Longevity, Lineage and Ladders: Social Mobility from Childhood to Adulthood and Later-life Mortality Risks – A Cohort Analysis Based on Linked Historic Census, Genealogical, and Vital Records

Abstract

Background:

This study examines childhood socioeconomic status (SES), early (25-34) and middle (35-44) adulthood SES, and patterns of all-cause and cause-specific mortality for an entire cohort. The contribution of the paper is its focus on entire population-based cohorts born in the early decades of the 20th Century. The analysis is innovative because it relies on objective rather than retrospective reports of socioeconomic status (SES) during childhood and early-middle adulthood based on Nam-Powers-Boyd SES Scores. Given the era, special attention is given to inter- and intra-generational social mobility from the farm, though social mobility from all sector of the economy are considered.

Methods:

Data are drawn from the Utah Population Database (UPDB) that contain data from all Utah census records from the 1900 through 1930 decennial censuses that are then linked into families and joined with death data drawn from genealogies and Utah death certificates. Survival analyses are conducted for adult mortality in stages that introduce SES measures one at a time from each of the three stages considered: childhood, early adulthood, and middle adulthood; and then they are introduced in the same model. The next stage is to introduce social mobility combinations between childhood and early adulthood, then between early and middle adulthood, and then the two sets together. For the expanded paper, we will be extending our sightings of SES to the parents when the parents themselves were young (i.e., the SES of the subjects’ parents which is the SES of the subject’s grandparents) as well as the SES from 1940 and form when the subjects die based on their occupation appearing on their death certificate. This latter source represents their most enduring occupation over the course of their lives. With these additions, SES assessment will include grandparent information (from the 1880 Census), parental and offspring SES from the 1900-1940 censuses, and then finally the SES based on death certification. This type of multigenerational assessment of SES mobility and its effects on mortality is unprecedented.

Results:

Higher SES in childhood is associated with favorable survival probabilities, but SES mobility also has an effect, with consistently low status or downward mobility associated with the poorest survival prospects. Individuals starting and staying on the farm or those who became a farming family but have the most favorable survival probabilities, particularly among men.

Conclusions:

Results suggest that changes in SES in early and middle adulthood can both aggravate and attenuate mortality risks associated with SES arising during childhood.
Introduction

It is axiomatic that higher levels of social standing and economic well-being are positively associated with an individual’s health outcomes for nearly every society throughout time. What is less considered, with notable exceptions, are the health consequence of inter and intra-generational mobility, specifically with respect to survival and longevity. In this analysis, we use the power of a very large population database, the Utah Population Database, to link information for complete cohorts in childhood, as well as early and middle adulthood to assess various socioeconomic (SES) mobility transitions are associated with adult mortality patterns.

Socioeconomic status (SES) is a well-established risk factor for morbidity and mortality (Adler et al. 2008; Antonovsky 1967; Bobak et al. 2000; Braveman et al. 2010; Chen, Yang and Liu 2010; Hay 1988; Hayward et al. 2000; Kadushin 1964; Mackenbach et al. 2008; Marmot et al. 1991). As population health has improved generally but accompanied by growing health disparities, this topic has grown in importance (Elo 2009; White and Preston 1996). Some research has focused on pathways that promote the persistence and expansion of health inequalities (Engdahl and Tambs 2010; House et al. 1990; Marmot and Siegrist 2004; Petrelli et al. 2006; Tang, Chen and Krewski 2003).

Growing evidence indicates that these pathways operate from early-life onward, implicating both childhood and adulthood SES as critical elements in affecting mortality risks later in life (Elo and Preston 1997; Galobardes, Lynch and Davey Smith 2004; Galobardes, Lynch and Smith 2008; Galobardes, Smith and Lynch 2006; Hayward and Gorman 2004; Luo and Waite 2005; Preston, Hill and Drevenstedt 1998; Smith and Hanson Forthcoming). Several models have been identified to explain these life course links (Pudrovskas and Anikputa 2014b). The critical period model argues that early-life disadvantages result in persistent biological scars that may not reveal themselves until later in life (Hamil-Luker and O’rand 2007; Kuh and Ben-Shlomo 1997). In contrast, the
accumulation model argues that the health and medical deficits associated with lower SES continues and indeed ‘accumulates’ as one ages (Kahn and Pearlin 2006; Pudrovskya and Anikputa 2014b; Ross and Wu 1996). Another position argues that chronic disadvantages derived from little access to resources and social and lack of social integration has a ‘weathering’ effect that enhances persistent allostatic (Geronimus et al. 2006). Finally, some have hypothesized that ‘correlated environments’ are fundamental to our understanding of health disparities; this perspective suggests that there is a tendency to both start and remain in the same SES position throughout life such that early and late-life SES are tightly related (Lawlor et al. 2006; Pudrovskya and Anikputa 2014b). Thus, children born to wealthy parents enjoy health benefits related to wealth, and because wealthy persons retain their socioeconomic advantage, the advantage persists into adulthood and into later-life (George 2005).

In this analysis, we ask whether childhood SES sets the stage for adult mortality risks and whether they are altered as individuals make their transition into early and middle (Hallqvist et al. 2004). Upward mobility may deflect adverse mortality effects of low SES while the downwardly mobile may face diminished benefits of high childhood SES. Depending on the mobility trajectory, the mortality consequences of attributable to childhood SES may be vanquished by SES attainment in adulthood. Accordingly, a young child from a low SES family is not necessarily fated to endure diminished health in adulthood if the health effects of SES are amenable to change. Generally, social mobility predicts that individuals born into low SES families who are upwardly mobile will have better late-life health outcomes than those whose status starts low and remains so.

This study is innovative in three ways. First, we use robust and well-established measures of SES that have been measured between childhood and middle adulthood, an advantage that permits us to examine SES both across and within generations with standard metrics. Second, the measure of SES is based on historic (1900-1930) census records where occupational information was collected prospectively and later codified with standard methodologies (via IPUMS methodology).
thereby avoiding methodological challenges associated with the use of SES recalled earlier in life.

Third, the full analysis will incorporate SES as recorded on death certificates (not yet introduced in this draft) which allows us to examine the last SES status of the individual. For this historic cohort, this is possible given that the cohort is extinct and linked to death certificates where occupational data are recorded and coded.

The vast majority of studies that examine social mobility and mortality are based on European populations and have a number of age restrictions both for the timing of their SES measurement (some based on recalled SES earlier in life) as well as the period of follow-up for mortality (Billingsley 2012; Blane, Harding and Rosato 1999; Boyle, Norman and Popham 2009; Breeze, Sloggett and Fletcher 1999; Claussen et al. 2005; Hart, Davey Smith and Blane 1998; Lynch et al. 1994). Two noteworthy exceptions are from US regional populations. Pudrovska and Anikputa use the Wisconsin Longitudinal Study where they found that early-life SES affects mortality indirectly via status attainment and health behaviors in adulthood and midlife, a result inconsistent with predictions of the critical period perspective and supportive of the accumulation risk model. (Pudrovska and Anikputa 2014a). Using the Utah Population Database, Zimmer, Hanson and Smith (2015) used SES information derived from death certificates (to represent parental SES) and birth certificates (to represent the offspring SES) to show that adverse childhood SES effects can be overcome by adult SES of the offspring (Zimmer, Hanson and Smith 2015). Numerous studies have reported on an association between SES and mortality risk or morbidity, although few have examined effects of SES on morbidity as it develops and changes over the course of old-age. An exception is Haas (2008) who examined functional health trajectories in Health and Retirement Study data.

Many studies of SES and late-life health, particularly in the United States, consider education and income as SES indicators. Occupation is considered less frequently (Fujishiro, Xu and Gong
Occupation has been a more common measure for assigning SES in Europe, particularly using data from the Whitehall studies of British civil servants (Adler et al. 2008; Macintyre 1997; Marmot et al. 1991). Elo (2009), in an extensive review of divergent measures of SES and their impact on health, notes that occupation has the advantage of being related to both income and education and of summarizing a combination of social, environmental and economic characteristics that are relevant for health outcomes. The current study converts occupations into Nam-Powers Occupational Status Scores (Nam and Terrie 1982), which themselves are derived in a way that represents educational requirements and income levels that relate to specific occupations. We will also compare the performance of the Nam-Powers score to the Duncan Socioeconomic Index (SEI) (Duncan 1961), which uses occupation but is informed by income, education and prestige.

In sum, the current analysis adds to our knowledge regarding childhood and adulthood SES and adult mortality in a number of ways. By using data that allows for reliable comparisons across generations it assesses the lethal and protective effects of social mobility. By using Nam-Powers SES scores (and later the Duncan SEI scale) it converts occupation into a multifaceted indicator of SES. Finally, using a database linking population information across sources it relies on objective rather than retrospective reports of health and early and mid-life SES.

Data and methods

Sample

The Utah Population Database (UPDB) is a unique resource which is based on numerous demographic and epidemiological data sources linked at the individual level spanning entire birth cohorts for the past two hundred years. A central element of the UPDB is genealogical records that document multigenerational pedigrees comprising the state of Utah beginning in the early part of the
19th century. Individuals from these records are connected to other available demographic data, including the main data sources for this study: statewide death certificates and U.S. Census records for the state of Utah.

At this writing, record linking between the UPDB and the 1900, 1910, 1920, and 1930 censuses is nearly complete. These records were keyed by FamilySearch and processed, cleaned and coded (occupation and geographic indicators) by IPUMS. The records were then linked to UPDB using probabilistic record linking software Quality Stage supplemented by manual review. For the full record linkage project, there are 1,640,216 census records (duplicates for individuals appearing across censuses). For our purposes, where we require multiple sightings of the same person across censuses, we need to observe individuals during this 30 year period where they are children in 1900 and young adults in 1920 and 1930. Overall, for all ages, we now have 182,746 individuals in 3 or 4 censuses and of these, 155,461 who are seen in at least 3 consecutive censuses.

For this preliminary analysis, we restricted the sample to include individuals old enough in 1920 to have likely acquired an occupation themselves or if female, to have married to a husband whose occupation will also represent his reasonable first adult SES standing. Accordingly, we restrict the sample to persons for this draft to be 25-34 in 1920. We then can observe SES of the family of origin in 1900 when the subjects are ages 5-15 and also their own SES later in adulthood when they are 35-44 in 1930. With these restrictions we have 9,977 men and 8,852 women.

For the expanded paper, we will be extending our sightings of SES to the parents when the parents themselves were young (i.e., the SES of the subjects’ parents which is the SES of the subject’s grandparents) as well as the SES when the subjects were 45-54 in 1940; and when they die based on their occupation appearing on their death certificate. This latter source represents their most enduring occupation over the course of their lives. With these additions, SES assessment will include grandparent information (from the 1880 Census), parental and offspring SES from the 1900-
This type of multigenerational assessment of SES mobility and its effects on mortality is unprecedented.

Measurement

Childhood and adulthood SES are based on occupations converted into Nam Powers Occupational Status Scores (NP-SES) (Nam and Powers 1968; Nam and Powers 1983). (As noted earlier, we will also examine the Duncan Socioeconomic Index (SEI) (Duncan 1961) for comparison).

NP-SESs range from 1 to 100 for specific occupations, with scores based on educational requirements and income levels typical for people with that occupation (Nam and Terrie 1982). Therefore, these scores do more than measure occupation but are a broad indicator of SES. The measure has been used in numerous studies linking SES and health (e.g., Meyer et al. 2004; Steenland et al. 2003; Steenland, Hu and Walker 2004; Temby and Smith 2013; Zimmer, Hanson and Smith 2015).

The analysis relies on US Census of Utah for data on childhood and adulthood occupations. Childhood SES is measured by the occupation of their parent as listed on their parent’s 1900 Census record when the subject was 5 to 14 years old. If there is information on more than one parent, which is not a common occurrence since the majority of mothers are listed as housewives, the measure reflects the highest NP-SES of the individual’s deceased parents - most often the father. Early (ages 25-34) and middle (35-44) adult SES is also drawn from the census records from the 1920 and 1930 censuses, respectively.

Since social structural changes arising over time may affect the occupations that have higher or lower SES, we operationalize SES as being relative within the generation. Childhood and early/middle adulthood SES are divided into four categories to represent relative social position at
each point in time. Farmers, who represent a large segment of each cohort comprise their own group. The remaining individuals are sorted into categories representing the bottom 25%, the middle 50% and the top 25% for their generation-specific NP-SES distributions.

All survival models adjust for several early and mid-life confounders that are available in the UPDB via the Census and have shown to be associated with both SES and later-life health outcomes (Smith et al. 2009). First, we include the number of children of the subject that is living in the household. Increasing parity may increase the risk of adult mortality through physiological pathways, particularly among females who disproportionately bear the physiological and psychological costs of childbirth and childrearing (Kirkwood and Rose 1991). We also include indicators of marital status at the time of the 1930 census – married, married but separated from spouse, divorced, widowed, and never married (no separations were noted in the census). Marital status has powerful survival effects especially for men (Smith and Zick 1994). The censuses used here do not hold education data (distinct from occupational information) but information on literacy (ability to read and write) is available and is included as a broad indicator of education; it has been shown to affect adult health and survival risks (Sudore et al. 2006; Weiss, Hart and Pust 1991). Finally, we also consider nativity (born in the US or not) as a general indictor of assimilation as well as a measure to capture the healthy migrant effect (Razum, Zeeb and Rohrmann 2000)

Analytic Strategy

Cox survival models are estimated for adult mortality across a series of specifications. All individuals must have been 5-15 years of age in 1900 and were observed in the census records linked to UPDB in the 1920 and 1930 censuses where their occupations were observed. Accordingly, survival follow-up begins at age 35-44 in 1930 through 2013 in the analysis shown in this draft.
The categorizations of the SES variables are shown in Table 1. In the first round of analyses, we introduce our categorical SES measures (the three percentile measures plus farming) as a set separately from each of the three stages considered: a model only with main effects for childhood (1900), a model only with main effects early adulthood (1920), and a model only with main effects middle adulthood (1930).

The next analysis shown excludes all the main effects but instead introduces categories representing social mobility combinations between childhood and middle adulthood. A total of 16 possible categories arise with this mobility scheme but we have reduced them to a smaller set of meaningful categories as shown here:

Given the genealogical structure of the UPDB, we know whether individuals within the data are related, and more specifically, whether they are siblings. These sibsets mean the assumption of statistical independence is violated especially when we focus on childhood SES which is shared by siblings. A suitable method for adjusting for this issue is to estimate the model using robust standard errors. Models in the final analysis will incorporate frailty effects as well.
Descriptive statistics for model covariates are provided in Table 1. Given the age and birth year restrictions (ages 5-15 in 1900) we have a final sample of 8,852 females and 9,977 males in the sample. In the final paper, other adjustments will be considered including additional midlife

<table>
<thead>
<tr>
<th>Variable</th>
<th>Females</th>
<th>Males</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Length of Follow-up from 1930</td>
<td>8852</td>
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</tr>
<tr>
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<td>8852</td>
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<td>Birth Year</td>
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<td>Never Married (=1)</td>
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Findings

SES mobility

Figure 2 shows the cross-tabulations for childhood by early adulthood SES and then early adulthood by middle adulthood SES. As this figure shows, there is considerable intergenerational and intergenerational mobility.
Figures 3 and 4 show the results of three sex-specific models where the SES categories are used to estimate their distinct effects, where the top 25 percentile is the comparison group. For females (Figure 3), under this specification, we show that females in the bottom 25 percentile have the poorest survival prospects at any of the ages considered and that early adulthood seems be the most lethal stage to have lower levels of SES, including females engaged in farming where being a farmer’s wife has some adverse health effects.
For males (Figure 4), there is a general benefit of growing up on a farm but also for being a framer in adulthood. In adulthood, lower SES levels are found to create elevated morality risks. Interestingly, not for childhood although the insignificant effects of low SES in childhood with respect to adult mortality risk may reflect stringer mortality selection effects for this group.

For females (Figure 5, mobility from childhood to Middle Adulthood) we show that being and staying in the bottom in childhood and still in middle adulthood is associated with a 30% excess mortality risk after middle adulthood. In addition, females moving away from farming or from the highest SES category to the bottom 25 percentile is also associated with excess mortality. A price seems to be paid for females who move up a category (that does not involve farming) also endure significantly higher death rates.
For males (Figure 6, mobility from childhood to Middle Adulthood), we demonstrate that those in farming, those who remain from childhood to middle adulthood or those who become farmers, have lower rates of mortality in relation to the excluded group (starting and staying in the top 25 percentile). In addition, declines in SES are also associated with excess adult mortality risk.

Figures 7 and 8 depict Kaplan Meier Curves for women and men, respectively. We also show Kaplan Meier Curves for sex differences in survival (Figure 8). We note the family of curves that distinguish men and women, a powerful and consistent different across nearly all populations, envelopes the family of survival curves distinguishing the social mobility groups. This implies that the large social forces affecting survival that embody the shifts in class standing from childhood to middle adulthood are roughly on par with the differences separating male and female survival.

Discussion

This study linked childhood SES, indicated by occupation of parent, with adulthood SES, indicated by occupation, both based on the data derived from historic census records. We applied these data to assess determine whether childhood and adulthood SES influences later-life mortality risk. On balance, our results indicate that both childhood and adulthood SES are important predictors of later-life survival and therefore both childhood SES and socioeconomic mobility are important for understanding health outcomes in beyond middle adulthood.
Our study supports earlier efforts to link childhood circumstances to later-life health and suggests that the origins of late-life health begin at very early ages (Blackwell, Hayward and Crimmins 2001; Elo and Preston 1997; Freedman et al. 2008; Galobardes, Lynch and Smith 2008; Gavrilova 2003; Hamil-Luker and O’rand 2007; Hayward and Gorman 2004; Luo and Waite 2005; Smith et al. 2009). It also supports research indicating a role for social mobility (Hallqvist et al. 2002).
2004; Pudrovsk and Anikputa 2014b), and complement findings on health outcomes associated with social mobility based on UPDB data (Zimmer, Hanson, and Smith, 2015).

We note also that through the use of linked databases the study was able to connect life-course characteristics in an objective way that avoided the need for retrospective information. By using a population database, the study was able to incorporate a large amount of data measuring decades of the life course in two generations. With the ability to include micro-data from the US Census and linking these records to vital records and the UPDB, a broad variety of conditions in early life can be brought to bear on studies seeking to understand adult health, in the tradition of life course demography and epidemiology.

Farmer status was clear focus of our analysis given the era in question. While children, mostly boys, from farming backgrounds enjoy better later-life health outcomes, the effect is altered by transitions later in life. A male farmer in childhood and adulthood has better survival than others, including the persistently high SES men. The finding is suggestive of positive health impacts
associated with the type of life and labor that is characteristic of farm work for men. Farmer status has weaker effects on females. Indeed, females in our data are generally categorized according to their husband’s occupation. While their husband may be doing farm labor, wives may be doing housework and childrearing, which does not have the same health benefits of farm labor. These results are consistent with other research (Gavrilov and Gavrilova 2012).

Occupation has been less frequently used as a measure of SES in studies in the United States than in Europe. There are advantages of using occupation to indicate SES, particularly given its tendency to represent the range of experiences thought to be characteristic of a social hierarchy (Elo 2009). Our findings for males generally correspond with the results of Hayward and Gorman (2004) who demonstrated, using the National Longitudinal Survey of Older Men, that a strong impact of occupation of parents during childhood on mortality was mediated by adult SES and lifestyle characteristics.

There are limitations to the current study. Individuals in the current sample are likely to be longtime Utah residents since we required that they live in Utah for the years 1900-1930. In addition, the individuals must link into the UPDB from that era, another stipulation that requires more stable Utah residence. It is worth, therefore, reflecting upon how this sample selection may affect results of this study and how results may differ across other samples such as national ones. Utah does have a dominant religion and higher fertility levels and thus, more so than other states, Utahns may in some ways be more orientated toward family. If this is the case with the current sample, one might presume that connections across family members may be more consequential in Utah than elsewhere. At the same time, Utah does follow national trends of fertility, marriage and mortality which should generally preserve many of the associations seen in other populations. Of course, as studies traverse backward in time, they are bound by available data, a common challenge in historical demography and anthropology, but from which considerable insights have been derived.
(Knodel and Van de Walle 1979). There are also other contemporary and historic samples such as the BALSAC database from Quebec that have dominant religions and high fertility and their samples have led to important findings (Gagnon et al. 2009). We do not want to overstate the uniqueness of the current sample. The data represent individuals that are both members and non-members of the Church of Jesus Christ of Latter-day Saints and therefore contain considerable diversity in terms of demographic, socioeconomic, and health changes occurring over the past century (Zick and Smith 2006).

The findings in this draft focus on a cohort born 1885-1895 and who arrive as 35-44 year olds at the start of the Great Depression. This is a unique cohort and others will be explored in the larger more expanded paper. Our record linkage includes completed 1880 census records and will add 1940 in the coming months. These will also be added to the analysis as these data become available and linked into the UPDB.

In summary, this study adds to our understanding of childhood and early/middle adulthood socioeconomic influences on later-life health. The chances of having favorable health patterns late in life are partly determined early in life or even before life begins. However, chances are not set but are malleable given changes between childhood and adulthood SES. This suggests that social mobility has an important role to play in the health of middle-aged and older people as they move through their elderly years.
REFERENCES


Zimmer, Z., H. Hanson, and K.R. Smith. 2015. "Childhood Socioeconomic Status, Socioeconomic Mobility, and Old-age Health Trajectories: Connecting Early, Middle and Late-Life" *Submitted.*