those age fifty-five to seventy-four. For example, while we have indicators for heart disease as a covariate in the regression, the severity of heart disease is not measured and we expect this to become a more severe condition as individuals age. While the PVW index of health is used in an effort to address this concern, we cannot speak directly to the extent to which we may be overstating employment capacity. Second, the approach assumes that the relationship between health and employment among those age fifty-five to seventy-four is the same as among those age fifty to fifty-four. Third, discretionary retirement at ages fifty to fifty-four in Canada is not unheard of. In 2014, 7 percent of men and women age fifty to fifty-four who were separated from their jobs report that the reason for job separation was retirement.[7] To the extent that nonemployment among fifty- to fifty-five-year-olds represents retirement for nonhealth reasons, our estimates will understate the potential employment capacity at older ages.

We use a sample of men and women from the Canadian Community Health Survey from 2001 to 2012. The survey was conducted biannually from 2001 to 2005 and then annually from 2007 to 2012. Each year a new sample of individuals are interviewed. Labor market information is quite limited in the survey, but we are able to measure whether one is employed (in the previous week), some basic demographics, and the health conditions listed above.[8] Several pieces of health information are only collected periodically or for specific geographic regions as part of the CCHS's optional modules.[9] For the analysis that follows we pool together all available observations over this time period, leaving us with 21,051 male and 23,853 female observations age fifty to fifty-four for estimating our employment regression.[10]

7. Only those not holding a job at the time of the survey or were separated from a job in the previous year respond to this question. Respondents can only choose one reason for job separation and options include quits, business conditions, own illness or disability, and family responsibilities as possible responses.

8. The resulting employment rates closely match those estimated using a comparable sample in the Canadian Labour Force Survey when the previous week is used as the reference time period. Also available in the CCHS are indicators for employment in the previous three months or past year, which tends to overstate employment rates. Occupation information is only collected for those currently employed.

9. For example, in the 2012 CCHS information on activity limitations is collected only for Newfoundland and Ontario, and depression information was an optional module used in the Atlantic, Saskatchewan, and Alberta.

10. We exclude all observations with incomplete health information for the regressions and the PVW index construction. Note that in 2001, only those age fifty to sixty-four reported the information necessary for the BMI. As such, summary statistics for older groups (sixty-five to sixty-nine and seventy to seventy-four) will not include observations from 2001.

Table 2.2A **Summary statistics (men)**

	50–54	55–59	60–64	65–69	70–74
Employed	0.821	0.702	0.495	0.266	0.134
Self-assessed health					
Excellent	0.211	0.199	0.181	0.161	0.132
Very good	0.352	0.333	0.311	0.305	0.290
Good	0.309	0.307	0.322	0.344	0.349
Fair	0.092	0.114	0.136	0.141	0.171
Poor	0.037	0.047	0.049	0.050	0.058
Health conditions					
Heart	0.050	0.093	0.123	0.167	0.212
Stroke	0.008	0.012	0.022	0.030	0.045
Cancer	0.015	0.021	0.040	0.055	0.070
High blood pressure	0.199	0.264	0.332	0.393	0.408
Arthritis	0.154	0.207	0.261	0.296	0.345
Diabetes	0.069	0.111	0.136	0.179	0.181
Back pain	0.244	0.250	0.248	0.238	0.222
Underweight	0.011	0.008	0.009	0.008	0.010
Normal weight	0.326	0.321	0.331	0.324	0.373
Overweight	0.401	0.403	0.408	0.460	0.454
Obese	0.262	0.267	0.253	0.207	0.162
Smoker-daily	0.227	0.201	0.166	0.131	0.095
Smoker-occasional	0.038	0.033	0.027	0.024	0.019
BMI	27.2	27.3	27.1	27.1	26.5
No. nights hospital	0.537	0.674	1.042	1.354	1.575
No. doctor visits	3.365	4.004	4.482	4.506	5.040
No. nurse visits	0.488	0.737	0.732	1.012	1.104
Education					
Less than HS grad.	0.153	0.184	0.247	0.303	0.375
HS graduate	0.171	0.155	0.143	0.129	0.119
Postsecondary (< BA)	0.430	0.412	0.387	0.361	0.324
University (BA +)	0.236	0.240	0.214	0.198	0.168
Married	0.794	0.818	0.820	0.830	0.814
White	0.764	0.770	0.784	0.762	0.756
No. observations	21,051	20,571	18,394	12,691	10,338

Source: CCHS.

The samples of older individuals by age group are described in tables 2.2A (men) and 2.2B (women). The likelihood of being employed rapidly falls with age, particularly after age fifty-five to fifty-nine. At ages fifty to fifty-four, 82.1 percent of men are employed in our sample; at ages fifty-five to fifty-nine 70.2 percent are employed, but at ages sixty to sixty-four only 49.5 percent are employed. For women, 71 percent are employed at ages fifty to fifty-four, and 32.5 percent by ages sixty to sixty-four.

The summary statistics in tables 2.2A and 2.2B also indicate the extent to which health deteriorates with age. Among men age fifty to fifty-four, 13 percent rated their health as fair or poor. At ages sixty-five to sixty-nine,

Table 2.2B Summary statistics (women)

	50–54	55–59	60–64	65–69	70–74
Employed	0.710	0.551	0.325	0.126	0.049
Self-assessed health					
Excellent	0.222	0.201	0.170	0.150	0.120
Very good	0.361	0.344	0.325	0.315	0.285
Good	0.286	0.298	0.320	0.352	0.361
Fair	0.096	0.112	0.136	0.141	0.175
Poor	0.035	0.045	0.049	0.042	0.059
Health conditions					
Heart	0.028	0.046	0.074	0.100	0.145
Stroke	0.007	0.012	0.017	0.022	0.028
Cancer	0.021	0.033	0.037	0.042	0.050
High blood pressure	0.185	0.262	0.344	0.427	0.499
Arthritis	0.244	0.327	0.400	0.468	0.513
Diabetes	0.050	0.076	0.097	0.119	0.131
Back pain	0.239	0.254	0.271	0.258	0.259
Underweight	0.028	0.026	0.027	0.021	0.030
Normal weight	0.472	0.427	0.408	0.417	0.411
Overweight	0.273	0.313	0.322	0.363	0.366
Obese	0.227	0.234	0.244	0.200	0.193
Smoker-daily	0.190	0.170	0.138	0.116	0.092
Smoker-occasional	0.035	0.028	0.025	0.020	0.020
BMI	26.1	26.4	26.6	26.4	26.2
No. nights hospital	0.518	0.633	0.877	0.999	1.305
No. doctor visits	4.799	4.822	4.980	4.794	5.047
No. nurse visits	0.619	0.782	0.716	0.704	1.153
Education					
Less than HS grad.	0.143	0.199	0.276	0.338	0.412
HS graduate	0.211	0.189	0.188	0.177	0.174
Postsecondary (< BA)	0.428	0.420	0.377	0.364	0.318
University (BA +)	0.209	0.185	0.152	0.110	0.084
Married	0.745	0.733	0.703	0.647	0.560
White	0.775	0.774	0.791	0.770	0.786
No. observations	23,853	23,971	21,590	15,336	13,695

Source: CCHS.

19 percent rate their health as fair or poor. Among women, 13 percent of those age fifty to fifty-four reported fair or poor health while 18 percent of those age sixty-five to sixty-nine reported fair or poor health. Most health conditions, including heart disease, arthritis, and diabetes are more common as one ages. However some conditions, such as back pain, are not increasing with age. With respect to weight, the age patterns are not clear. On one hand, men and women appear more likely overweight as they age. On the other hand, they are less likely obese with age. Notably, the likelihood of being a smoker tends to fall with age in our samples, in part reflecting the fact that those in worst health at younger ages are not likely to survive.

Table 2.3A **Employment regressions, all health variables**

	Men 50–54		Women 50–54	
	Coef.	Std. err.	Coef.	Std. err.
SAH				
Very good	–0.0090	0.0069	0.0081	0.0076
Good	–0.0431	0.0073	–0.0321	0.0083
Fair	–0.1821	0.0107	–0.2015	0.0117
Poor	–0.4171	0.0152	–0.4940	0.0172
Heart	–0.0299	0.0119	–0.0161	0.0174
Stroke	–0.1094	0.0290	–0.2162	0.0332
Cancer	–0.0967	0.0204	–0.0139	0.0196
High blood pressure	0.0012	0.0066	–0.0096	0.0076
Arthritis	–0.0399	0.0072	–0.0231	0.0069
Diabetes	–0.0159	0.0103	–0.0046	0.0134
Back pain	–0.0176	0.0060	–0.0197	0.0068
Underweight	0.0034	0.0242	–0.0573	0.0171
Overweight	0.0026	0.0060	0.0142	0.0067
Obese	0.0065	0.0069	–0.0041	0.0076
Smoker-daily	–0.0310	0.0062	–0.0199	0.0074
Smoker-occasional	–0.0505	0.0132	–0.0035	0.0153
Less than HS grad.	–0.0545	0.0087	–0.1337	0.0095
Postsecondary (< BA)	0.0122	0.0070	0.0642	0.0073
University (BA +)	0.0380	0.0079	0.0963	0.0086
Married	0.1183	0.0063	–0.0196	0.0064
White	0.0539	0.0060	0.0535	0.0067
Constant	0.7500	0.0109	0.7151	0.0112

Table 2.3B **Employment regressions, PVW health index**

	Men 50–54		Women 50–54	
	Coef.	Std. err.	Coef.	Std. err.
Health index	0.0025	0.0001	0.0027	0.0001
Less than HS grad.	–0.0670	0.0089	–0.1506	0.0097
Postsecondary (< BA)	0.0158	0.0071	0.0687	0.0074
University (BA +)	0.0506	0.0080	0.1031	0.0087
Married	0.1425	0.0063	–0.0034	0.0065
White	0.0657	0.0060	0.0604	0.0068
Constant	0.5038	0.0107	0.4768	0.0110

The results of estimating our regression are presented in tables 2.3A and 2.3B. In table 2.3A, we present the results for our employment equation that includes all health variables. The results show that most of the health conditions accounted for have large and statistically significant effects on employment. Men indicating poor health are 42 percentage points less likely employed than men indicating excellent health, and the effect of poor health

on women's employment is even larger (49 percentage points). Heart disease, stroke, cancer, arthritis, and back pain also have substantial and significant effects on the likelihood of men's employment. However, high blood pressure, diabetes, and weight conditions do not appear to affect men's employment. For women, a slightly different set of health conditions appears important for employment—stroke, arthritis, back pain, and weight conditions have a significant effect on the likelihood of women's employment at ages fifty to fifty-four. However, and perhaps counterintuitively, being overweight appears to increase a woman's likelihood of being employed. Being a daily smoker negatively affects men's and women's likelihood of employment.

In table 2.3B, the effect of an increase in the health index is positive and significant. For example, a 10 percentage point increase in the index raises the likelihood of being employed by 2.5 percentage points for men and 2.7 percentage points for women. This aligns well with the estimates presented in table 2.3A and we suggest the index functions well as an overall indicator of one's health. With respect to other demographic characteristics, the estimated effects do not heavily depend on whether the health variables or the index is used in the regression. In what follows, we tend to focus on the results in table 2.3B as they are most comparable with respect to interpretation of results with other countries presented in this volume.

In table 2.4 we report the results of imposing our regression estimates in tables 2.3A and 2.3B (based on a sample of fifty- to fifty-four-year-olds) on men and women age fifty-five to seventy-four and predicting their work status conditional on their health and demographics. The first set of columns in table 2.4 uses the regression estimates in table 2.3A in the simulation exercise (with all health variables included in the regression) and the second set of columns uses the regression estimates presented in table 2.3B (using the PVW health index).

Table 2.4 **Simulations of work capacity**

		Use all health variables			Use PVW health index		
Age group	No. obs.	Actual % working	Predicted % working	Estimated work capacity (%)	Actual % working	Predicted % working	Estimated work capacity (%)
				Men			
55–59	20,571	70.2	81.0	10.8	70.2	80.8	10.6
60–64	18,394	49.5	79.6	30.1	49.5	79.1	29.6
65–69	12,691	26.6	78.5	51.8	26.6	77.4	50.8
70–74	10,338	13.4	76.1	62.6	13.4	75.4	62.0
				Women			
55–59	23,971	55.1	68.8	13.7	55.1	68.3	13.2
60–64	21,590	32.5	66.1	33.6	32.5	65.1	32.6
65–69	15,336	12.6	64.6	51.9	12.6	62.4	49.8
70–74	13,695	4.9	61.3	56.4	4.9	59.6	54.6

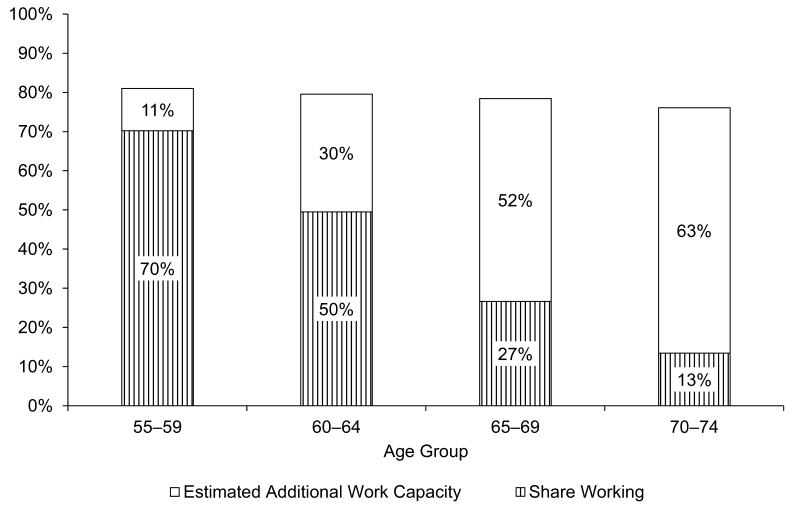

Fig. 2.8 Share of men working and additional work capacity by age
Note: Based on CCHS, regression uses PVW index, matches table 2.4 results.

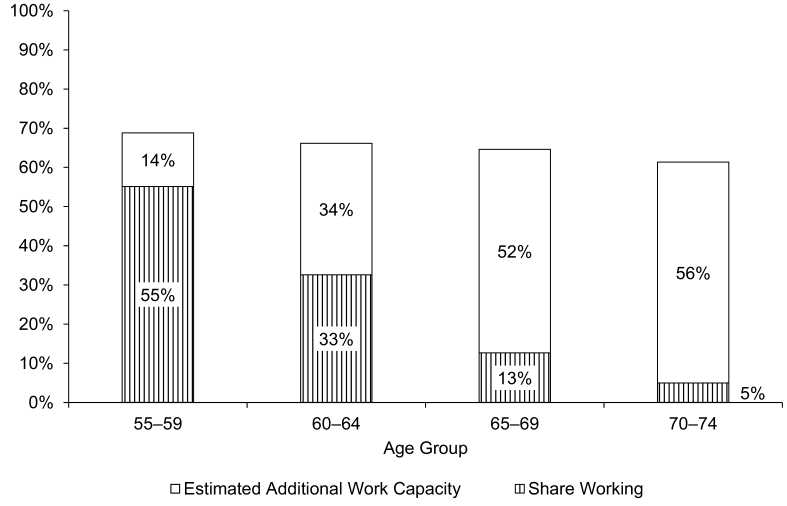

Fig. 2.9 Share of women working and additional work capacity by age
Note: Based on CCHS, regression uses PVW index, matches table 2.4 results.

The estimates in table 2.4 (also presented in figure 2.8 for men and figure 2.9 for women) indicate a substantial unused work capacity at older ages, for both men and women. At age fifty-five to fifty-nine, we observe 70 percent of men employed. The predicted percent of men working (when using the PVW health index), however, is much higher at 81 percent, implying there is an additional 11 percent of men age fifty-five to fifty-nine that could be working

given their health status. These estimates are not out of line with the suggested capacity in the previous section using mortality, which suggested an additional 17.7 percent of men could be working at age fifty-seven given the mortality rate differences from 1976 to 2011. The estimates for older groups also suggest large unused work capacity. For example, for men at ages sixty-five to sixty-nine, the estimates in table 2.4 suggest employment rates could be 50.8 percentage points higher than observed. At age sixty-seven, our estimates based on mortality suggested a 56.9 percentage point additional employment capacity. If we use methods similar to those in the previous section (specifically table 2.1), the simulations imply an additional employment capacity of 4.6 years between the ages of fifty-five and sixty-nine.

Estimates for women's work capacity are slightly larger than the estimates for men at younger, but not older, ages. At ages fifty-five to fifty-nine, we estimate an additional employment capacity among women of 13 percentage points. At ages seventy to seventy-four, our estimates indicate an additional 55 percent of women could be employed, representing a slightly lower unused work capacity than among men.

In tables 2.5A and 2.5B (and graphically in figures 2.10 and 2.11), we present results based on regressions that allow the effects of health on employment to vary by education group, with an expectation that the capacity to work at older ages will vary across education groups. While it is clearly the case that more educated individuals are more likely employed at each age than less educated individuals, an education gradient for additional work capacity is not as clear.

Among men, it appears the lowest educated (with less than high school graduation in table 2.5A and figure 2.10) have the lowest employment rates and the smallest potential for additional work capacity. The notable exception here is among university-educated men at ages sixty-five to sixty-nine, who appear to have the same work capacity as those with less than high school graduation at ages sixty-five to sixty-nine. Otherwise, men with higher education—high school graduates and those with postsecondary education (university or college)—appear to have roughly the same estimated work capacity.

Among women, there is modest evidence that potential additional work capacity may have a clearer relationship with education. Similar to men, women in the lowest education group have the lowest employment rates and the lowest estimated work capacity. Among sixty- to sixty-four-year-olds and seventy- to seventy-four-year-olds there appears some evidence that additional capacity increases with education beyond high school graduation. For example, among sixty- to sixty-four-year-old women our estimates indicate 34 percent more women with high school graduation could be employed. Among those with a university degree, 38 percent more women could be employed at ages sixty to sixty-four. However, these patterns across education are not stark and are not observed for women ages fifty-five to fifty-nine and sixty-five to sixty-nine.

Table 2.5A **Simulations of work capacity (regressions by education group)**

	Men, all health variables			Men, PVW health index		
	Actual % working	Predicted % working	Estimated work capacity (%)	Actual % working	Predicted % working	Estimated work capacity (%)
			Age 55–59			
< HS grad	62.2	70.3	8.0	62.2	70.7	8.5
HS grad	70.8	83.1	12.3	70.8	82.8	12.0
PS (< BA)	71.5	82.6	11.1	71.5	81.9	10.3
University (BA +)	75.5	87.3	11.8	75.5	87.2	11.7
			Age 60–64			
< HS grad	45.2	70.0	24.8	45.2	69.5	24.3
HS grad	50.2	81.5	31.3	50.2	81.4	31.2
PS (< BA)	48.4	82.1	33.8	48.4	81.0	32.6
University (BA +)	57.6	86.4	28.8	57.6	86.5	28.8
			Age 65–69			
< HS grad	20.3	70.0	49.6	20.3	67.9	47.5
HS grad	27.3	81.9	54.6	27.3	81.1	53.8
PS (< BA)	25.5	81.6	56.0	25.5	79.9	54.4
University (BA +)	38.8	86.2	47.4	38.8	85.7	46.8
			Age 70–74			
< HS grad	10.3	69.3	59.0	10.3	67.1	56.8
HS grad	13.3	79.5	66.2	13.3	79.7	66.4
PS (< BA)	14.1	81.0	66.9	14.1	79.3	65.2
University (BA +)	19.8	83.1	63.3	19.8	84.1	64.4

Table 2.5B **Simulations of work capacity (regressions by education group)**

	Women, all health variables			Women, PVW health index		
	Actual % working	Predicted % working	Estimated work capacity (%)	Actual % working	Predicted % working	Estimated work capacity (%)
			Age 55–59			
< HS grad	39.2	49.2	10.0	39.2	48.6	9.4
HS grad	53.0	69.3	16.3	53.0	68.2	15.3
PS (< BA)	60.2	74.0	13.8	60.2	73.5	13.3
University (BA +)	63.8	79.7	15.9	63.8	79.4	15.6
			Age 60–64			
< HS grad	21.6	48.5	27.0	21.6	47.2	25.6
HS grad	33.5	68.3	34.7	33.5	67.3	33.7
PS (< BA)	37.1	73.5	36.5	37.1	72.2	35.1
University (BA +)	41.2	79.6	38.5	41.2	78.9	37.8
			Age 65–69			
< HS grad	7.2	48.8	41.6	7.2	45.9	38.7
HS grad	12.0	69.6	57.6	12.0	66.9	54.9
PS (< BA)	15.4	73.4	58.0	15.4	71.3	55.9
University (BA +)	22.3	79.0	56.7	22.3	78.0	55.8
			Age 70–74			
< HS grad	2.2	47.5	45.3	2.2	44.3	42.1
HS grad	5.4	68.1	62.6	5.4	65.8	60.3
PS (< BA)	6.9	71.5	64.7	6.9	70.0	63.2
University (BA +)	10.5	78.0	67.5	10.5	77.7	67.2

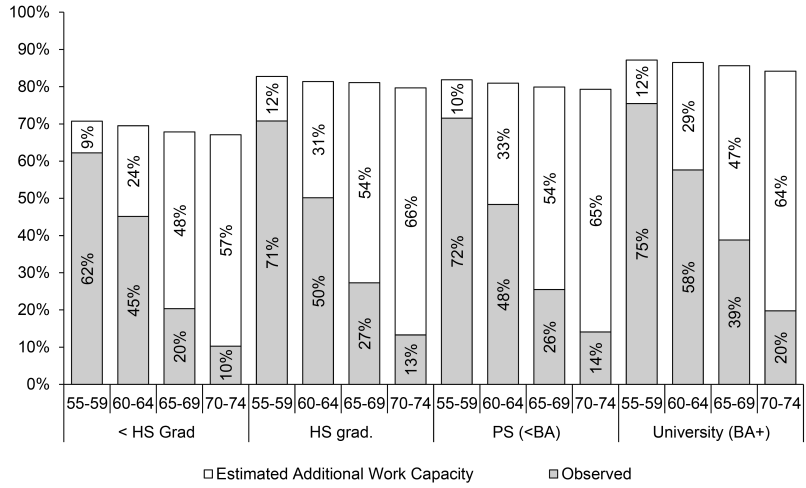

Fig. 2.10 Share of men working and estimated work capacity

Note: CCHS, regressions by education group, using PVW index. Results correspond to table 2.5A.

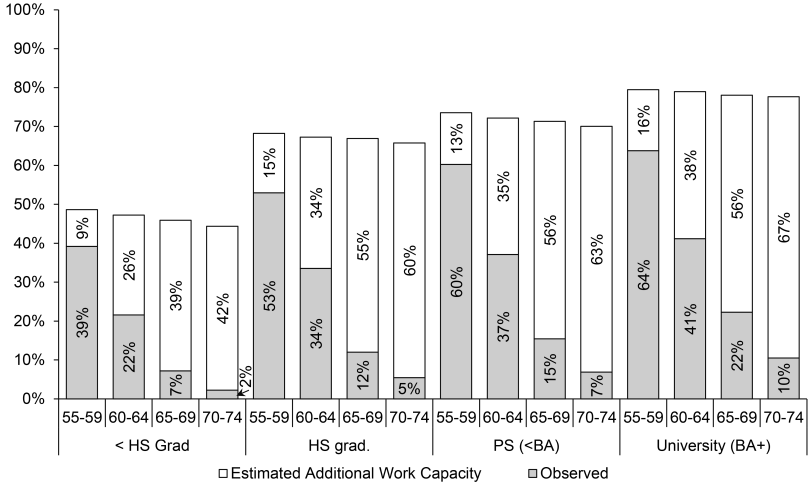

Fig. 2.11 Share of women working and estimated work capacity

Note: CCHS, regressions by education group, using PVW index. Results correspond to table 2.5B.

In this section we have employed the method of Cutler et al. to estimate the work capacity of older workers in the fifty-five to sixty-nine age range using the observed health-employment relationship among fifty- to fifty-four-year-olds. We find results that are quite similar to the mortality results, showing a substantial unused capacity to work at older ages.

2.5 Changes in Self-Assessed Health by Education Level over Time

In this section we explore further the potential for heterogeneity in health capacity and its evolution over time. Past Canadian research has demonstrated clear heterogeneity in life expectancy. Carriere and Galarneau (2012) have found that life expectancy tends to be shorter for those with less education. According to their estimates, life expectancy at age fifty was 32.4 years for people with less than a high school diploma, but thirty-six years for those with postsecondary education. Wolfson et al. (1993) used the CPP administrative data up to 1989 to relate earnings histories of men to their mortality at ages sixty-five to seventy-four. They find significant earnings-mortality gradients across earnings quintiles while accounting for various demographic characteristics. While there have been studies in other countries (including Waldron 2007; Bosworth and Burke 2014) finding that life expectancy has been growing more rapidly over time for high-income than low-income groups, there is not yet Canadian evidence to suggest a similar divergence in life expectancy among Canadians.

Here we want to more closely examine self-assessed health as reported in the Survey of Labour and Income Dynamics (SLID), 1996–2011, along the lines of socioeconomic status. We lack the information necessary for a careful measure of socioeconomic status, and turn to education as a key indicator. Using education, however, is problematic since education levels increased quite dramatically over time and failing to account for this can generate misleading results. Bound et al. (2014) suggest constructing education quartiles as an alternative to using education groups defined by levels of education attainment.

In figure 2.12, we provide estimates of the distribution of education for each year of birth among men. Pooling all available years from SLID 1993 to 2011, we find the portion of men that belong to each education category by year of birth.[11] Those born in 1921 are age seventy-five when we first observe their self-assessed health reports in 1996. Among men born in the 1920s, it was quite common to leave school before high school graduation: the median male completed some high school and the 25th percentile male completed five to eight years of elementary school. Men born in 1961 are age fifty when we observe their health in 2011. The median male born in 1961 has completed a nonuniversity postsecondary degree or certificate and the 25th percentile male has graduated from high school.

We use the information presented in figure 2.12 to construct education quartiles for each birth cohort. When assigning individuals to a quartile, we need to account for the extent to which an education category extends across quartiles. For example, for the men born in 1961, the first quartile

11. Using SLID, we are likely overstating the education levels of the earliest cohorts: for example, the 1921 cohort is observed from ages seventy-two to ninety (1993–2011) to derive the education distribution and those most educated are most likely to survive. We likely understate the education levels of the most recent cohorts as some men will upgrade education at later ages.

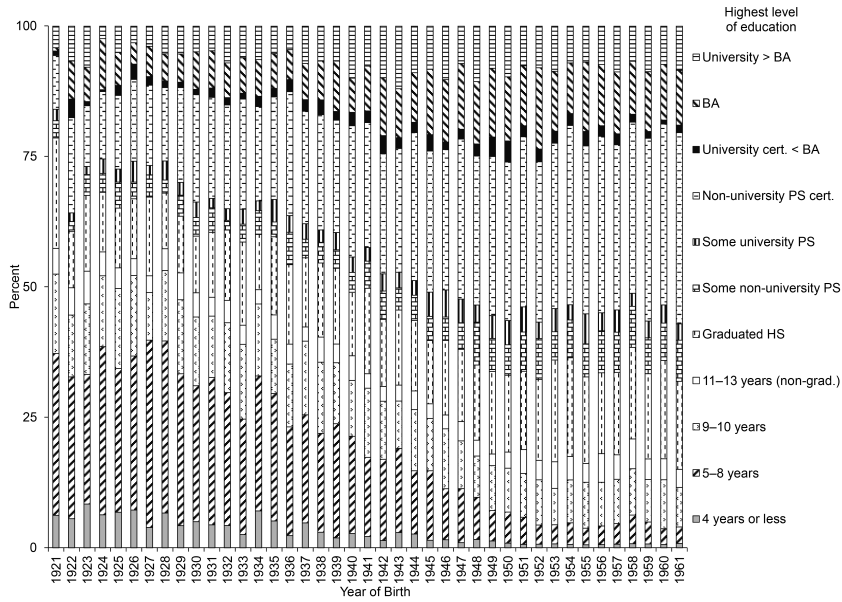

Fig. 2.12 Distribution of education completed by birth cohort (men)
Source: Based on tabulations in SLID, 1993–2011.

is represented by graduation from high school. Those reporting less than high school graduation are assigned to the first quartile. In addition, a portion of the men with high school graduation are also allocated to the first quartile. More precisely, 17 percent of men born in 1961 graduated from high school. If we could order them according to socioeconomic status, we would place 10 of the 17 percent into the first quartile. As a simpler procedure, we randomly assign 10 of the 17 percent of high school graduates to the first quartile, and place 7 of the 17 percent of high school graduates in the second quartile. The same procedure is used to allocate individuals to quartiles in each year of birth.

In figure 2.13, we present the share of men who report their health as fair or poor by age and education quartile, for the years 1996–2000 and 2007–2011. Similar to the information we provided in figure 2.3, we do not see a clear improvement in health over time for any of the education quartiles. This is despite aggregating five years of data to gain precision, and we have added smoothed polynomials to make any trends easier to recognize.

Figure 2.13 demonstrates a clear age gradient for all education quartiles. It is also clear that those with the lowest education are more likely to report poor or fair health at any age between fifty and seventy-five. Moreover, it appears the lowest educated face a steeper age gradient: for those in the first quartile, 18 percent report fair or poor health at age fifty compared to 45

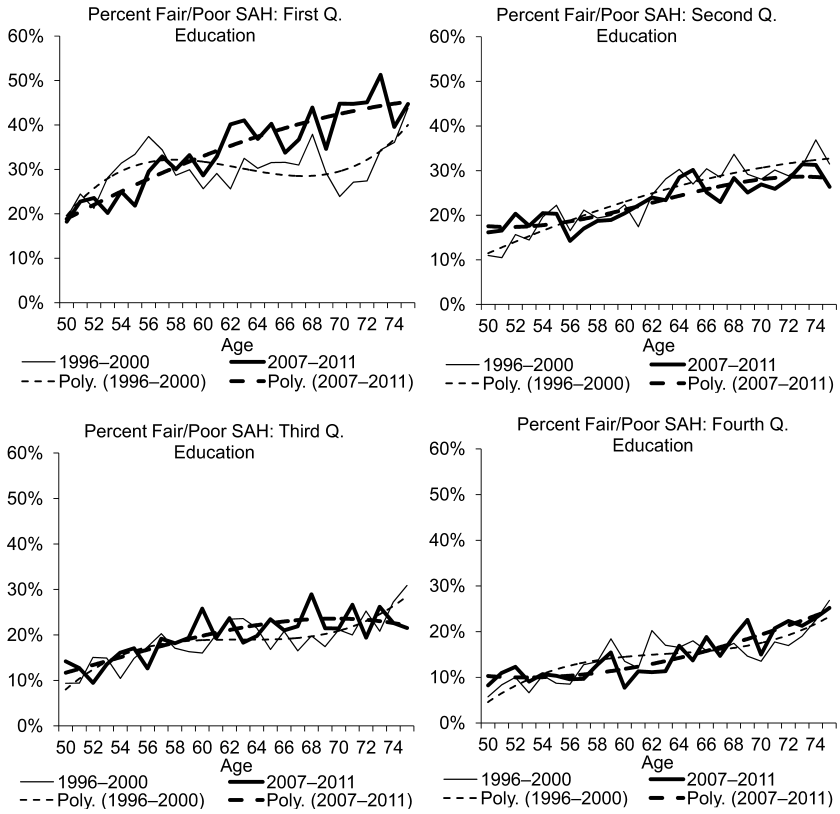

Fig. 2.13 Evolution of fair/poor health by education quartile

percent at age seventy-five. For those in the highest quartile, 8 percent report fair or poor health at age fifty compared to 25 percent at age seventy-five. Combined with evidence of shorter life expectancy among those with lower education, the heterogeneity across education groups in the evolution of their health with age remains an important consideration in the development of policy.

2.6 Discussion and Conclusion

In this chapter we study the capacity of older workers to continue working. Health has improved substantially over the decades, while employment expansion has not kept pace. The work in this chapter attempts to quantify that gap between how much work capacity has expanded and how much of it has been taken up with additional work. We do so using complementary methods that employ mortality as a simple yet comparable proxy measure

for health, followed by a more subtle analysis that incorporates many observed health characteristics.

We find a substantial increase in unused work capacity of those age fifty-five to sixty-nine through time, on the order of five years of work, if workers were employed at the same rate as implied by their mortality levels or as much as workers age fifty to fifty-four with comparable health. It is not necessarily desirable for this expansion in work capacity to be filled entirely with work. Some who are elderly may have disabilities or other incapacities that do not allow continued work. Others have amassed a sufficient flow of retirement income that they prefer leisure to work. However, we consider the study of work capacity to be an important input to the ongoing discussion of how one's lifespan ought to be split between work and retirement, in the face of ever-expanding longevity and improving elderly health.

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