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The moderating effect of sociodemographic factors on the predictive power of self-rated health for mortality in Canada

James Falconer[1]
Amélie Quesnel-Vallée

Abstract

Self-rated health is a reliable predictor for mortality, but its predictive power varies depending on social characteristics. This study tests the moderating effect of age, sex, education, and income on the power of self-rated health to predict mortality in Canada using data from the National Population Health Survey. Predictive power trajectories are modelled using time-series generalized estimating equation logistic regression. Findings show that self-rated health is a predictor for mortality up to 14 years prior to death in Canada, and is weakly moderated by income and education, and age/sex interactions. Self-rated health remains reliable across population sub-groups in Canada.

Keywords: mortality; self-rated health; predictive power; sociodemography; Canadian population

Résumé

La santé auto-évaluée est un prédicteur fiable de la mortalité, mais son pouvoir prédictif varie en fonction des caractéristiques sociales. Cette étude examine l'effet modérateur de l'âge, du sexe, de l'éducation, et du revenu sur le pouvoir de la santé auto-évaluée pour prédire la mortalité au Canada utilisant des données de l'Enquête nationale sur la santé de la population. Les trajectoires de puissance prédictive sont modélisées avec une régression logistique de l'équation d'estimation généralisée. Les résultats montrent que la santé auto-évaluée est un prédicteur de la mortalité jusqu'à 14 ans avant le décès au Canada, et est faiblement modérée par le revenu, l'éducation, et les interactions entre l'âge et le sexe. La santé auto-évaluée demeure valide parmi les sous-groupes de la population du Canada.

Mots-clés : mortalité; santé auto-évaluée; prédicteur fiable; sociodémographie; population canadienne

Introduction

Much of the quantitative sociology of health research to date has relied upon self-reported measures of health and illness. In this context, *self-rated health* became a mainstay of population health research. Self-rated health is measured by asking respondents, "In general, how would you rate the overall state of your health?" with response options (1) Poor, (2) Fair, (3) Good, (4) Very good, or (5) Excellent. Since the beginning of its use in population health research, the validity of self-rated health for predicting mortality has been one of the most consistently reproduced findings in social epidemiology (DeSalvo et al. 2006; Idler and Benyamini 1997, 1999; Mossey and Shapiro 1982).

Self-rated health is a robust and valid predictor of mortality, but its predictive power varies across social contexts and population groups. For nearly as long as self-rated health has shown a predictive association with

1. Corresponding author: James Falconer, SSHRC Postdoctoral Fellow, Department of Sociology, 5-21 HM Tory Bldg., University of Alberta, Edmonton AB, T6G 2H4, email: james.falconer@ualberta.ca. Amélie Quesnel-Vallée, Department of Sociology and Department of Epidemiology, Biostatistics, and Occupational Health, McGill University.

mortality, the measure has come under criticism for its variability across social and cultural contexts—which, it is argued, undermines its comparative utility and brings into question the measure's ability to capture "true" latent health (Huisman and Deeg 2010; Lindeboom and van Doorslaer 2004; Sen 2002). Some of these criticisms are based on studies which show that self-rated health varies according to social context, showing systematic differences by age, sex, socioeconomic status, and country (Bago d'Uva et al. 2008; Quesnel-Vallée 2007; Singh-Manoux et al. 2007). Differences in the conceptualization of health across social and cultural groups result in different subjective constructions of health, and therefore the question of what self-rated health really measures is unresolved. This may be problematic for the comparative utility of self-rated health across social and population groups. Health perceptions that do not correspond to an underlying latent state of health or to an actual risk for mortality may lead to the underestimation of health inequalities across social strata (Delpierre et al. 2009).

However, recent innovations in self-rated health research have begun to investigate the determinants of its *predictive power*, defined as the association between subjective health and actual risk of mortality (Stenholm et al. 2014). Rather than criticizing the measure's failure to capture the same meaning of health across social contexts, this study investigates how the power of self-rated health to predict mortality varies in systematic ways that provide information about how different social groups conceptualize their health and construct their self-assessments. Measuring predictive power for mortality, rather than just self-rated health, permits an objective and quantifiable evaluation of this subjective variable and allows it to be compared across contexts where different social and cultural interpretations of health prevail. This study investigates some of the conditions under which self-rated health can be considered a valid proxy for "true" latent health.

This study tests the moderating effect of two demographic variables (age, sex) and two socioeconomic variables (income, education) on the predictive power of self-rated health for mortality in Canada. Systematic differences in predictive power across social covariates reflect different capacities of group members to accurately assess their own latent health, in terms of how closely their subjective health perceptions conform to their actual risk of mortality. For example, there is a well-known maxim in social epidemiology that "women are sicker, but men die quicker." This expresses the "gender paradox" between women's consistently worse self-reported health and men's consistently higher risk of mortality at all ages (Case and Paxson 2005; Deeg and Kriegsman 2003; Idler 2003; Jylhä et al. 1998). Whether women's subjective health is more strongly impacted by health conditions that are unassociated with mortality, or men's subjective health fails to take into account serious mortality-relevant health conditions, these are two sides of the same coin: both may lead to diminished population-averaged predictive power.

Similarly, research has shown that the predictive power of self-rated health diminishes with age (Layes et al. 2012; Stenholm et al. 2014). This is attributed to excessive "health optimism" among very old respondents relative to their higher risk of mortality (Layes et al. 2012), and to survivorship bias, whereby only the healthiest respondents survive to very old ages, thus generating a sample of respondents with progressively improving health and less variation between respondents of different health statuses (Stenholm et al. 2014). Failing to differentiate deceased cases and surviving controls by prior health status reduces the overall population-average predictive power of their subjective health.

That socioeconomic status (SES) is associated with health and mortality is one of the most consistently reproduced findings in social epidemiology (see meta-analyses such as Kondo et al. 2009; Okun et al. 1984; Pinquart and Sörensen 2000). However, the effect of SES on the *predictive power* of self-rated health is not as clear and direct as its effect on health and mortality (Bago d'Uva et al. 2008; Burström and Fredlund 2001; Dowd and Zajacova 2007; Huisman et al. 2007; McDonough and Berglund 2003; Yao and Robert 2008; Zajacova and Dowd 2011). Generally, a high SES is associated with better predictive power. This may be explained by advantages in human capital such as education and health literacy (Jylhä 2009), and by better access to healthcare and the health information upon which health self-assessments depend (van Doorslaer et al. 2006).

However, some notable counter-examples challenge the direct relationship between SES and predictive power, suggesting that the gradient could be ambiguous or inverse. Singh-Manoux et al. (2007) found an inverse SES gradient in the strength of predictive power of self-rated health for mortality within an occupational sector in France. Against expectations, predictive power was *weaker* in the high occupation and income groups. They

found that members in the high-SES groups were more sensitive to minor health complaints, thus reporting "poor" health at a higher rate that was incommensurate with their lower risk of mortality. Similarly, Sen (2002) shows that there is an inverse gradient between per capita income and self-reported morbidity across the states of India: residents of the richest and longest-lived state (Kerala) report the most sickness, while residents of the poorest state with the lowest life-expectancy (Bihar) reported the least sickness. Like the example from the French occupational sector, this presents an incongruity between self-assessed health and actual risk of mortality.

Canada provides an interesting case in the investigation of an SES effect for predictive power in the context of its universal healthcare system. The research literature on the relationship between SES and the predictive power of self-rated health, based on studies from other countries, has not produced generalizable conclusions because the effect of SES appears to vary across different national populations. For example, SES appears to be a stronger moderator of predictive power where socioeconomic inequality is high, such as in the United States (Dowd and Zajacova 2007), and a weaker determinant where inequality is low and health information is distributed more equally across the social classes, such as in Sweden and the Netherlands (Huisman et al. 2007; Johansson et al. 2015). The effect of SES on predictive power in the Canadian context has not yet been researched, but will be a unique contribution because Canada is situated between the United States and Europe (from where most studies originate) on a number of social dimensions that determine good predictive power for mortality—namely education, healthcare, and socioeconomic inequality (Cingano 2014; Falconer and Quesnel-Vallée 2014; Fortin et al. 2012; OECD 2010; Paris et al. 2010).

This study will use the Canadian NPHS data to examine longitudinal trajectories of self-rated health and its predictive power for mortality in the final years of life, and the moderating effects of age, sex, income, and education.

Conceptualizing predictive power

The predictive association between self-rated health and mortality can be viewed as a measure of correspondence between health *perceptions* and *reality*. There exists no single definition for "true" health, which can mean something different across individuals and social groups. At best, self-rated health has been shown to be a reliable proxy for an underlying construct of latent health. *Latent health* can be defined in several ways, but always as an objective state of health that exists independently from the respondent's subjective feelings about their own health (Layes et al. 2012). Whatever the elements of latent health informing a respondent's subjective self-rating, they tend to make it a very reliable predictor for mortality (Jylhä 2010). We can define latent health for this study using a conceptualization of health that we can measure with the best accuracy and reliability, and which has the greatest overall impact on people's lives (Quesnel-Vallée 2007): Mortality is the obvious candidate for such a measure, because measuring the timing of death is free from bias or cultural interpretation. Individuals and population groups have an underlying state of latent health that corresponds to their risk of mortality, and that also corresponds to some extent with how they *feel* about their own health. Understanding the degree to which different respondents' self-rated health conforms to their latent health and actual risk of mortality are what motivates this study.

Self-rated health is almost universally measured using a single-item 5-point ordinal scale. The response options typically include "poor," "fair," "good," "very good," and "excellent." Typically, the research questions in the literature aim to understand the validity of "poor" health for predicting mortality. When studies dichotomize the 5-point scale into "poor" versus "good" health, they are comparing the lower two options ("poor" and "fair") against the higher three ("good," "very good," and "excellent").

Predictive power is calculated as the population-averaged propensity to report "poor" self-rated health between deceased and surviving samples; it is a measure of how well subjective health corresponds to latent health and actual risk of mortality (DeSalvo et al. 2006; Dowd and Zajacova 2007; Huisman et al. 2007; Idler and Benyamini 1997; Jylhä 2009; Mossey and Shapiro 1982; Stenholm et al. 2014). Using longitudinal panel data, we can retrospectively examine how closely a respondent's health perceptions through the life course correspond with their survival or mortality outcome, and investigate the factors which can improve or diminish this predict-

ive power. When studies and meta-analyses report that self-rated health shows predictive power for mortality, it means that they find systematic differences in previously reported self-rated health between those who died and those who survived. Studies typically show that sub-samples of deceased cases report poor health during their lifetimes at a rate 1.5 to 3.0 times higher than survivors, which quantifies the *power* of self-rated health to *predict* mortality in the sample (DeSalvo et al. 2006; Idler and Benyamini 1997). This predictive association has been detected up to 12 years prior to death, and is robust to statistical adjustments for a large set of objectively measured sociodemographic and health variables, suggesting that the power of self-rated health to predict mortality goes beyond the reach of objective health factors (Stenholm et al. 2014).

Objectives

This study situates Canada within the global literature, examining whether the predictive relationship between self-rated health and mortality operates similarly in Canada to other developed countries. Next, we investigate differences across social groups (in this case, age, sex, income, and education) to better understand how the magnitude of predictive power is moderated by these social covariates in Canada.

In this study, we analyze the time series prevalence of poor self-rated health among a sample of Canadians according to their status in a group of deceased cases versus a control group of matched survivors. The guiding research questions are: How does the predictive power of self-rated health in Canada evolve according to proximity to death? How do age, sex, income, and education moderate the predictive power of self-rated health in Canada?

Hypotheses

We expect to find that the power of self-rated health to predict mortality will be detectable long before death (up to 14 years—the limits of our longitudinal data), and that its predictive power will increase with proximity to death, as demonstrated in studies from other developed countries (Idler and Benyamini 1997; Stenholm et al. 2014).

Consistent with previous research, we hypothesize that self-rated health among older age groups will show diminished predictive power for mortality, holding proximity to death constant (Idler 1993; Layes et al. 2012).

Previous research has suggested that women's self-rated health may be overly sensitive to mortality-irrelevant health conditions, and/or men's self-rated health fails to take into account mortality-relevant health risks, in the formulation of their subjective health self-ratings (Case and Paxson 2005; Deeg and Kriegsman 2003). These are both reasons to expect diminished correspondence between self-rated health and latent health among both sexes, and thus there is no particular reason to hypothesize why one sex might show better or worse predictive power than the other, except insofar as women and men may differ across *other* types of relevant social covariates such as age, income, and education.

A higher individual SES is expected to be associated with better predictive power, due to advantages in human capital, health literacy, cognitive ability, and access to health information. Therefore, we expect to observe that higher levels of income and education will be associated with better predictive power of self-rated health for mortality.

Data

The Canadian National Population Health Survey (NPHS) is a nationally representative biennial panel study comprising 17,276 respondents over 9 survey cycles from 1994 to 2010. The survey includes measures of self-rated health, date of death, and a set of sociodemographic and health control variables. The NPHS surveys residents of households in all provinces and territories, except for people living on Indian Reserves, Canadian Forces bases, and some people in remote locations. The longitudinal panel had a 93.6 per cent follow-up response rate. Data are weighted to correct for sampling design, non-response, and post-stratification (Statcan et al. 1998). For these studies, we accessed the full NPHS confidential microdata file at the McGill University

branch of the Statistics Canada Research Data Centre Network (CRDCN). The NPHS is described in greater detail in Statcan (1998) and Tambay & Catlin (1995).

Dependent variable: predictive power of self-rated health for mortality

The predictive power of self-rated health for mortality is a measure of how well subjective health perceptions conform to one's actual risk of mortality. Between the sub-sample of deceased cases and a surviving control group, there are differences in their life-course propensity to report "poor" self-rated health. The relative ratio of reporting poor health between respondents who died and those who survived is quantified as its *predictive power for mortality*. Predictive power depends, of course, on the relationship between two values: self-rated health and mortality, discussed here in turn:

In each wave of data collection, the self-rated health question asks, "In general, how would you rate your health?" with response options (1) poor, (2) fair, (3) good, (4) very good, and (5) excellent. As per the norm throughout the research literature, the 5-point ordinal measure is dichotomized into "poor" health (poor or fair) versus "good" health (good, very good, or excellent). Poor health is then modelled as the predictor for mortality. The proportion of Canadians who report poor health ranges from 9.8 to 15.6 per cent across survey cycles.

The NPHS contains mortality data for respondents who died during longitudinal observation. Deaths are first reported by proxy survey respondents, then validated by matching to a mortality register in a national vital statistics database (Statcan 2012). The mortality data reports the day, month, and year of death.

Control variables: Sociodemographic, health behaviours, and diagnosed diseases

Several types of health covariates have well-demonstrated associations with self-rated health and mortality, and are thus controlled in multivariate models. These can be categorized into three types: (1) *Sociodemographic variables*, such as age, sex, income, education, race, and marital status (Browning et al. 2003; Case and Paxson 2005; Deeg and Kriegsman 2003; Ferraro et al. 1997; House and Williams 2000; McCullough and Laurenceau 2004; Yao and Robert 2008); (2) *Health behaviours*, such as smoking, body-mass index, and blood pressure (Kawachi et al. 1999; Okosun et al. 2001); and (3) *Diagnosed diseases*, such as heart disease, lung disease, cancer, diabetes, stroke, and psychiatric disease (Farmer and Ferraro 1997; Idler and Kasl 1995; Kawachi et al. 1999; Kennedy et al. 2001; Latham and Peek 2013; Miilunpalo et al. 1997; Stenholm et al. 2014).

Sociodemographic: *Age* in each of the survey cycles is derived from year of birth, and coded into three age groups: 30–64 (representing premature mortality), 65–79, and 80+. *Sex* is coded as male or female, with no alternate responses or missing values. *Race* is coded as "not visible minority" (white), "visible minority" (non-white), and "Aboriginal/Indigenous/First Nation." *Education* is reported in 10 categories, then re-coded into 3 categories: "Less than high school," "Completed high school," and "Post-secondary degree/diploma." *Income* is reported to the dollar value at the household level, then re-coded into sex-specific tertiles, with low, middle, and high income groups for each sex. The income inequality between men and women produced slightly different tertile thresholds for each sex. *Marital status* was re-coded from 7 to 4 categories: "Single," "Married/Cohabiting," "Divorced/Separated," and "Widowed."

Health behaviours: *Smoking* is coded as "non-smoker" (never smoked), "former smoker," and "current smoker." *Body-mass index* (BMI) is reported in the data to 1 decimal point, which we re-coded as "Underweight" (< 18.5 kg/m^2), "Normal" (18.5–24.9 kg/m^2), "Overweight" (25.0–29.9 kg/m^2), or "Obese" (> 30 kg/m^2). *Hypertension* is based upon a yes/no self-report of whether "a doctor [has] ever told you that you have high blood pressure."

Diagnosed diseases: *Heart disease*, *lung disease*, *stroke*, *cancer*, *diabetes*, and *psychiatric disease* are the leading causes of 68 per cent of all deaths in Canada (Statcan 2014). Diagnosis for each disease is reported in the NPHS based on self-reports of whether "a doctor [has] ever told you that you have…" (each disease asked in a separate question).

Table 1 reports the descriptive statistics for the dependent and independent variables in the analytic sample of deceased cases and surviving controls.

Table 1. Descriptive statistics of the analytic sample

	Deceased cases	Surviving controls	$p > H_0$
Sample size	1,749	2,782	–
Mean number of self-rated health measures	5.5	7.8	0.000
% "poor" self-rated health	34.4	17.3	0.000
Mean age at death (or last SRH measure)	78.2	72.7	0.000
Age groups (%)			
<30	0.6	1.3	0.000
30-64	16.0	40.0	0.000
65-79	29.2	43.5	0.000
80+	54.1	15.3	0.000
Sex (% male)	45.6	45.1	0.760
Race (%)			
Non-visible minority	96.4	95.3	0.082
Visible minority	3.5	4.7	0.026
Education (%)			
Less than high school	51.0	37.4	0.000
High school	30.2	32.8	0.077
Post-secondary	18.8	29.8	0.000
Income tertile (%)			
Lowest tertile	68.8	52.1	0.000
Middle tertile	21.8	29.6	0.000
Highest tertile	9.4	18.3	0.000
Marital status (%)			
Single	9.7	8.0	0.000
Married/Cohabiting	46.4	58.1	0.000
Divorced/Separated	9.3	11.2	0.000
Widowed	34.7	22.8	0.000
Smoking (%)			
Non-smoker	31.7	36.9	0.000
Ex-smoker	43.8	47.4	0.000
Current smoker	24.5	15.7	0.001
BMI (%)			
Underweight (<18.5)	3.7	1.3	0.000
Normal (18.5–24.9)	41.7	37.3	0.000
Overweight (25–29.9)	37.4	42.5	0.000
Obese (>30)	17.1	18.9	0.000
Health conditions ever reported (%)			
High blood pressure	36.2	33.3	0.000
Heart disease	21.0	11.2	0.000
Lung disease	7.7	3.9	0.000
Stroke	6.4	2.6	0.000
Cancer	6.3	3.1	0.000
Diabetes	16.2	8.9	0.000
Psychiatric disease	5.0	4.2	0.008

Sampling

The analysis uses a quasi-experimental nested case-control design to compare the self-rated health trajectories of deceased cases relative to surviving controls. We included all deceased cases who met the inclusion criteria. For each deceased case, we randomly selected up to three surviving controls matched for sex, race, and age (±2 years), and who also matched the inclusion criteria. Inclusion in the analytic sample is limited to respondents who have self-rated health measures in at least two prior survey waves, with at least one proximal measure (0–6 years prior to death), and one distal (7–12 years prior to death). This proximal/distal criterion ensures that the

analysis capitalizes on the longitudinal nature of the panel data, and allows the modelling strategy to account for intra-individual correlation over time, which is not possible with a cross-sectional measure (Stenholm et al. 2014). Although 2 self-rated health measures are only the minimum criteria for inclusion, the sample had an average of 7 measures throughout longitudinal observation. We conducted a robustness check to detect any bias arising from differences between the sample of deceased cases that met the inclusion criteria, versus *all* deceased respondents in the data, and found no bias in self-rated health trajectories. These criteria resulted in an analytic sample of 1,749 deceased cases and 2,782 matched surviving controls.

Methods

We estimate the relative risk of poor health between deceased cases and surviving controls in each year prior to death, using a *Generalized Estimating Equation* (GEE) with a logit-binomial parameterization and an exchangeable correlation structure, with sampling weights applied. GEE models permit us to control for unobserved intra-individual correlation over time, such as a respondent's path dependency in responses over successive measurements, or an overall individual propensity toward biased responses (Hardin and Hilbe 2003; Liang and Zeger 1986; Zeger and Liang 1986). Under some mild assumptions about the respondent's auto-correlation structure, GEE produces unbiased estimates of the "treatment" effect, controlling for unobserved intra-individual error. Fully adjusted models were controlled for the above-mentioned set of *sociodemographic*, *health behaviour*, and *diagnosed disease* variables. Repeated models over the life course of a synthetic cohort, centred on proximity to death, generated trajectories of predictive power over the last 14 years prior to death. All statistical programming used STATA version 13.

Results

Results for the moderating effects of each of the four covariates of interest (age, sex, education, income) are presented here in turn:

The moderating effect of *age group* for predictive power

Figure 1 shows the proportion of deceased cases and surviving controls who report poor self-rated health up to 16 years prior to death, and its predictive power for mortality. Prevalence of poor health is based on unadjusted mean differences between case/control groups, while the predictive power trajectory is calculated from a fully adjusted multivariate GEE model.

Figure 1 shows that the prevalence of poor health among survivors rises gradually over time as a function of increasing age, which is expected. Poor health among deceased cases begins higher, and rises faster as death approaches. The widening gap in poor health reports between deceased cases and matched surviving controls suggests an increasing predictive power of poor health for mortality over time, which is indeed the case, shown by the black dotted line. Although the trajectories of poor health get higher with age, its predictive power for mortality declines.

In order to directly compare predictive power across the age groups, Figure 2 displays the predictive power trajectories for each of the three age groups, showing the raw data points on which the smoothed exponential trendlines from Figure 1 were calculated. Each data point represents a relative risk ratio for reporting "poor" health in each year prior to death, calculated from a fully adjusted GEE model. Only statistically significant point estimates are included, so only the last 14 (not 16) years prior to death are shown, and some point estimates are missing for the highest (80+) age group.

The trajectories of predictive power in the last 14 years prior to death in Figure 2 show more clearly the gradient in predictive power by age. As hypothesized, we see increased predictive power among the younger age groups (30–64 and 65–79), and diminished predictive power among the oldest group (80+). The predictive power estimates for the younger two age groups are not statistically distinguishable (falling within each other's 95 per cent confidence interval), whereas predictive power is significantly lower for the oldest 80+ age group within 7 years proximity to death.

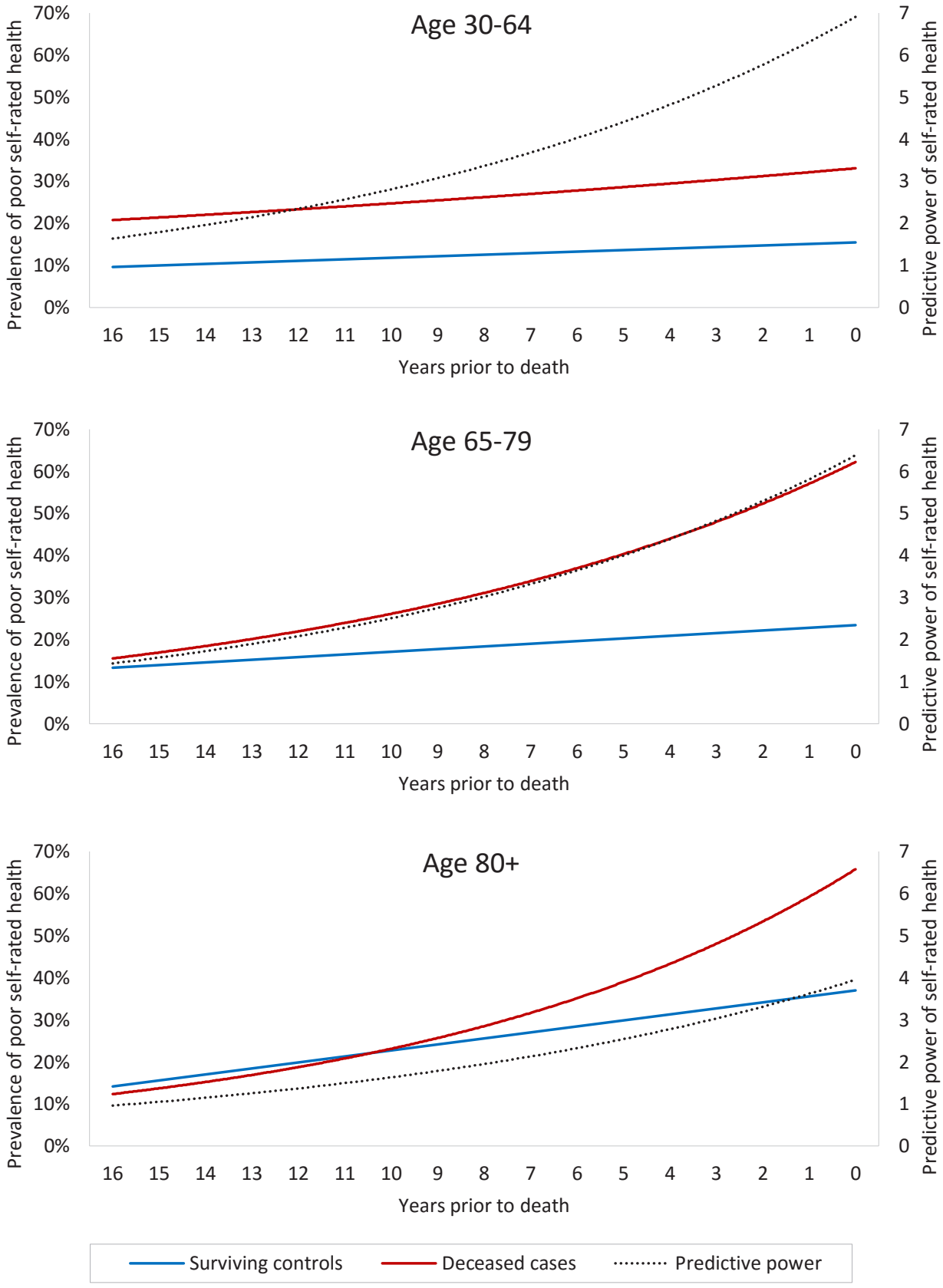

Figure 1. ***Prevalence and predictive power of "poor" self-rated health up to 16 years prior to death, by age group (smoothed exponential trendline).***

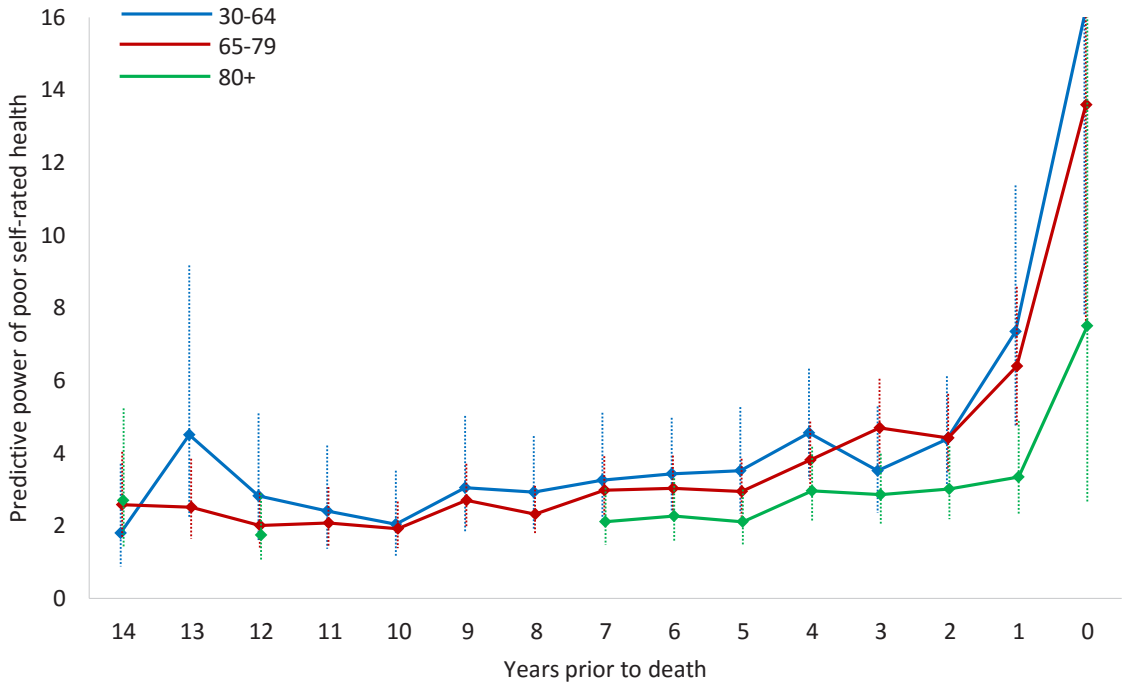

Figure 2. ***Predictive power of poor self-rated health by age group in the last 14 years prior to death: relative risk of reporting "poor" health for deceased cases versus surviving controls, fully adjusted GEE models (raw data points with 95 per cent CI).***

The moderating effect of *sex* for predictive power

Figure 3 reports the predictive power trajectories for women (red) and men (blue). Data points represent predictive power estimates for the relative risk of reporting "poor" health in each year prior to death, calculated from a fully adjusted GEE model. Only statistically significant point estimates are included.

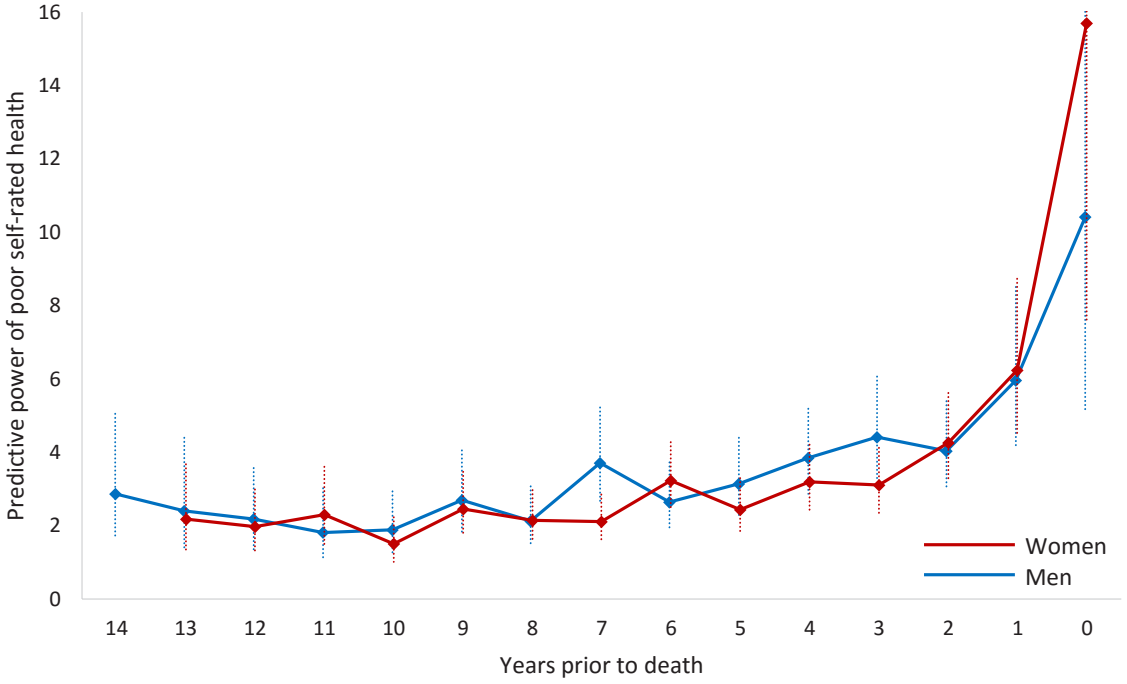

Figure 3. ***Predictive power of poor self-rated health by sex in the last 14 years prior to death: relative risk of reporting "poor" health for deceased cases versus surviving controls, fully adjusted GEE models (raw data points with 95 per cent CI).***

Both sexes show statistically significant predictive power for mortality at all observations up to 14 years prior to death, and increasing predictive power as death approaches. Figure 3 offers no solution to the gender paradox; the trajectories of the predictive power of self-rated health by sex are statistically indistinguishable. However, it is possible that age and sex interact differently to affect the predictive power of self-rated health. Therefore, Figure 4 shows the predictive power trajectory by age group for each sex.

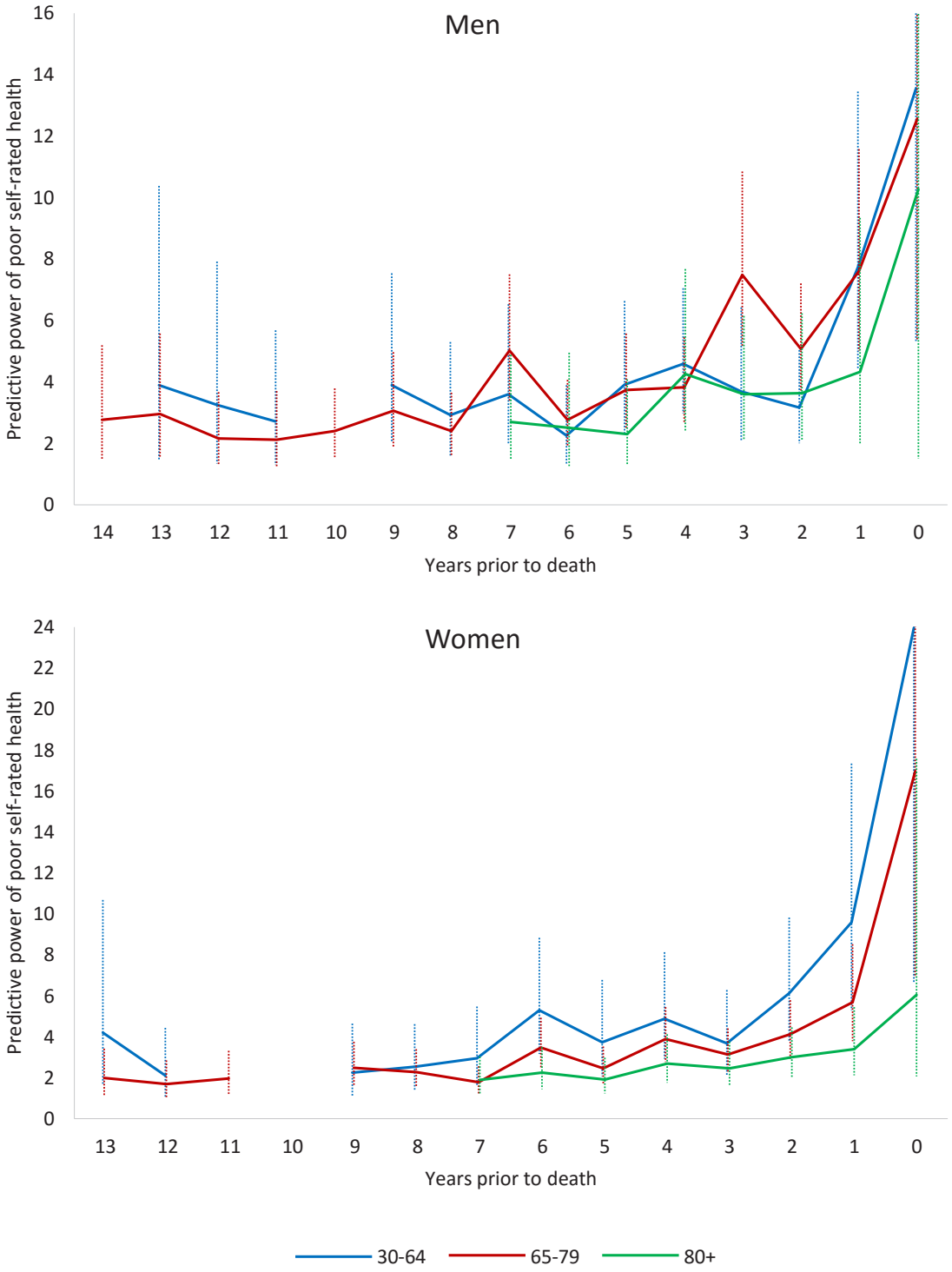

Figure 4. ***Predictive power of poor self-rated health by sex and age group in the last 14 years prior to death: relative risk of reporting "poor" health for deceased cases versus surviving controls, fully adjusted GEE models (point estimates with 95 per cent CI high/low lines).***

Figure 4 shows that there is no discernible gradient in the trajectories of predictive power by age group among men. Except for a few anomalous observations, men's predictive power trajectories for all ages fall within each other's confidence intervals. Women's predictive power trajectories, on the other hand, show a consistently ordered gradient according to the initial hypothesis: reduced predictive power with increasing age. Among women, the youngest age group (30–64) is distinguishable from the middle group (65–79) at about half the observations. The oldest (80+) age group is distinguishable from both younger age groups (30–64 and 65–79) at most observations for which complete data are available.

The moderating effect of *education* for predictive power

Figure 5 reports the population prevalence of poor self-rated health among deceased cases and surviving controls for respondents of each level of education. Among both deceased cases and surviving controls, the health gradient by education in Figure 5 is in the expected direction, with increasing education associated with lower rates of poor health. The ratio in poor health between deceased cases and surviving controls forms the basis for predictive power. However, the ratios in Figure 5 are simple descriptive proportions. Figure 6, on the other hand, reports the relative risk ratio point estimates for reporting "poor" health between deceased cases and surviving controls for each education group up to 14 years prior to death, calculated from fully adjusted GEE models controlling for sociodemographic, health behaviours, and diagnosed diseases.

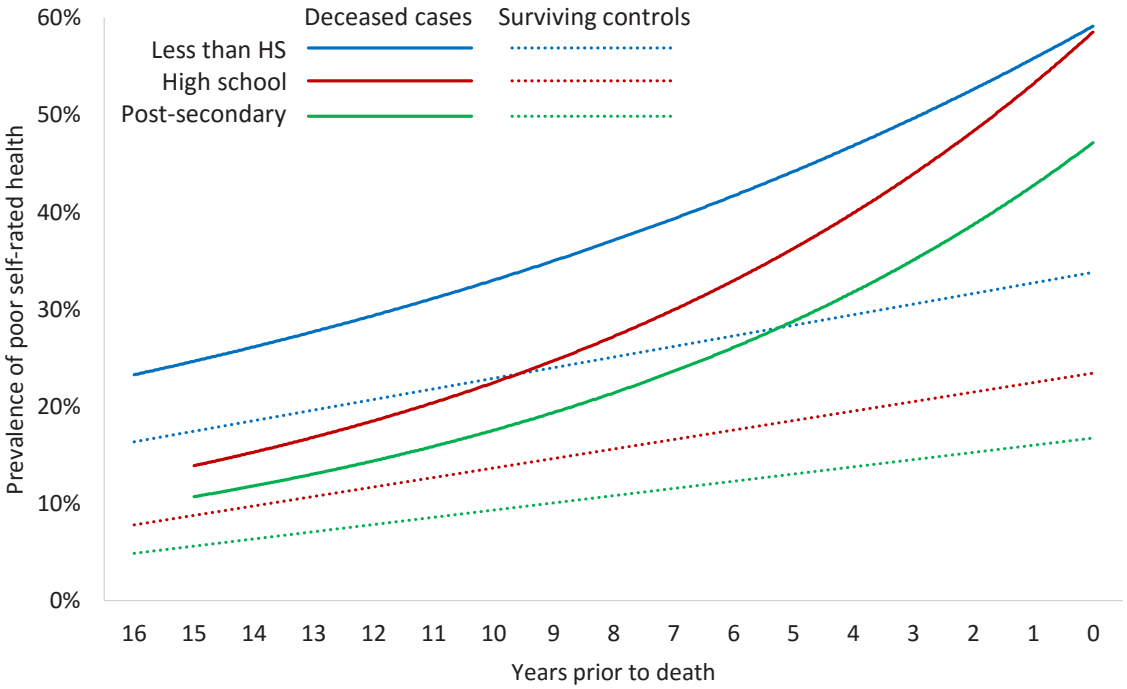

Figure 5. ***Prevalence of poor self-rated health by level of education, deceased cases and surviving controls.***

The results in Figure 6 fail to show any discernible gradient in predictive power according to education level. Not only are the predictive power trajectories by education level statistically indistinguishable from each other, the trajectory for respondents with the highest level of education (post-secondary) is lower than that of high-school educated respondents at many observations. Like with age group, we tested sex differences in predictive power by educational group (not shown), and found that neither sex showed the hypothesized gradient in predictive power by education level.

The evidence for the moderating effect of education for predictive power fails to support the hypothesis of increasing predictive power for mortality with increasing education gradient. Neither did disaggregating education gradients by sex show that the hypothesis held for men or women. The analysis now turns to a second operationalization of SES, to examine the effect of the sex-specific *income* tertile on the predictive power of self-rated health.

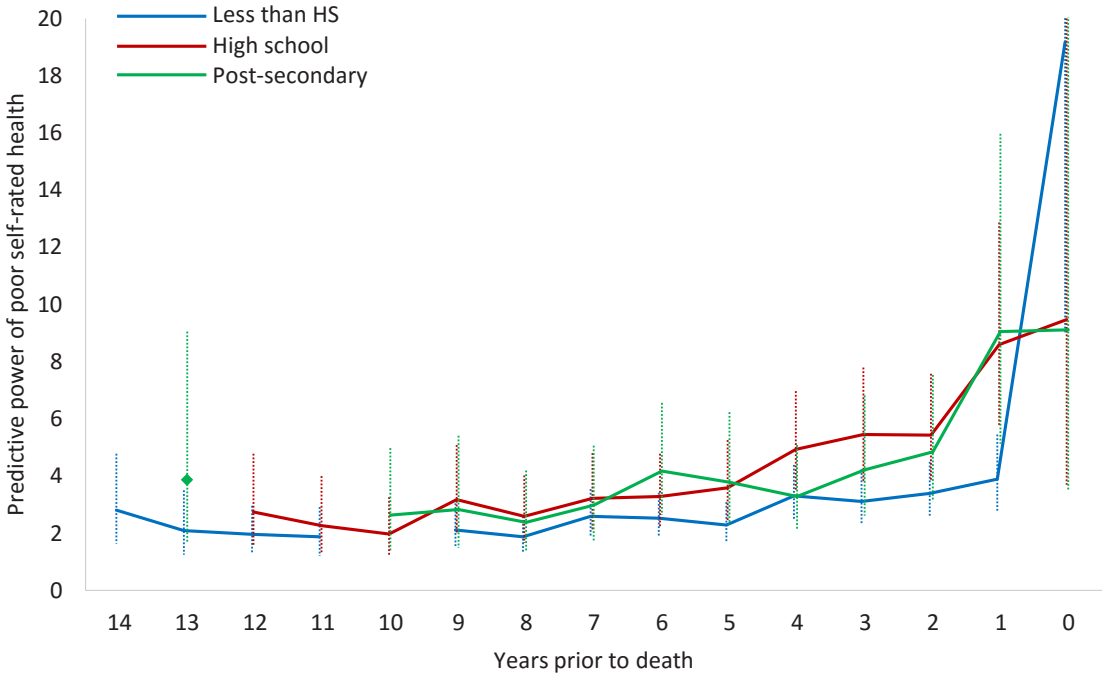

Figure 6. ***Predictive power of poor self-rated health by education in the last 14 years prior to death: relative risk of reporting "poor" health for deceased cases versus surviving controls, fully-adjusted GEE models (raw data points with 95% CI).***

The moderating effect of *income* for predictive power

Figure 7 reports the population-average prevalence of poor self-rated health among deceased cases and surviving controls, according to the sex-specific income tertile up to 16 years prior to death. Like with education, the gradient in poor self-rated health is in the expected direction, among both deceased cases and surviving controls: the lowest-income respondents report the worst health, and the highest-income respondents the best. Figure 7

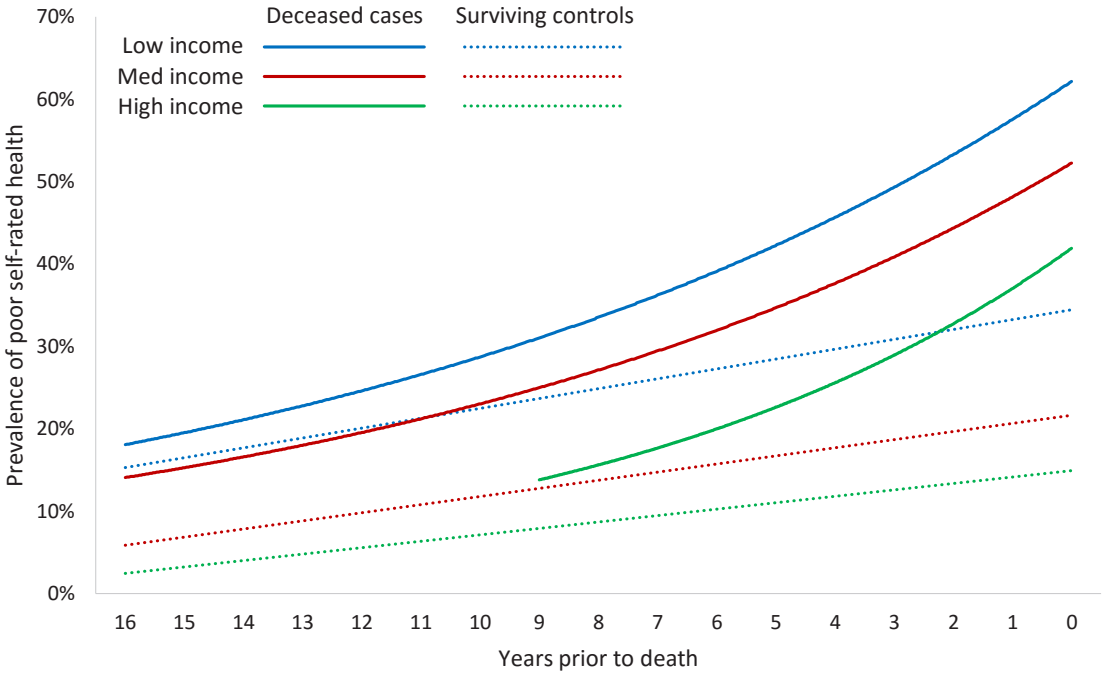

Figure 7. ***Prevalence of self-rated poor health by sex-specific income tertile in the last 16 years prior to death, deceased cases and surviving controls (exponential regression trendline).***

shows unadjusted mean differences, whereas Figure 8 reports the relative risk of reporting poor health, calculated from multivariate GEE models and controlling for sociodemographics, health behaviours, and diagnosed diseases.

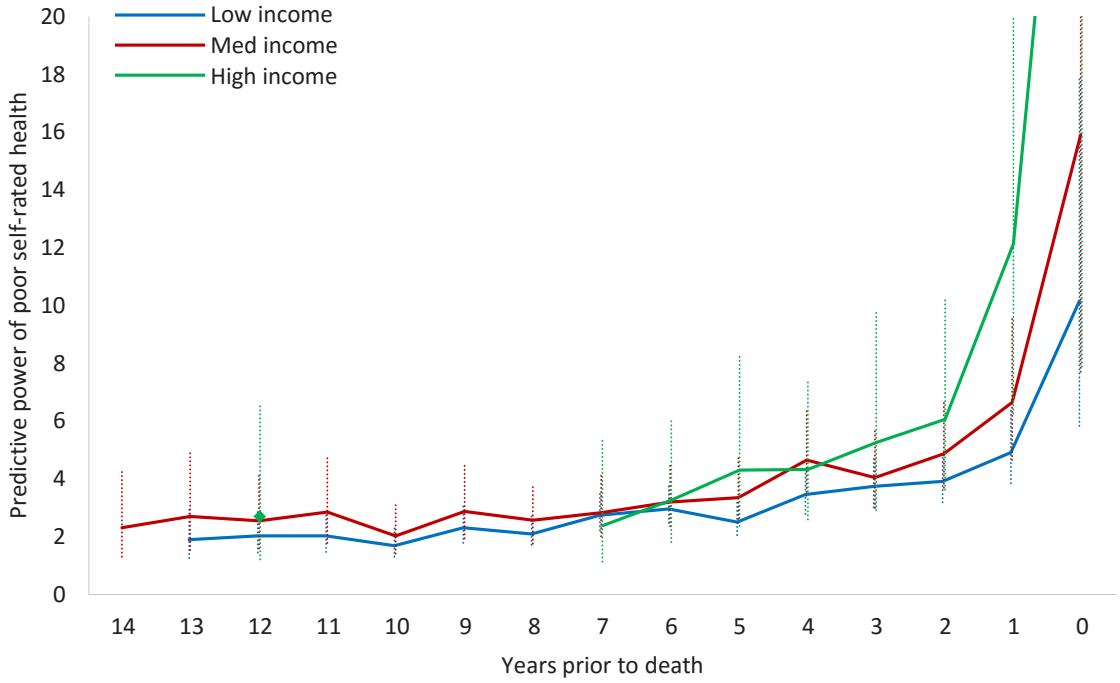

Figure 8. ***Predictive power of poor self-rated health by sex-specific income tertile in the last 14 years prior to death: relative risk of reporting "poor" health for deceased cases versus surviving controls, fully adjusted GEE models (raw data points with 95 per cent CI).***

Unlike with education (in Figure 6), in Figure 8 income shows a more consistent positive gradient in predictive power, particularly in the last 3 years prior to death. However, only the highest and lowest income tertiles are statistically distinguishable from each other at most observations. Like with age and education before, we decomposed the income tertiles by sex (not shown), and find that neither sex is contributing disproportionately to the apparent income gradient in predictive power.

Discussion

Self-rated health predicts mortality in Canada up to 14 years prior to death among all ages, sexes, and socioeconomic classes, and the predictive power of self-rated health increases exponentially with proximity to death.

When undifferentiated by sex, there appears to be a declining gradient in the predictive power of self-rated health in Canada by increasing age group (Figure 2). However, the predictive power trajectories among the younger two age groups (30–64, 65–79) are not statistically distinguishable. The hypothesis for a clear age gradient could be more adequately supported by a replication that uses a larger sample to more conclusively distinguish the trajectories between younger age groups. The evidence in this study shows that the larger decline in predictive power occurs for respondents in the oldest (80+) age group. This finding of low predictive power of self-rated health for mortality among the oldest age group conforms to the hypotheses of excessive health "optimism" compared to their higher actual risk of mortality (Layes et al. 2012), and of the cumulative effect of attrition/survivorship bias in the sample (Idler 1993; Stenholm et al. 2014), and to findings in the research literature from other developed countries (Johansson et al. 2015; Kaplan and Baron-Epel 2003).

The trajectories of predictive power of self-rated health for mortality in Canada are not statistically distinguishable by sex (Figure 3). However, an investigation of sex differences in predictive power revealed an interaction with age group. The declining gradient in predictive power by age is only discernible among

women (Figure 4). Among men, there is no direct relationship between predictive power and age. There may be a justification for revisiting the established literature that shows consistent findings of declining predictive power among the oldest respondents, to determine whether this observed age gradient is driven equally by both sexes.

Education and income affect the health of both deceased cases and surviving controls. Improvements in SES showed a gradient in *decreasing* prevalence of poor self-rated health (i.e., better health). However, when we investigate the extent to which these prevalences of poor health correspond to actual mortality by measuring predictive power, the gradient is less clear. The findings from this study offer only weak support, if any, for the hypothesis that the predictive power of self-rated health varies according to socioeconomic status in Canada. There is no discernible moderating effect of education, although respondents in the lowest education group (less than high school) show a systematic and statistically significant disadvantage in predictive power at some observations up to 9 years prior to death. The middle and high education groups (high school; post-secondary) are not distinguishable. Likewise, although the trajectories of predictive power by income showed the expected gradient, only the highest and lowest income tertiles were statistically distinguishable at some observations prior to death. Neither sex contributed disproportionately to the apparent moderating effect of income or education.

One of the hypotheses guiding this study is that SES differences in health knowledge, and therefore predictive power, may not arise from circumstances where healthcare is universally available across all socioeconomic classes. In such a context, differences in health knowledge may only be detectable at the extremes of socioeconomic measures (Quesnel-Vallée 2007). The findings from this study suggest that this may be the case in Canada: there is no clearly ordered gradient between the predictive power trajectories across the educational groups, but the highest and lowest education group are often distinguishable from each other. This may offer support to the hypothesis that more equal access to objective information from healthcare across the socioeconomic classes reduces the moderating effect of SES.

Evidence from the United States shows that socioeconomic status is an important determinant of predictive power, but this is in a context where health, health literacy, access to healthcare, and health information are distributed unequally according to SES (Blackwell et al. 2009; Blendon et al. 2002; Dowd and Zajacova 2007, 2010). Conversely, evidence from Europe shows that SES is a weak or null determinant of predictive power, likely because health information is more equally distributed across the social classes (Huisman et al. 2007; Quesnel-Vallée 2007). The findings from Canada appear not to support a strong effect of SES, suggesting that the more equal distribution of health knowledge in Canada diminishes the moderating effect of SES to produce inequalities in predictive power. This study, therefore, situates Canada among its European counterparts in terms of the weak or null effect of SES on the predictive power of self-rated health, and differentiates it from the United States, where SES is a stronger moderator for the validity of subjective health. However, there is some evidence (Figure 8) that differences in predictive power are discernible across the extremes of socioeconomic status at some observations. Future studies should seek to explicitly articulate and test the influence of objective medical information, obtained from access to healthcare, for the validity of subjective self-rated health.

Conclusion

This study introduces Canada into the global literature on population-level predictive power of self-rated health for mortality by analyzing how its longitudinal trajectory is moderated by age, sex, education, and income. The concern that self-rated health measures different phenomenon across social groups, and thus cannot be used to evaluate inequalities in health, is not generally supported by the evidence from Canada. Self-rated health is a valid proxy for latent health in Canada, showing a predictive association with mortality that is detectable up to 14 years prior to death, and which is not significantly moderated by sociodemographic and socioeconomic covariates. The investigation of health inequalities using self-rated health in Canada is therefore not unduly biased by different conceptualizations of health across sociodemographic attributes.

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Appendix

Data tables for the predictive power of self-rated health up to 16 years prior to death in Canada, by sex, age, education, and income. Relative risk ratios of reporting "poor" self-rated health between deceased cases and matched surviving controls, calculated from fully adjusted GEE models (rows excluded where models failed to converge).

Sex: Male

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	10.410	3.723	6.55	0.000	5.164	20.982
1	5.964	1.083	9.83	0.000	4.177	8.514
2	4.032	0.599	9.39	0.000	3.013	5.394
3	4.419	0.713	9.20	0.000	3.221	6.064
4	3.855	0.584	8.91	0.000	2.865	5.188
5	3.138	0.537	6.68	0.000	2.243	4.390
6	2.646	0.463	5.56	0.000	1.878	3.728
7	3.702	0.651	7.44	0.000	2.622	5.226
8	2.123	0.403	3.96	0.000	1.462	3.081
9	2.696	0.564	4.75	0.000	1.790	4.062
10	1.880	0.427	2.78	0.006	1.204	2.935
11	1.812	0.474	2.27	0.023	1.086	3.025
12	2.174	0.550	3.07	0.002	1.323	3.570
13	2.409	0.740	2.86	0.004	1.319	4.399
14	2.869	0.829	3.65	0.000	1.629	5.053

Sex: Female

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	15.701	5.851	7.39	0.000	7.564	32.594
1	6.242	1.068	10.70	0.000	4.463	8.731
2	4.256	0.601	10.25	0.000	3.227	5.614
3	3.108	0.448	7.86	0.000	2.342	4.123
4	3.193	0.452	8.21	0.000	2.420	4.213
5	2.439	0.376	5.79	0.000	1.803	3.298
6	3.237	0.463	8.20	0.000	2.445	4.285
7	2.105	0.328	4.78	0.000	1.551	2.856
8	2.147	0.358	4.58	0.000	1.549	2.978
9	2.451	0.433	5.08	0.000	1.734	3.465
10	1.504	0.303	2.03	0.043	1.013	2.233
11	2.294	0.529	3.60	0.000	1.460	3.604
12	1.969	0.420	3.18	0.001	1.296	2.992
13	2.184	0.580	2.94	0.003	1.298	3.677

Age: 30–64

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	16.042	5.898	7.550	0.000	7.804	32.975
1	7.355	1.637	8.970	0.000	4.755	11.376
2	4.382	0.747	8.670	0.000	3.138	6.119
3	3.524	0.727	6.110	0.000	2.352	5.280
4	4.558	0.764	9.050	0.000	3.282	6.330
5	3.509	0.730	6.040	0.000	2.335	5.275
6	3.429	0.648	6.530	0.000	2.368	4.965
7	3.260	0.746	5.160	0.000	2.081	5.106
8	2.929	0.634	4.960	0.000	1.916	4.478
9	3.042	0.779	4.340	0.000	1.842	5.025
10	2.036	0.566	2.560	0.010	1.181	3.509
11	2.405	0.688	3.070	0.002	1.373	4.212
12	2.828	0.848	3.470	0.001	1.572	5.090
13	4.506	1.632	4.160	0.000	2.215	9.164
14	1.806	0.664	1.610	0.108	0.879	3.711
15	1.576	0.817	0.880	0.381	0.570	4.352
16	1.764	0.841	1.190	0.234	0.693	4.492

Age: 65–79

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	13.594	4.249	8.350	0.000	7.367	25.086
1	6.392	0.960	12.350	0.000	4.762	8.580
2	4.414	0.548	11.960	0.000	3.461	5.631
3	4.690	0.609	11.900	0.000	3.637	6.049
4	3.817	0.474	10.790	0.000	2.993	4.868
5	2.937	0.404	7.830	0.000	2.243	3.845
6	3.031	0.400	8.410	0.000	2.341	3.925
7	2.981	0.413	7.880	0.000	2.272	3.911
8	2.326	0.340	5.780	0.000	1.747	3.097
9	2.706	0.436	6.170	0.000	1.973	3.711
10	1.917	0.320	3.890	0.000	1.382	2.660
11	2.074	0.412	3.670	0.000	1.406	3.061
12	2.010	0.380	3.700	0.000	1.388	2.910
13	2.508	0.547	4.220	0.000	1.636	3.845
14	2.573	0.590	4.120	0.000	1.642	4.033
15	1.746	0.519	1.880	0.061	0.976	3.125

Age: 80+

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	7.499	3.987	3.790	0.000	2.646	21.257
1	3.348	0.647	6.250	0.000	2.292	4.891
2	3.016	0.504	6.610	0.000	2.174	4.184
3	2.863	0.484	6.220	0.000	2.055	3.988
4	2.968	0.517	6.250	0.000	2.110	4.175
5	2.107	0.376	4.170	0.000	1.485	2.991
6	2.273	0.435	4.290	0.000	1.562	3.307
7	2.115	0.396	4.010	0.000	1.466	3.051
8	1.229	0.256	0.990	0.321	0.818	1.848
9	1.397	0.290	1.610	0.107	0.930	2.097
10	1.191	0.275	0.760	0.449	0.757	1.872
11	1.544	0.437	1.530	0.125	0.886	2.690
12	1.741	0.451	2.140	0.032	1.048	2.893
13	0.876	0.275	−0.420	0.674	0.473	1.622
14	2.685	0.915	2.900	0.004	1.376	5.237
15	1.031	0.477	0.070	0.947	0.416	2.554

Appendix data tables (cont'd)

Men 30–64

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	13.545	6.466	5.460	0.000	5.315	34.522
1	7.720	2.185	7.220	0.000	4.432	13.445
2	3.169	0.748	4.890	0.000	1.996	5.033
3	3.684	1.043	4.610	0.000	2.115	6.418
4	4.581	1.005	6.940	0.000	2.980	7.043
5	3.917	1.052	5.080	0.000	2.314	6.629
6	2.254	0.627	2.920	0.004	1.306	3.889
7	3.599	1.096	4.210	0.000	1.982	6.535
8	2.916	0.887	3.520	0.000	1.606	5.292
9	3.900	1.313	4.040	0.000	2.016	7.543
10	1.939	0.808	1.590	0.112	0.857	4.389
11	2.714	1.021	2.650	0.008	1.298	5.672
12	3.254	1.475	2.600	0.009	1.339	7.910
13	3.888	1.949	2.710	0.007	1.456	10.386

Men 65–79

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	12.558	5.423	5.860	0.000	5.387	29.274
1	7.609	1.630	9.470	0.000	4.999	11.580
2	5.072	0.908	9.070	0.000	3.571	7.203
3	7.477	1.420	10.590	0.000	5.152	10.849
4	3.830	0.688	7.470	0.000	2.693	5.447
5	3.729	0.766	6.410	0.000	2.493	5.578
6	2.770	0.542	5.200	0.000	1.887	4.066
7	5.025	1.028	7.890	0.000	3.365	7.504
8	2.403	0.514	4.100	0.000	1.580	3.654
9	3.069	0.756	4.550	0.000	1.894	4.974
10	2.399	0.561	3.740	0.000	1.517	3.795
11	2.118	0.605	2.630	0.009	1.210	3.708
12	2.164	0.585	2.850	0.004	1.274	3.676
13	2.954	0.960	3.340	0.001	1.563	5.584
14	2.774	0.886	3.190	0.001	1.483	5.189
15	1.477	0.668	0.860	0.388	0.609	3.584
16	0.461	0.244	−1.460	0.144	0.164	1.301

Men 80+

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	10.273	10.073	2.380	0.018	1.503	70.197
1	4.333	1.697	3.740	0.000	2.010	9.337
2	3.637	1.002	4.690	0.000	2.119	6.243
3	3.591	0.986	4.650	0.000	2.096	6.151
4	4.257	1.279	4.820	0.000	2.362	7.671
5	2.301	0.675	2.840	0.004	1.295	4.087
6	2.498	0.870	2.630	0.009	1.263	4.943
7	2.690	0.817	3.260	0.001	1.483	4.880
8	1.091	0.379	0.250	0.803	0.552	2.154
9	1.354	0.488	0.840	0.401	0.668	2.744
10	1.033	0.427	0.080	0.938	0.460	2.321
11	0.791	0.410	−0.450	0.651	0.287	2.184
12	1.260	0.565	0.520	0.606	0.523	3.035

Women 30–64

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	23.956	15.718	4.840	0.000	6.621	86.678
1	9.580	2.900	7.460	0.000	5.293	17.341
2	6.112	1.476	7.500	0.000	3.807	9.813
3	3.677	1.005	4.770	0.000	2.153	6.282
4	4.870	1.274	6.050	0.000	2.917	8.133
5	3.737	1.135	4.340	0.000	2.061	6.776
6	5.281	1.386	6.340	0.000	3.158	8.832
7	2.949	0.927	3.440	0.001	1.593	5.462
8	2.523	0.780	2.990	0.003	1.376	4.625
9	2.258	0.832	2.210	0.027	1.097	4.649
10	1.691	0.620	1.430	0.152	0.825	3.468
11	1.879	0.794	1.490	0.135	0.821	4.300
12	2.107	0.798	1.970	0.049	1.003	4.427
13	4.210	1.997	3.030	0.002	1.661	10.666
14	1.299	0.654	0.520	0.603	0.485	3.484
15	3.218	2.133	1.760	0.078	0.878	11.795
16	1.060	0.678	0.090	0.928	0.302	3.713

Women 65–79

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	16.955	7.758	6.190	0.000	6.915	41.572
1	5.670	1.174	8.380	0.000	3.778	8.509
2	4.115	0.712	8.170	0.000	2.931	5.777
3	3.135	0.542	6.610	0.000	2.235	4.399
4	3.879	0.675	7.790	0.000	2.758	5.456
5	2.446	0.454	4.820	0.000	1.701	3.518
6	3.460	0.623	6.890	0.000	2.431	4.925
7	1.788	0.332	3.130	0.002	1.242	2.572
8	2.267	0.466	3.980	0.000	1.516	3.390
9	2.495	0.520	4.390	0.000	1.658	3.754
10	1.472	0.345	1.650	0.099	0.930	2.330
11	1.965	0.525	2.530	0.011	1.164	3.318
12	1.690	0.447	1.990	0.047	1.007	2.838
13	1.983	0.551	2.470	0.014	1.151	3.418

Women 80+

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	6.044	3.291	3.300	0.001	2.079	17.570
1	3.401	0.820	5.080	0.000	2.121	5.455
2	3.004	0.606	5.460	0.000	2.024	4.460
3	2.460	0.528	4.190	0.000	1.615	3.747
4	2.683	0.585	4.520	0.000	1.749	4.114
5	1.910	0.436	2.830	0.005	1.221	2.989
6	2.250	0.503	3.630	0.000	1.452	3.487
7	1.892	0.454	2.660	0.008	1.182	3.029
8	1.308	0.345	1.020	0.310	0.779	2.195
9	1.343	0.341	1.160	0.245	0.817	2.209
10	1.225	0.344	0.720	0.471	0.706	2.123
11	1.976	0.695	1.940	0.053	0.992	3.936
12	1.883	0.621	1.920	0.055	0.986	3.595
13	1.095	0.424	0.240	0.814	0.513	2.337
14	2.250	1.093	1.670	0.095	0.868	5.830

Appendix data tables (cont'd)

Education: Less than HS

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	19.179	7.420	7.630	0.000	8.985	40.939
1	3.886	0.669	7.880	0.000	2.773	5.447
2	3.398	0.487	8.530	0.000	2.566	4.500
3	3.118	0.484	7.330	0.000	2.300	4.226
4	3.300	0.480	8.210	0.000	2.481	4.389
5	2.276	0.357	5.250	0.000	1.674	3.094
6	2.526	0.384	6.100	0.000	1.875	3.402
7	2.584	0.417	5.880	0.000	1.882	3.546
8	1.878	0.310	3.810	0.000	1.358	2.596
9	2.119	0.388	4.100	0.000	1.479	3.034
10	1.426	0.274	1.850	0.065	0.979	2.079
11	1.873	0.425	2.760	0.006	1.200	2.922
12	1.961	0.414	3.190	0.001	1.297	2.965
13	2.096	0.550	2.820	0.005	1.252	3.507
14	2.800	0.762	3.790	0.000	1.643	4.772

Education: High school

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	9.469	4.551	4.680	0.000	3.691	24.290
1	8.597	1.768	10.460	0.000	5.746	12.865
2	5.418	0.928	9.870	0.000	3.873	7.578
3	5.449	0.991	9.320	0.000	3.815	7.784
4	4.930	0.870	9.040	0.000	3.488	6.967
5	3.576	0.704	6.470	0.000	2.431	5.261
6	3.279	0.632	6.160	0.000	2.248	4.784
7	3.207	0.660	5.670	0.000	2.143	4.800
8	2.581	0.584	4.190	0.000	1.656	4.023
9	3.175	0.762	4.810	0.000	1.984	5.081
10	1.970	0.503	2.650	0.008	1.194	3.251
11	2.263	0.660	2.800	0.005	1.278	4.008
12	2.745	0.777	3.570	0.000	1.576	4.780
13	1.824	0.717	1.530	0.126	0.844	3.942
14	1.656	0.660	1.260	0.206	0.758	3.618

Education: Post-secondary

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	9.111	4.452	4.520	0.000	3.496	23.742
1	9.053	2.619	7.620	0.000	5.135	15.960
2	4.848	1.093	7.000	0.000	3.117	7.542
3	4.224	1.033	5.890	0.000	2.615	6.821
4	3.290	0.730	5.370	0.000	2.130	5.082
5	3.774	0.962	5.210	0.000	2.290	6.222
6	4.162	0.968	6.130	0.000	2.639	6.566
7	2.971	0.804	4.020	0.000	1.748	5.049
8	2.378	0.686	3.010	0.003	1.352	4.185
9	2.825	0.938	3.130	0.002	1.474	5.414
10	2.630	0.856	2.970	0.003	1.389	4.979
11	2.153	0.912	1.810	0.070	0.939	4.937
12	1.759	0.730	1.360	0.174	0.779	3.970
13	3.864	1.677	3.110	0.002	1.650	9.048

Low Income

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	10.158	2.915	8.080	0.000	5.787	17.828
1	4.905	0.652	11.960	0.000	3.780	6.366
2	3.915	0.438	12.190	0.000	3.144	4.876
3	3.735	0.433	11.370	0.000	2.976	4.687
4	3.468	0.393	10.970	0.000	2.777	4.331
5	2.506	0.302	7.630	0.000	1.979	3.173
6	2.969	0.354	9.130	0.000	2.350	3.750
7	2.734	0.340	8.100	0.000	2.144	3.488
8	2.085	0.277	5.520	0.000	1.606	2.706
9	2.307	0.330	5.840	0.000	1.742	3.053
10	1.688	0.265	3.330	0.001	1.241	2.297
11	2.020	0.365	3.890	0.000	1.418	2.879
12	2.020	0.359	3.960	0.000	1.426	2.861
13	1.902	0.421	2.900	0.004	1.232	2.936

Med Income

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	15.906	5.872	7.490	0.000	7.714	32.794
1	6.657	1.220	10.340	0.000	4.648	9.535
2	4.876	0.760	10.170	0.000	3.594	6.617
3	4.045	0.691	8.190	0.000	2.895	5.653
4	4.656	0.735	9.740	0.000	3.416	6.345
5	3.362	0.582	7.000	0.000	2.394	4.722
6	3.200	0.543	6.850	0.000	2.295	4.463
7	2.838	0.535	5.530	0.000	1.961	4.107
8	2.560	0.492	4.900	0.000	1.757	3.730
9	2.885	0.642	4.760	0.000	1.865	4.462
10	2.027	0.433	3.310	0.001	1.333	3.082
11	2.863	0.729	4.130	0.000	1.738	4.717
12	2.549	0.623	3.830	0.000	1.579	4.117
13	2.704	0.816	3.300	0.001	1.497	4.885
14	2.316	0.712	2.730	0.006	1.268	4.232

High Income

Years prior to death	Odds Ratio	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
0	37.125	29.561	4.540	0.000	7.797	176.778
1	12.135	4.139	7.320	0.000	6.219	23.679
2	6.062	1.604	6.810	0.000	3.608	10.182
3	5.254	1.657	5.260	0.000	2.832	9.749
4	4.336	1.163	5.470	0.000	2.564	7.335
5	4.303	1.423	4.410	0.000	2.250	8.229
6	3.254	1.015	3.780	0.000	1.765	5.997
7	2.382	0.979	2.110	0.035	1.064	5.332
8	1.998	0.720	1.920	0.055	0.986	4.047
9	1.596	0.587	1.270	0.204	0.776	3.283
10	1.489	0.571	1.040	0.299	0.702	3.159
11	1.444	0.654	0.810	0.418	0.594	3.509
12	2.690	1.215	2.190	0.028	1.110	6.519
13	1.739	0.938	1.030	0.305	0.604	5.007
14	0.944	0.507	−0.110	0.914	0.329	2.705
15	3.479	2.111	2.050	0.040	1.059	11.428
16	0.536	0.324	−1.030	0.303	0.164	1.753