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The socioeconomic health gradient across the life cycle: What role for selective mortality and institutionalization?

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ABSTRACT

Several studies have documented the now fairly stylized fact that health inequalities by income differ across the age distribution: in cross-sections the health gap between rich and poor tends to widen until about age 50 and then declines at higher ages. It has been suggested that selective mortality and institutionalization could be important factors driving the convergence at higher ages. We use eight waves of a health survey linked to four registries (on mortality, hospitalizations, (municipal) residence status and taxable incomes) to test this hypothesis. We construct life cycle profiles of health for birth year/gender/income groups from the health surveys (based on 128,689 observations) and exploit the registries to obtain precise estimates of individual probabilities of mortality and institutionalization using a seven year observation period for 2,521,122 individuals. We generate selection corrected health profiles using an inverse probability weighting procedure and find that attrition is indeed not random: older, poorer and unhealthier individuals are significantly more likely not to survive the next year and to be admitted to an institution. While these selection effects are very significant, they are not very large. We therefore reject the hypothesis that selective dropout is an important determinant of the differential health trajectories by income over the life course in the Netherlands.

Introduction

The evolution of health disparities by socioeconomic status (SES) over the life cycle has been studied by scholars from a variety of disciplines (Beckett, 2000; Case & Deaton, 2005; Herd, 2006; House, Lantz, & Herd, 2005; Lynch, 2003; Mirowsky & Ross, 2008; Sacker, Clarke, Wiggins, & Bartley, 2005; Smith, 2007). Two hypotheses are generally put forward on how this SES health gradient evolves over the life cycle: *cumulative advantage* and *age-as-leveler*. Both hypotheses assume that health deteriorates with age and that the rate of deterioration is steeper for low than high SES individuals up to late middle age. Proponents of cumulative advantage argue that health differences between SES groups keep widening until the late stages of life, while age-as-leveler states that health disparities start converging from late middle age onwards. A potential explanation for such a converging trend is that the biological determinants of aging (and thus health deterioration) start dominating the influence of SES after late-middle age (Herd, 2006), with most prominence in the literature so far being given to explanations based on cohort effects (Lynch, 2003) and selective mortality (Beckett, 2000).

In this paper we focus on the role of selective mortality and institutionalization – mortality differences and differences in institutionalization rates between high and low SES groups – in shaping the life course profile of the SES health gradient. Selective mortality seems a likely candidate as an explanation for the converging SES health gradient after late-middle age as relative mortality differences have been found to peak around ages 50–60 and to fall again at higher ages (van Kippersluis, O'Donnell, van Doorslaer, & Van Ourti, 2010). When a high SES individual is more likely to survive than a low SES individual – even when both are equally (un)healthy – then at older ages, the high SES group will include a greater share of unhealthy individuals than the low SES group. Selective mortality is a general phenomenon that might occur in any population, but selective institutionalization can only arise when institutionalized individuals have not been sampled. When the institutionalized are excluded, as is the case in most surveys, one can treat both forms of selection alike from a methodological perspective, i.e. when the low SES and unhealthy are more likely to move into an institution than their equally unhealthy

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high SES counterparts, the SES health gradient would start falling around those ages at which individuals move to institutions like elderly and nursing homes. Both types of selective dropout may therefore contribute to the apparent narrowing of the health gradient above a certain age in cross-sectional evidence.

In this paper we add to the existing literature on this phenomenon in five respects. First of all, we propose a new method to control for selective attrition by combining an approach examining health levels at an aggregated group level (Deaton & Paxson, 1998) with inverse probability reweighting at the individual level. This combination of methods has not featured in the literature on selective attrition and the SES health gradient before, but has been used in related fields (e.g. van Kippersluis, Van Ourti, O'Donnell, & van Doorslaer, 2009). The aggregated approach consists of transforming the set of repeated cross-sections into a panel dataset of age-groups, thereby allowing for the identification of life cycle effects. Inverse probability weights (IPWs) are used to correct for selective attrition (see e.g. Jones, Koolman, & Rice, 2006; Tchetgen Tchetgen, Glymour, Shpitser, & Weuve, 2012; Tchetgen Tchetgen, Glymour, Weuve, & Robins, 2012; Weuve et al., 2012). They are derived from an individual's predicted mortality/institutionalization conditional on past individual characteristics such as age, SES and health status. It thus, and unlike the imputation method of Beckett (2000), considers the experiences of *both* survivors/non-attritors and decedents/attritors.

Secondly, we allow attrition to depend on the interaction between prior SES and prior health status. Again, this is a crucial feature and a major advantage of our approach, because selective mortality will matter most for the SES health gradient if and when the association between mortality and ill-health differs *across* SES groups. Instead, all prior studies have relied simply on interactions between age and SES in explaining differential health trajectories.

Third, our analysis has greater statistical power to study selective attrition as we link cross-sectional surveys to administrative registry data for a 7 year follow-up period. This allows for a rather precise estimation of the mortality and institutionalization probabilities due to the much larger sample size than what is typically available in surveys.

Fourth, we test and correct for selection effects due to residential long term care. While others, such as Beckett (2000), have typically studied the effect of *overall* dropout (including mortality and institutionalization), we can separate these. The Netherlands is a particularly interesting country to study this phenomenon since Dutch elderly have relatively higher utilization rates of residential long term care than elderly in other OECD countries (OECD, 2011): in 2009, almost 10 percent of the 65+ population was living in a residential long term care institution (Statistics Netherlands, 2011).

Finally, we are the first to study the importance of selective mortality for the life cycle profile of the SES health gradient in the Netherlands. With the exception of one Canadian (Prus, 2007) and two UK studies (McMunn, Nazroo, & Breeze, 2009; Sacker et al., 2005), all other studies have been based on US data.

Previous approaches to correct for selection

The combined influence of selective mortality, institutionalization and other sources of sample attrition was analyzed first by Beckett (2000) for the US. Exploiting changes between the 1982–1984 and 1992 waves of the NHANES I Epidemiologic Followup Study, she identified the overall effect of any type of attrition on the SES health gradient. She confirmed that health by SES differences widen till late middle age and converge thereafter, but also found the convergence not to be the result of attrition. Noymer (2001) criticized her approach for relying on counterfactual health levels of deceased that may be overestimated because they were imputed from the experience of the survivors only. Another criticism was that the counterfactual health levels differed by age, SES and their interaction, but did not account for the interaction between initial health and initial SES. It was therefore not too surprising that Beckett (2000) found no effect of selective mortality on converging SES health differences at older ages. In later work, Beckett and Elliott (2001) partially addressed both concerns by estimating mortality models on the sample of survivors and deceased and by conditioning on initial health status and its interaction with initial SES, but did not use these models to analyze the effect of selective mortality on the SES health gradient.

Another influential approach – mainly credited to Lynch (2003) – consists of analyzing SES-differences in the life cycle profile of health using a random coefficients model. It has generally found evidence in favor of converging SES health differences at older ages being driven to some extent by selective mortality (Herd, 2006; Mirowsky & Ross, 2008; Sacker et al., 2005). A crucial feature of this approach concerns the splitting of overall health variation into variation *between* and *within* individuals. The life cycle behavior of the SES health gradient is then derived from the within-individual variation only and, in contrast to Beckett's (2000) approach, the effect of selective mortality (and attrition) on the life cycle profile of the SES health gradient is only implicitly revealed, and imputation of counterfactual health levels for the deceased (or other attritors) is not required. The main intuition is that purging within-individual health variation from between-variation should eliminate the effect of selective mortality (and attrition), but this will only hold if the deceased/attritors are "missing at random". This assumption has recently been criticized by Petrie, Allanson, and Gerdtham (2011). They argue that "missing at random" contradicts the idea that death itself is an indication that health deteriorates more rapidly for the deceased than for the survivors, and will thus lead to a lower bound of the SES health gradient. They instead propose to impute a(n absolute) zero health level to the deceased individuals which is the opposite of 'missing at random' and will inevitably give rise to an upper bound of the SES health gradient.

While the importance of selective mortality and institutionalization for the SES health gradient has not been analyzed for the Netherlands before, van Kippersluis et al. (2010) do provide some evidence for the age-as-leveler hypothesis using self-reported health and different indicators for SES. They show that the health decline with age – as observed in a cross-section – becomes less steep and even reverses after the age of 55 for low SES individuals. While the underlying mechanisms leading to this pattern have not been well understood, it has also been reported for the US by Smith (2004). van Kippersluis et al. (2010) also find that cohort effects in the SES health gradient are absent in the Netherlands, thereby confirming earlier findings with other Dutch survey data (van Kippersluis et al., 2009).

Data and methods

Data, variables and sample

Our primary source of self-assessed health data consists of representative samples of non-institutionalized Dutch individuals taken from eight annual cross-sectional Surveys of Living Conditions held between 1998 and 2005 (SLC hereafter). The main variables for our analysis are ill-health status and income. We define poor self-reported health as the bottom three (out of 5) response categories on the question "How good is your health in general?" ("very good", "good", "it's ok", "poor", "very poor" in 2002–2005 and "very good", "good", "it's ok", "sometimes good, sometimes poor", "poor" in 1998–2001), and use income quartiles as a measure of SES. We constructed the income quartiles from current