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Fundamental resource dis/advantages, youth health and adult educational outcomes

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ABSTRACT

Recent studies find lasting effects of poor youth health on educational attainment but use young samples and narrow life course windows of observation to explore outcomes. We apply a life course framework to three sets of Health and Retirement Study birth cohorts to examine early health status effects on education and skills attainment measured late in life. The older cohorts that we study were the earliest recipients of U.S. policies promoting continuing education through the GI Bill, community college expansions and new credentials such as the GED. We examine a wide range of outcomes but focus on GEDs, postsecondary school entry and adult human capital as job-related training. We find that older U.S. cohorts had considerable exposure to these forms of attainment and that the effects of youth health on them vary by outcome: health selection and ascription group effects are weak or fade, respectively, in outcomes associated with delayed or adult attainment. However, poorer health and social disadvantage in youth and barriers associated with ascription carry forward to limit attainment of key credentials such as diplomas and college degrees. We find that the human capital – health gradient is dynamic and that narrow windows of observation in existing studies miss much of it. National context also matters for studying health-education linkages over the life course.

1. Introduction

The positive correlation between education and health remains one of the most well-established in the social sciences. From a life course perspective, it reflects human growth and development co-occurring across both domains over time, as facilitated by individual, familial and social institutional resources (Elder, 1994). This correlation, however, is not well understood (Cutler and Lleras-Muney, 2008, 2012; Krieger and Fee, 1994; Schnittker, 2004), and our ability to conceptualize and measure it is further challenged by recent re-structuring of the life course. A once-normative life course division, which locates schooling in youth and work in adulthood (Becker, 1964; Riley and Riley, 2000), has faded since the mid-20th century (Kohli, 1986). Educational participation now reaches beyond the adult childbearing years, into midlife and even older years (Astone et al., 2000; Jacobs and Stoner-Eby, 1998; Maralani, 2011; O'Rand et al., 2009; Sampson and Laub, 1996). As a result, education, which is a major component in the social determination of health, is no longer limited to youth or a prelude to the adult life course. It is now a dynamic, lifelong component of "emergent social health gradients" (Hertzman, 1999).

Conceptualization and measurement of the education – health correlation has also grown more complex due to a greater recognition that health status matters over all life course stages, but especially over "critical periods" including perinatal stages and youth. Early life course health deficits significantly reduce educational attainment (Case et al., 2002; Conley

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and Bennett, 2000; Cutler and Lleras-Muney, 2012; Haas, 2006), the deficits resulting from low parental resources as well as from biological vulnerabilities, environmental exposure or social policies that limit health care access (Case et al., 2002; Jackson, 2009; Rosenbaum, 2008). Growing up in a resource-poor household may exacerbate rather than explain negative youth health impacts on attainment (Aber et al., 1997; Geronimus et al., 1996).

Accounting for youth health is important in attainment research (Palloni, 2006). However, recent studies investigating the youth health-education correlation only observe attainment patterns over the early life course and most often stop at high school completion or postsecondary entry. Our study adds to the literature by exploring a wider range of attainment outcomes, much later in life: we argue that the point over the life span at which attainment is measured is substantively important in its own right. A narrow window of study censors observation because adult education in recent cohorts and, as we show, even in older cohorts, significantly contributed to total lifetime attainment. Measuring attainment in young samples misses, *by design*, age- and time-related educational gains (Maralani, 2011; Milesi, 2010). Furthermore, assessment of youth health effects on attainment in young samples is problematic because of selectivity: women, ethnic minorities and/or adults who experienced economic disadvantage in youth make up a disproportionately large share of adult students (Astone et al., 2000; Elman and O'Rand, 2004, 2007; Jacobs and Stoner-Eby, 1998; Maralani, 2011) and they are the same subgroups that are at the greatest risk of poor youth health. We use a longitudinal database of older U.S. cohorts, the Health and Retirement Study (HRS), to explore youth health impacts, by midlife or beyond, on self-reported human capital outcomes involving formal schooling and work-related skill (Becker, 1964).

2. Background

2.1. Theoretical Overview

Our emphasis on life stage timing advances life course theory; our study of older adults also invokes a key theoretical issue in social stratification and health: social selection versus social causation (Cutler and Lleras-Muney, 2008; McLeod and Kaiser, 2004; Palloni, 2006). The first section below briefly reviews relevant studies and highlights health selection effects on the development of human capital. The second section reviews relevant studies about adult educational participation and job-training over the latter twentieth century, reflecting that most adult education is work-related. Two human capital streams, of formal schooling and work-related skills training, versus formal schooling alone, are the main mechanisms underlying heterogeneous adult attainment outcomes (Becker, 1964; see Loewenstein and Spletzer, 1999; Veum, 1999 on school/training trade-offs and timing). Because the link between health and education likely varies by gender (Buchmann et al., 2008; Jacobs, 1995) and race/ethnicity (Astone et al., 2000; Crosnoe, 2006; O'Rand et al., 2009), the third section discusses social heterogeneity across these domains.

2.1.1. Health selection and attainment

A major debate in stratification research involves causal direction in the health-education link. A health selection viewpoint suggests that, in the aggregate, poor health precedes and therefore reduces potential educational and occupational status.[1] Poor health might initially reflect family resource disadvantage, genetic influences, environmental exposures, health system effects or a combination of factors. Once set in motion, however, poor health itself reduces educational attainment and triggers adverse social structural circumstances. Moreover, serious youth health deficits become more problematic over time. For example, an HRS study that tracks child health effects past midlife finds that poor health "follow(s) children into adulthood" (Case and Paxson, 2008: 463). The effects of poor health in youth become embodied, as indicated by shorter adult height and altered adult BMI (Cutler and Lleras-Muney, 2012). Parallel to this, "socioeconomic stunting" occurs: poor youth health lowers educational (Palloni, 2006) and occupational attainment (Haas et al., 2011) and via complex bio-social pathways, reduces cognitive ability late in life (Case and Paxson, 2008). This pattern of worsening health over time is found *within* parent socioeconomic status groups, post-stratification (Currie and Stabile, 2003), and across nations (Cutler and Lleras-Muney, 2012).

Scholars suggest we study how early health deficits reduce educational gains over the adult life course (Case and Paxson, 2008; Cutler and Lleras-Muney, 2008; Haas et al., 2011; Palloni, 2006), but study has been limited because most longitudinal U.S. databases – including the HRS – do not simultaneously track educational and health status changes over the adult years, for all ethnic groups or across cohorts. But we can surmise that physical disabilities or chronic conditions such as hearing impairments or ADHD provoke lifelong learning problems, due to the nature of the health deficits themselves or the medications required for treatment (Currie, 2005; Newachek and Halfon, 1998). For youth in school, health conditions and/or treatments often lead to school absences, altered attention spans and/or impaired cognitive development and learning (Klebanov et al., 1998; Newachek and Halfon, 1998; Ready, 2010). In addition, low- and middle-income U.S. families face difficulty in getting timely access to health care or managing long-term medical treatment regimens (Aber et al., 1997). We know that these influences shape the early life course and throw students "off-track" in attainment: they lead to grade retention, dropping out of high school and/or not advancing to college (Conley and Bennett, 2000; Haas and Fosse, 2008; Nagin et al., 2003).

[1] We do not address an alternate mechanism of health selection involving social downward mobility, or drift, due to emergent poor health status and economic costs of illness.

In contrast to a health selection viewpoint, social causation holds that fundamental resource disadvantages inherent in low status social positions most often precede, and therefore produce, ill health (Link and Phelan, 1995). This viewpoint predominates in sociology, whereas the health selection perspective above predominates in economic literature. Yet recent longitudinal studies find, once again, great complexity in the health-education link: elements from both pathways can co-occur to reduce educational attainment (Case et al., 2002, 2005; Crosnoe, 2006; Currie and Stabile, 2003; Conley and Bennett, 2000, 2001; Cutler and Lleras-Muney, 2008, 2012; Haas and Fosse, 2008; Haas et al., 2011; Needham et al., 2004; Palloni, 2006; Wells et al., 2003). Therefore, extreme positions about the causal ordering of these effects are receding; what is "new" in new studies, across disciplines, is that scholars formally test for these forces rather than assume or stress one causal direction of influence over the other (Case et al., 2002; Conley and Bennett, 2000; Cutler and Lleras-Muney, 2008; Haas, 2006; Palloni, 2006 as exemplars).

2.1.2. Educational expansion over the life course

The previous section highlights the important contribution that youth health status makes, alongside other early resource advantages, to attainment. This section highlights heterogeneity in lifetime human capital outcomes, largely due to dynamic U.S. educational institution arrangements and social policies that promoted non-normative school attainment timing in our cohorts of older adults. We start from the position that education, like health, is rooted in institutionally-based "strong forces"[2] (Kerckhoff, 1995, 2003) that shape access to schooling over the life course. Paradoxically, in the U.S. context, social institutional forces not only constrained individuals' school attainment by adulthood (Blau and Duncan, 1967; Hauser and Featherman, 1976; Shavit and Blossfeld, 1993), perhaps in a pattern of cumulative advantage (Dannefer, 1987; O'Rand, 1996), but also produced heterogeneity in educational trajectories, such that disadvantaged adults extended schooling beyond the early adult years (Astone et al., 2000; Elman and O'Rand, 2004, 2007; Maralani, 2011; O'Rand et al., 2009; Sampson and Laub, 1996).

Education and skills expansion into the midlife years partly reflects adults' greater propensities to participate. Why has this occurred? In the context of the older U.S. birth cohorts that we study, education in youth and work in adulthood involved different streams of human capital, formal schooling and job-related training. Much as Becker (1964) observed in these older cohorts, each stream was apportioned to its respective life stage; the sequencing in human capital fit youthful school and adult work patterns well. School attainment facilitated employer–employee job matching (Becker, 1964; Spence, 1973) and adult human capital, generally firm-specific job training, increased occupational status, income and job tenure (Hachen, 1992). For most, job changes occurred early in life, after school exits, as young adults sought job matches commensurate with their attainment (Hachen, 1992). Most employers relied on school attainment to estimate potential productivity in making long-term hiring decisions (Lazear, 1976).

However, many adults in the birth cohorts that we study faced military service (Sampson and Laub, 1996) and other unexpected circumstances that delayed or blocked schooling or job-related human capital. In addition, decades of changing technology (Spenner, 1995), restructuring of blue collar and of administrative service (white collar) occupational sectors (DiPrete, 1993) produced high rates of involuntary job loss, especially for midlife versus younger adults (Gardner, 1995). Adult human capital, as on-the-job-training, plateaued or declined by the 1980s, especially in the private sector (Yang, 2006). If job training was offered at all, it was targeted to men, the highly educated, skilled and younger workers (Brown, 1990; Knoke and Ishio, 1998). Adults were therefore propelled back to school or on-the-job training because all of these events triggered labor market re-entries, often involving job sector shifts, and because employers still used education and training to estimate productivity for hiring (Loewenstein and Spletzer, 1999; Veum, 1999). Lesser-skilled adults might turn to outside-of-firm skills-training, most often vocational in nature (Lynch, 1991; Veum, 1999). Other adults might self-sponsor formal schooling, also work-related and often vocational, to get certificates, or, less likely, to earn degrees (Elman and O'Rand, 2002, 2007; Elman and Weiss, forthcoming; Jacobs and King, 2002; Taniguchi and Kaufman, 2005).

Educational expansion into midlife also reflects growing gender equality in the returns to education (Buchmann et al., 2008; Goldin, 2006), in families' investments in schooling (Bailey and Dynarski, 2011) and rising variability in family formation timing (Astone et al., 2000; Blossfeld and Huinink, 1991; Jacobs and King, 2002; McClelland, 1990; Taniguchi and Kaufman, 2007). It is important to note that women in our older HRS cohorts still had significantly lower school attainment than did men by age 35 (Bailey and Dynarski, 2011; Buchmann et al., 2008; McDaniel et al., 2011; Torche, 2011) and limited access to skilled jobs. But with growing service sector opportunity by the 1970s, older women and ethnic minorities extended education over the life course. Many started formal schooling as adults, perhaps first earning GEDs (Maralani, 2011; Milesi, 2010). Others resumed studies if life events such as child-bearing or marriage had limited their ability to start or complete postsecondary degrees "on time" (Astone et al., 2000; Elman and O'Rand, 2007; Maralani, 2011; McClelland, 1990; Milesi, 2010; O'Rand et al., 2009; Taniguchi and Kaufman, 2005). Of importance, the adult schooling pattern tends to be drawn out, part-time and marked by school moves and starts and stops, whether progress to the degree occurs or not (Attewell and Lavin, 2007; Bozick and DeLuca, 2005; Goldrick-Rab, 2006; Jacobs and King, 2002; Taniguchi and Kaufman, 2005).

U.S. institutional arrangements facilitated adult access to high school and postsecondary school resources, thereby expanding education over the life course. National policies over the mid-twentieth century increased access based on

[2] "Strong forces' include neighborhood-level access to secondary schools of high quality (Williams and Braboy Jackson, 2005), institutional sorting including into "vocational" versus "academic" secondary-level and postsecondary trajectories (Ainsworth and Roscigno, 2005; Elman and O'Rand, 2007; Goldrick-Rab, 2006) and the financial ability to make "on-time" postsecondary school entries (Attewell et al., 2011; Bozick and DeLuca, 2005; NCES, 2005).

military (Sampson and Laub, 1996) or welfare-related eligibility (Boudette et al., 2000). Also, greater U.S. population access to secondary and postsecondary schooling, compared to populations in other countries, reflects public funding of tuition and institutional capacity: GI policies promoted schooling for returning war veterans and the Higher Education Act of 1965 facilitated massification of education, including expansion of community colleges for subgroups often identified as "non-traditional" students (Brock, 2010; Heckman and LaFontaine, 2010; Lazerson, 1998; Zemsky, 1998).

National policies promoting new credentials and degrees expanded educational participation as well. For example, the GED test was developed in 1942 to certify that World War II veterans who left high school for military service were equivalent to adults with high school diplomas, for the purposes of continuing education or work (Heckman and LaFontaine, 2010). Fig. 1 shows, for the three HRS cohorts that we study, by birth year, educational attainment milestones (mutually exclusive) of high school dropout; secondary completion by GED; secondary completion by diploma; postsecondary entry (some college); or 4-year college degree completion or higher. Most notable is the marked decline in terminal high school dropout status, over successive birth year cohorts of older men and women. Adults in this category had never resumed education (remained educationally disadvantaged) by late life.

A small proportion of HRS respondents, across birth year cohorts, earned GEDs. The GED is often considered to be a diploma equivalent in academic studies. But GEDs differ from diplomas. First, while ability appears to be similar across both high school credential groups, GED study intensity, content and wage values are less than that of the diploma (Heckman and LaFontaine, 2010). Second, GEDs reference delayed, often *adult education*. For example, the conditional probability that a non-high school graduate got a GED peaked around age 21 for Late Boomer cohort members (NLSY, born 1955–1964) and then stabilized well into the forth decade of life (Maralani, 2011). Although the HRS lacks longitudinal educational data allowing replication of this calculation for older cohorts, more than one-third of U.S. non-high school graduates between 1974 and 1990 obtained GEDs after age 25 (Heckman and LaFontaine, 2010; Jacobs and Stoner-Eby, 1998) with about 15–20% being older than age 35 (Snyder et al., 2008). These adults belong to the War Baby and Early Boomer birth cohorts that we observe in our study.

Also prominent in Fig. 1 is rising postsecondary attainment, that is, of having some college or a baccalaureate degree or higher. But, although the completion of baccalaureate or higher degrees rose, having "some college" most boosted our HRS birth cohorts' attainment. [We do not know if postsecondary attainment might have been preceded by diploma or GED because only the highest level of attainment is available in the HRS data.] As noted above, the opportunity for postsecondary entry was facilitated by policies such as the GI bill, and by new institutional program tracks such as community college and other non-baccalaureate programs that arose in the 1960s (Brock, 2010). By the late 1980s, students age 30 and older had become the fastest growing postsecondary segment (Lazerson, 1998). But parallel to the case of GEDs versus diplomas, adult students tended to enter non-baccalaureate programs, which had different academic content (Lazerson, 1998). Even when adults entered 4 year colleges, they tended to not complete baccalaureate degrees due to cost, work conflicts or part-time and/or non-continuous attendance (Attewell et al., 2011; Jacobs and King, 2002; Kane and Rouse, 1999; Maralani, 2011; Milesi, 2010; Taniguchi and Kaufman, 2005). Many adults used the GED as a stepping stone to postsecondary entry, which may have further limited postsecondary preparedness: Late Boomer GED recipients in their 20s were more likely than

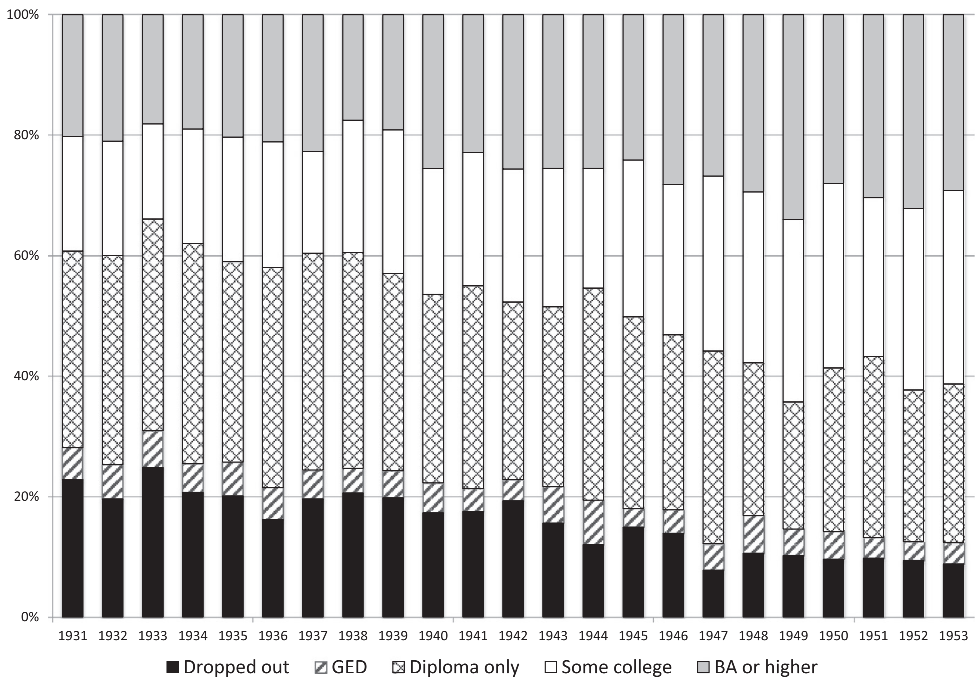

Fig. 1. Health and Retirement Study: Educational attainment by birth year, 1931–1953.

traditional high school graduates to enter 2-year colleges (Maralani, 2011; also see Taniguchi and Kaufman, 2007) but were less likely to ever transfer to 4 year colleges or earn higher degrees (Alburg et al., 2002). Between 1942 and 1977 about 40% percent of GED test-takers planned to pursue further studies.[3]

We return to the fact that most studies use young age samples to explore the association between youth health and educational attainment. This truncates the measured life course and poses a potential problem of censoring when examining the education–health correlation. For example, individuals in young samples considered to have "dropped out" or to have low attainment due to health effects may very well gain GEDs or enter college in later decades and be misclassified because of timing effects. We stress that Fig. 1 measures educational attainment late in life; as adults in midlife and older age, HRS respondents had many years to attain the levels of education reported. Jacobs and Stoner-Eby (1998) warn that part-time status and apparent low national [aggregate] adult enrollment rates by age group and year mislead us, in the direction of underestimating adult attainment gains, because adult students participate over many years. As we discuss next, censoring and timing effects also matter because the adults who (re)enter school or obtain on-the job training are significantly different from those who do not.

2.1.3. Ascriptive social divisions

Race/ethnicity and gender demark institutional resource allocations which, in turn, affect health (Link and Phelan, 1995; Williams and Collins, 1995). African American and Hispanic infants experience poorer health at earlier ages (Boardman et al., 2002; Sastry and Hussey, 2003; Sparks, 2009). They are less likely to receive prenatal care (Boardman et al., 2002; Sparks, 2009) or to be hospitalized for chronic conditions like anemia or asthma (Currie, 2005) hence cumulate more and multiple (co-morbid) health deficits that carry over across the adult life course (Geronimus et al., 1996). Health circumstances associated with race/ethnicity then play a direct role in educational attainment (Williams and Braboy Jackson, 2005). For example, perhaps 25% of the race gap in school readiness reflects health-related factors (Currie, 2005). Although relatively few studies explore gendered health differences in school attainment, poor low birth weight (LBW) girls, more than poor LBW boys (Currie and Hyson, 1999, Canadian data), and teen girls of shorter height, characteristics that are indicative of poorer health (Case and Paxson, 2008, UK and U.S. data), have higher rates of cognitive deficits and lower school attainment in adulthood.

Additionally, minority teens face educational barriers such as limited access to high quality schools (Reardon and Yun, 2001) due to neighborhood of residence (Williams and Braboy Jackson, 2005) or family resource effects (Roscigno, 1998). Limited school access then limits high school courses, guidance counselor assistance and college preparedness more generally (Attewell et al., 2011; National Center for Educational Statistics, 2005). Women, in all race/ethnic groups, may experience school institutional "steering" effects with regard to school prep for career tracks (Jacobs, 1995). HRS women and ethnic minorities also more often encountered family and work-related circumstances that triggered school dropout or delays (Attewell and Lavin, 2007; Taniguchi and Kaufman, 2007; Kerckhoff, 1995), and, as members of older cohorts, faced higher costs in postsecondary school entry and/or persistence, compared to men and non-ethnic-minorities.

When windows of observation close in early adulthood, health-education studies not only miss attainment over time but also social heterogeneity underlying added attainment. For while ethnic minority men and women of all ethnic backgrounds in the cohorts that we study were less likely than European American men to complete college (Buchmann et al., 2008; McDaniel et al., 2011), they had high rates of postsecondary participation. Fig. 1 illustrated rising postsecondary attainment across birth year cohorts; Fig. 2 focuses on gender, showing that War Baby cohort (born 1942–1947) and Early Boomer cohort (born 1948–1953) men had rising and high rates of baccalaureate or higher degree attainment, respectively. Women's rates of college or higher degree attainment also rose, but only Early Boomer women attained much beyond secondary schooling. And, unlike men, Early Boomer women were as or more likely to have stopped at "some college" as to earn baccalaureate or higher degrees.

Jacobs and Stoner-Eby (1998) find in their study of the Baby Boomer cohort that race/ethnic and gender gaps narrowed in postsecondary entry (some college) due to higher educational participation over the adult years, despite widening gaps in college completion. Hamil-Luker and Uhlenberg (2002) also find, in comparing two national cross-sections at the start and end of the 1990s decade, that race/ethnicity was less a predictive or even a non-significant predictor of midlife educational participation. Fig. 3 presents Years of Schooling Completed for the HRS sample, collapsing years in a way to highlight secondary and postsecondary attainment by gender and race/ethnicity. We find that the advantage in baccalaureate attainment by men was largely attributable to attainment by men of European American or Other ethnicity background. Beyond this, considerable, comparable experience of "some college," of around 20 to 25 percent, had occurred across subgroups by later life, except for Hispanic men and women. These figures and studies illustrate both convergence and divergence, by ascription, in the types and levels of educational attainment gained, when measured late in life. We address whether, in addition, differences in youth health also shaped school attainment and job training differences by later life.

2.1.4. Hypotheses

Numerous studies establish that family resource disadvantage and health deficits in youth contribute to academic failure, high school dropout, and a lack of postsecondary entry. Greater educational attainment, in the aggregate, accrues to those

[3] The early GED was also taken for work-related reasons as more than 40% reported between 1942 and 1977, when a second GED version was released. http://www.gedtestingservice.com/educators/history last accessed 01.28.13.

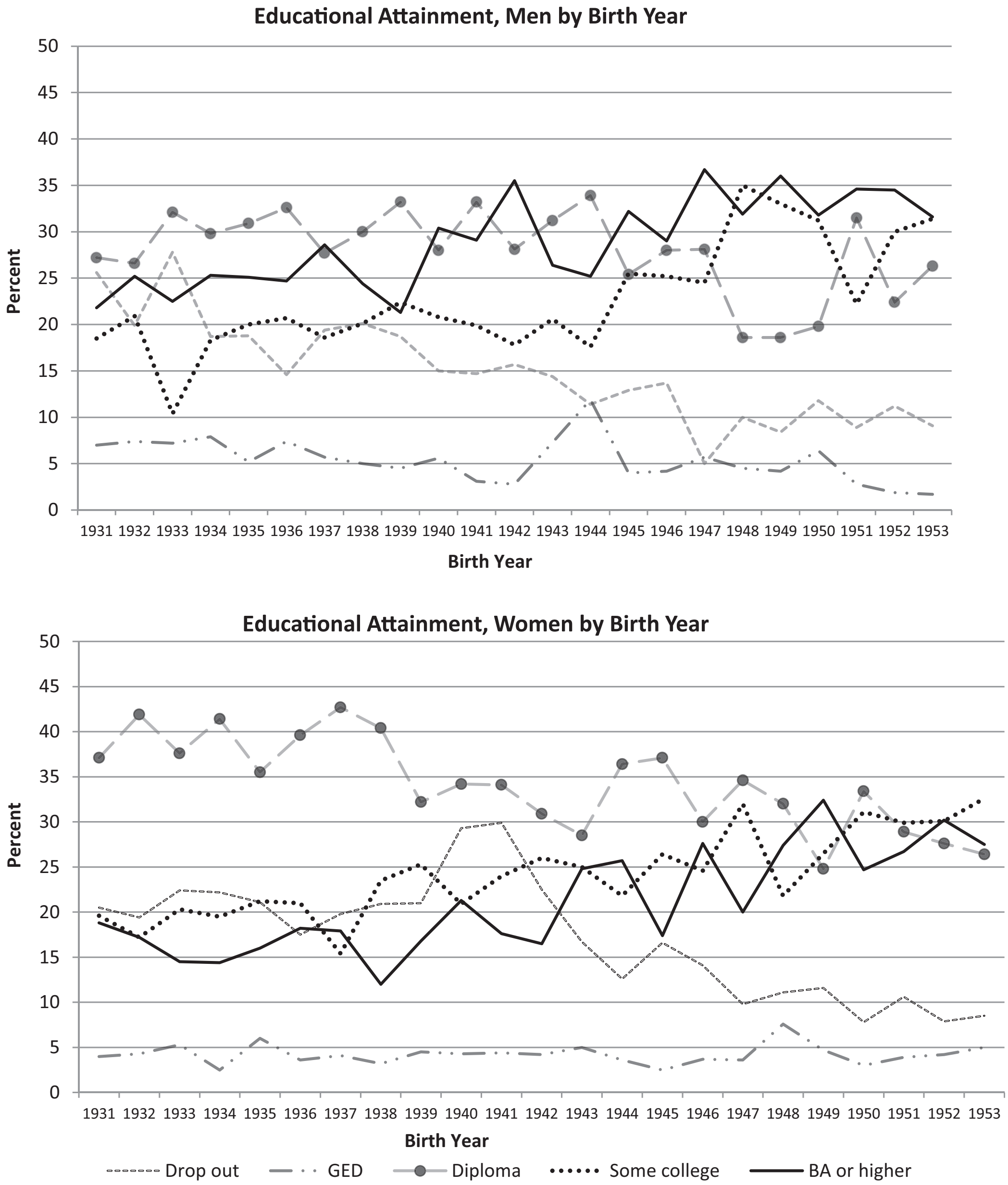

Fig. 2. (a) Health and Retirement Study: Men's educational attainment by birth year, 1931–1953. (b) Health and Retirement Study: Women's educational attainment by birth year, 1931–1953.

with early exposure to better life course resources and health, often in evidence of a Matthew effect or pattern of cumulative advantage (Dannefer, 1987; Merton, 1968; O'Rand, 1996); moreover, attainment gaps attributable to rising income inequality have only widened since the 1970s (Bailey and Dynarski, 2011). Yet numerous studies cited also establish that a low school attainment early in life does not preclude significant gains in adulthood—as mediated by circumstances and social policies. In terms of the mechanisms underlying adult human capital gains, a division of school and job training as noted by Becker (1964) is still relevant, although his views about life course timing no longer "fits" due to fading of tripartite segments of youth, adulthood and old age/retirement. Adults seek schooling because associated human capital or credentials (Spence, 1973) still anchor job matches—perhaps more so—in a rising flexible economy, for the unemployed of all ages. Also, greater job-based experience and skill still predict upward occupational mobility through job training (Loewenstein and Spletzer, 1999; Veum, 1999), although this human capital pathway is increasingly difficult to maintain with advancing age (Couch, 1998; Munnell et al., 2006). Similarly, health stratification models that apportion the life course so that schooling is of theoretical interest only to the point of adulthood do not "fit" what we know about the modern life course although theoretical mechanisms still hold: the effects of health and education, more broadly, continue to correlate or interwine over time. As noted by Palloni (2006: 596):

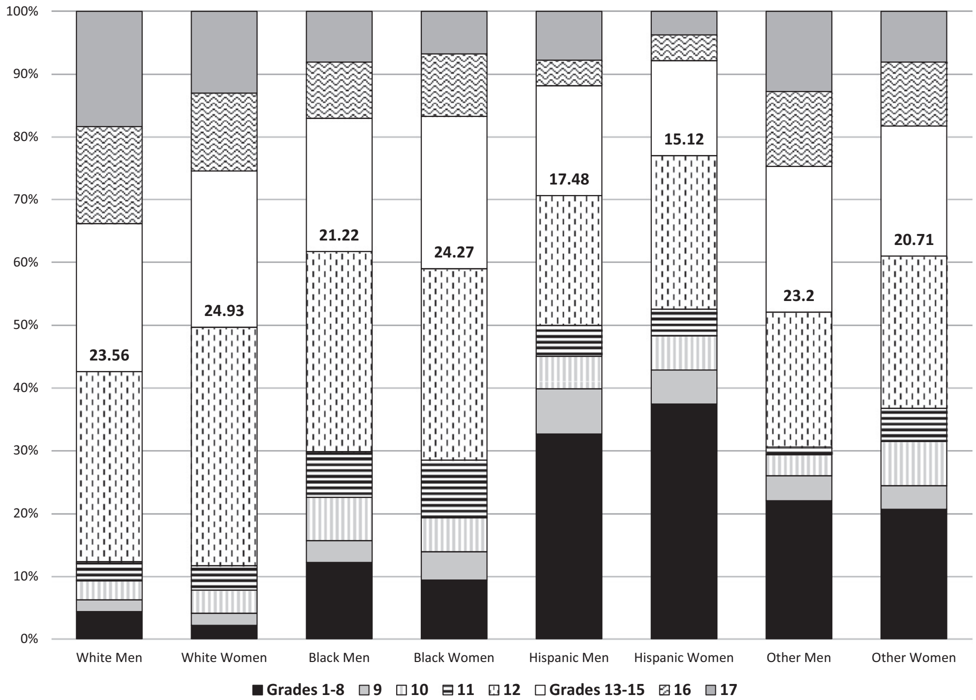

Fig. 3. Educational attainment as years of school completed, by sex and race/ethncity.

> The selection process…. requires that … childhood health status constrain individuals' choices and access to resources over part or all of the life cycle…. So that social class attained as an adult is a partial outcome of early health status.

Based on the above we expect to find that fundamental resource dis/advantage maintains strong, independent effects on human capital attainment, whether school or work-related:

H_1. Higher parental and family resources promote higher lifetime attainment (fundamental resource effects).

However, the key issue we explore pertains to youth health effects across the life course. We expect to find that:

H_2. Better youth health status, net of parental and family resources, significantly increases lifetime attainment while worse health status in youth reduces attainment (health selection effects). We examine a range of outcomes but pay special attention to the types of formal schooling most associated with adult education such as GEDs, postsecondary entry without degree completion and job-training.

With regard to the second hypothesis, we would much prefer to reject this, based on empirical tests, and to find support for the alternative of non-significance of youth health effects on attainment. Rejection of the second hypothesis in a sample where attainment is measured late in life – given that most studies using young samples find significant effects due to youth health – would indicate that adult formal schooling or job training may compensate, at least in part, for early health disadvantage. We caution that few or no studies of youth health have examined GED or college completion or work-related human capital. Testing another potential policy effect, we expect that:

H_3. Veteran status facilitates educational and work-related human capital gains, as measured late in life.

Although there is some health selection involved with enlistment and military service, our models control for health selection effects to the degree possible. We also will examine whether gender and race/ethnicity impacts attainment, over and above socioeconomic resources and health status in youth, and whether gender or race/ethnicity moderates the effects of youth health status on educational attainment. We expect to find that:

H_4. Ethnic minority men, especially African American and Hispanic men, and women have lower attainment net of early resource disadvantages and youth health.

Because learning problems in youth are possibly correlated with poor health, low parental resources and/or lower initial gains in schooling, we control for this effect across outcomes. And, because behavior problems in youth are associated with both poorer health (Crosnoe, 2006) and lower educational attainment trajectories (Nagin et al., 2003), we control for this as well. We also model effects across several older cohorts and control for cohort membership.

3. Data, operationalization and methods

3.1. Data sources

We use the Health and Retirement Study (HRS), a longitudinal, nationally representative database of middle-aged and older adults, to explore youth health status effects on human capital by later life. We note, as do Case and Paxson (2006), that current longitudinal U.S. databases cannot adequately track adult sequencing or fine-grained interrelationships between education, skills-training and health; the few studies able to do so are limited in that they either do not track activities through and beyond midlife (NLSY79) and/or lack childhood health measures (MIDUS, NSFH) or ethnic inclusiveness (WLS). Although the HRS is an excellent data source, it does not map the timing and sequencing of health and education or training spells. However, it is the most well-established U.S. database tracking adults from midlife to older age; in the 2008 wave, respondents were asked to retrospectively report on their childhood health status precisely to explore life course health effects.

The original 1992–1994 HRS waves interviewed persons born between 1931 and 1941 (ages 51–61 years) as well as adults age 70 and above, oversampling African American and Hispanic American adults. The HRS expanded in 1998 to include an additional older birth cohort and two younger birth cohorts, the War Babies (born 1941–1947) and Early Boomers (born 1948–1953). All living sample members were re-interviewed and new respondents were added in biennial waves after 1998. We use the RAND-J HRS database, an NIA- and SSA-sponsored file that uses all eleven HRS biennial waves, from 1992 to 2008, to tally, consolidate, or, when necessary, to provide the best estimates of responses to selected questions that have inconsistent or missing values across waves (St. Clair et al., 2010). We link RAND-J data to the 2008 HRS core interview file, the 2008 HRS tracker file and to corresponding data for respondents in the 1998–2006 HRS core files to supplement missing data, where possible. Our analytic sample then consists of RAND-J respondents in three cohorts, the original HRS cohort, the War Baby cohort and the Early Boomer cohort with non-missing responses to the 2008 HRS core cluster of youth health questions, with non-missing weights and with non-missing data on educational attainment and self-rated youth health (n = 11,134). Respondent-level sampling weights for 2008, provided in the RAND-J file, are used to analyze variable proportions, means and standard deviations in Figs. 1–3 and the Appendix. The weighted database is nationally representative (per March CPS) of all non-institutionalized U.S. adults ages 51–74 in 2008.

3.2. Dependent variables

3.2.1. Educational attainment

We examine two educational outcomes: (1) total years of school completed; and (2) attainment categories of high school dropout, high school completion by GED, high school completion by diploma, postsecondary entry (some college) and baccalaureate degree or higher. The harmonized (across waves) RAND-J variable Years of School Completed (''Raedyear'' variable) has 17 categories; we model this using an OLS method, with reported standard errors and significance tests adjusted by the method of White (1980), due to significant tests for heteroskedasticity. Categories of attainment are based on RAND-J's ''Raeduc,'' recoded to be mutually exclusive dummy variables: ''*dropout*'' (yes = 1), ''*GED*'' (yes = 1), ''*postsecondary entry*'' (yes = 1) or ''*baccalaureate degree completion or higher*'' with *high school diploma* as the reference category. Postsecondary schooling might occur in trade schools, business schools or universities and over any portion of the life course up until the interview; the HRS does not query respondents about the timing or place of study. Also, terminal 2 year degrees are not reported. This dependent variable is qualitative and we use SAS Proc Logistic to test a multinomial model (Glogit link function).

3.2.2. Work-related training

A second analysis examines youth health status effects in work-related human capital acquisition. This dependent variable is a respondent's report about obtaining work-related or *job training* of at least 100 h, whether in a vocational school or employer setting. This question was only asked of 1992 and 1994 respondents (the original HRS cohort) and only if they had 0–12 years of education. These respondents are recorded as having (''Readtrn'' from RAND-J): (1) job training, (2) no job training, or (3) not asked (skip pattern) about job training because the respondent had 13 or more years of school. This is re-coded as two dichotomies, with the first, *nocollege* = 1 (12 years or less of schooling) versus *nocollege* = 0 (respondent data is selectively missing as part of a skip pattern due to 13+ years of schooling). A second dichotomous variable indicates whether non-skipped respondents attended *job training* (1 = yes). Because only HRS 1992 and 1994 wave respondents with 0–12 years of education were asked about vocational training, our analytic sample is all HRS respondents in these two waves who had ever worked (N = 6578). We use a bivariate probit selection model to estimate two equations, *nocollege* (yes, or no due to the skip pattern) and *job training* (yes or no if *nocollege* = 1) because of survey design and because one or more unobserved factors determining the lack of college participation might also determine the probability of later life vocational training.

3.3. Independent variables

3.3.1. Youth health and development

A global domain of health status, *self-rated youth health,* (SRYH) is a reliable indicator of youth health (Haas, 2007). The question, *How would you rate your health from birth to 16?* was asked of the full sample in 1998 and, in subsequent waves, of all new respondents upon entry into the survey. While retrospective self-rated youth health measures are not ideal due to recall bias and other problems, they have been robust health indicators in HRS studies (Elo, 1998; Haas, 2007).[4] HRS respondents were again asked in 2008 to retrospectively estimate their health from birth to age 16 as part of a large cluster of questions pertaining to youth health conditions, learning problems and assorted health behaviors. To maintain a consistency of sourcing across respondents, the 2008 SRYH response is used. Approximately 600 respondents in the linked RAND J-2008 HRS file had missing values for SRYH in the 2008 HRS. Where possible, we filled in missing values with a previous response to the question, first in the 1998, then subsequent waves; ultimately 174 respondents, missing values across all waves, were dropped from the sample. Responses to the question ranged from excellent (1) to poor (5). This is reverse coded and used as an ordinal variable. We coded a set of dummy variables indicating *fair/poor, good, very good* versus *excellent self-rated youth health* as the reference; results do not substantively change by coding scheme and so we report the ordinal results (Manor et al., 2000).

We also examine adult height. Respondent height was measured at each HRS wave; we use the harmonized RAND_J variables and code respondent's maximum height reported over the waves, converted from meters to inches, as *height,* a continuous variable. In the 2008 series of HRS questions about youth health respondents were asked if they experienced learning problems up to age 16 to the extent that they regularly attended "special classes, received special training sessions, or had to attend a different school for more than six months." Even though embedded in the health questions, the learning problem question itself does not overtly suggest to respondents that past learning problems would or should be associated with past health status. The response was dichotomized to form a dummy variable, *learning problems* (yes = 1). 2008 core HRS respondents were also asked if they had regularly smoked or used drugs or alcohol in grade school or high school. Drug use, alcohol use and/or smoking in youth are combined as a *risk behavior* indicator if any pertained (yes = 1). Respondents with missing values for learning problems and risk behaviors are coded as "0," with missing dummy flags included in all multivariate models.

3.3.2. Economic need and social class

The HRS does not query respondents about family income (in dollars) in youth. Instead, respondents were asked at an initial interview and again in the 2008 HRS core cluster of health questions, about "aspects of your family while you were growing up from birth to age 16," including how well-off the family was. Economic need in youth is measured in a set of dummy variables where *poor family status* indicates that the family was very poor or "it varied," *average* that the family was "about average"; *well-off* is the reference category. If missing a value, the value from the 1998 or subsequent HRS wave is used. A RAND-J variable *parent education* harmonizes respondents' answers across waves to the question, "What is the highest grade your [mother/father] completed?" We average both parents' education, if reported, the reported parent's education if only one was reported and use the sample mean where both are missing. Dummy variables indicating missing responses for family SES status and parent education are used in all models.

3.3.3. Ascription

The measures for age, gender, race and Hispanic identity are drawn from the RAND-J file. Race/ethnicity is indicated by dichotomous variables representing African American (non-Hispanic), Hispanic, White (non-Hispanic), or Other. Indicators of *veteran status* and cohort membership, as *HRS* (born 1931–1941), *War Baby* (born 1942–1947) or *Early Boomer* (born 1948–1953, reference) are also obtained from the RAND-J and are coded as dichotomous variables.

4. Results

4.1. Educational attainment

Weighted descriptive statistics on our study sample are provided in the Appendix. We first examine Years of Schooling, using Ordinary Least Square models, to test the effects of resource dis/advantage, ascription and youth health on this form of educational attainment. In the next section we use multinomial models to examine educational credentials, such as GEDs, high school diplomas and baccalaureate and higher degrees.

4.1.1. Years of school completed

Table 1 reports Years of School completed by later life. The model in column 1 only contains health-related variables, to later assess mediation effects. All youth health variables are significant and suggest health selection (H_2): each unit increase in self-rated youth health (SRYH) and in height increase educational attainment, net of learning difficulties and early life course health risk behaviors. The second model includes ascription measures only. African American, Hispanic and Other ethnic group men have lower attainment than European American men (reference group). In addition, gender moderates the effect of ethnic background on Years completed for European American women, who have significantly lower attainment (coefficient of women) than European American men, and for African American women who have significantly higher attain-

[4] Haas (2007) found high reliability in self-rated youth health responses in the HRS and in two PSID waves; HRS reports from older HRS respondents were more reliable than those of older PSID respondents. Anchoring of responses (retrospectively changing one's report about youth health based on adult health status changes) was minimal and less of a problem for HRS than for PSID respondents.

Table 1
OLS regression: school attainment as years of school completed.

	Column 1 Parameter estimate (S.E.)	Column 2 Parameter estimate (S.E.)	Column 3 Parameter estimate (S.E.)	Column 4 Parameter estimate (S.E.)
Intercept	4.034*** (0.497)	13.394*** (0.046)	10.201*** (0.143)	5.976*** (0.661)
Ascription group				
Women	–	−0.291*** (0.057)	−0.292*** (0.051)	0.272** (0.085)
African American	–	−1.684*** (0.140)	−0.789*** (0.126)	−0.776*** (0.119)
Hispanic	–	−3.558*** (0.254)	−1.692*** (0.219)	−1.560*** (0.215)
Other Ethnic	–	−1.883*** (0.295)	−0.596* (0.249)	−0.549* (0.248)
Women * African American	–	0.726*** (0.166)	0.728*** (0.149)	0.646*** (0.142)
Women * Hispanic	–	−0.294 (0.326)	−0.404 (0.276)	−0.514 (0.272)
Women * Other Ethnic	–	−0.017 (0.370)	0.031 (0.311)	−0.045 (0.308)
Socioeconomic resources				
Parent schooling (years)	–	–	0.379*** (0.009)	0.351*** (0.009)
Poor SES in Youth	–	–	−0.963*** (0.096)	−0.886*** (0.094)
Average SES in Youth versus Well off in Youth	–	–	−0.570*** (0.084)	−0.570*** (0.083)
Health selection				
Self-Rated Youth Health	0.522*** (0.030)	–	–	0.220*** (0.025)
Height (Tallest recorded adult)	0.098*** (0.007)	–	–	0.056*** (0.009)
Risk Behaviors	−0.402*** (0.066)	–	–	−0.475*** (0.058)
Learning Problems	−1.227*** (0.175)	–	–	−1.113*** (0.150)
Veteran	–	–	–	0.520*** (0.073)
HRS Cohort (1931–1941)	–	–	–	−0.705*** (0.062)
War Baby Cohort (1942–1947) versus Early Baby Boom Cohort	–	–	–	−0.181* (0.076)
Adj. *R* Square	0.057	0.118	0.326	0.354
N	11,134	11,134	11,134	11,134

Note: S.E. corrected by method of White.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

ment than African American men. Overall, as expected (H_4) and indicated in Fig. 3, attainment is significantly higher for European American men.

Model 3 in column 3 adds socioeconomic resource variables to ascription group effects. As expected (H_1) adults with more educated parents or who were well off in youth, relative to growing up in poor families or even in families of average means, had completed significantly more years of schooling. Adjustment for socioeconomic resource effects reduces ethnic attainment gaps by more than half, but does not eliminate them. The final model in column 4 adds youth health variables and controls for cohort and veteran status. SRYH and height coefficient sizes are reduced by about half when compared to Model 1 in column 1, but remain significant. The added variables have minimal impact on ascription group effects, with the exception that European American women's attainment becomes significantly higher than European American men's attainment with the adjustment.[5] Comparing column 4 to column 3, socioeconomic resource coefficients remain substantively

[5] In intermediate analysis, adding veteran's status, alone, to a model with ascription group and socioeconomic resources moves the coefficient for women to insignificance. Variables testing moderating effects of parent socioeconomic status, gender and race/ethnicity * SRYH did not improve model fit by *F* test of full and reduced models, as a group, and are not shown. In a Bonferroni correction for multiple ascription group comparisons, in Model 4, the coefficient for "Other" Ethnic group fails a test of significance; the adjusted $p = 0.0018$; the coefficient is significant at $p < 0.027$.

Table 2
Multinomial regressions: school attainment as dropping out, GED, some college or BA or higher versus diploma.

	Dropped out versus Diploma			GED versus Diploma			Some College versus Diploma			BA or Higher versus Diploma		
	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b	Model 4c
Ascription group	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR
Women	0.80**	0.85*	0.49***	0.65***	0.68***	0.92	0.85**	0.83**	1.37**	0.56***	0.54***	0.66***
African American	3.02***	2.16***	2.05***	0.78	0.63*	0.76	0.93	1.10	1.08	0.46***	0.64**	0.58***
Hispanic	5.94***	2.80***	2.43***	2.04**	1.39	1.63	0.97	1.48	1.65*	0.45**	0.94	0.92
Other Ethnic	4.76***	2.38***	2.18***	1.40	0.98	1.03	1.62*	2.31***	2.29***	1.22	2.21***	2.08**
Women ∗ African American	1.06	0.99	1.11	1.87*	1.85*	1.57	1.28	1.36	1.29	1.84**	2.08***	2.16***
Women ∗ Hispanic	1.44	1.52	1.74	0.88	0.93	0.79	1.18	1.11	1.01	1.23	1.05	1.12
Women ∗ Other Ethnic	1.34	1.43	1.72	1.38	1.46	1.28	0.97	0.97	0.90	1.15	1.17	1.23
Socioeconomic resources												
Parent Schooling (years)	–	0.83***	0.83***	–	0.91***	0.91***	–	1.16***	1.14***	–	1.32***	1.31***
Poor SES in Youth	–	1.84***	1.78**	–	2.79**	2.73**	–	0.65***	0.64***	–	0.48***	0.50***
Average SES in Youth versus Well off in Youth	–	1.19	1.20	–	1.52	1.57	–	0.58***	0.58***	–	0.48***	0.46***
Health selection												
Self-Rated Youth Health	–	–	0.81***	–	–	0.82***	–	–	0.99	–	–	1.15***
Height (Tallest recorded adult)	–	–	0.97**	–	–	0.97	–	–	1.03**	–	–	1.05***
Risk Behaviors	–	–	1.27**	–	–	1.93***	–	–	1.03	–	–	0.50***
Learning Problems	–	–	2.25***	–	–	1.18	–	–	0.68*	–	–	0.31***
Veteran	–	–	0.42***	–	–	1.80***	–	–	1.63***	–	–	0.95
HRS cohort (1931–1941)	–	–	1.92***	–	–	0.86	–	–	0.52***	–	–	0.60***
War baby cohort (1942–1947) versus Early Baby Boom Cohort	–	–	1.06	–	–	0.88	–	–	0.68***	–	–	0.89
Model Chi Square	1145.56	3846.9	4697.02									
df	28	48	76									
Pseudo *R* squared	0.103	0.307	0.362									
N	11,134	11,134	11,134									

* $p < .05$.
** $p < .01$.
*** $p < .001$.

unchanged; this suggests that the clusters, although intercorrelated, involve somewhat independent mechanisms, each contributing to attainment. As expected (H_3), veterans have significantly higher attainment than non-veterans and the Early Boomers (reference category, born 1948–1953) have significantly more years of schooling than adults in the original HRS (born 1931–1941) or War baby cohorts (born 1942–1947).

In all, socioeconomic resources (H_1), health selection (H_2) and veteran's policies (H_3) strongly influenced attainment in this older sample. There is support for (H_4), that gender and race/ethnicity shaped attainment over and above other effects, but with some unexpected turns. Based on the full model, older cohorts of European and African American women had closed ethnic gender gaps in attainment by late life, when attainment is measured as years of schooling.

4.1.2. Educational attainment levels and credentials

The models in Table 1 explored school attainment as cumulative years of schooling, an outcome often used in attainment studies, but this outcome does not highlight degrees. Table 2 presents a multinomial model with four outcomes: high school drop-out with non-completion over the life course (column 1); high school completion by a GED equivalent (column 2); a lifetime transition into postsecondary school or "some college" (column 3); and postsecondary completion with a baccalaureate degree or higher (column 4). All outcomes are compared to high school completion by diploma (reference category). Categorical depictions of the outcomes were presented in the Figures. All results are reported as relative risk ratios. Because Type 3 analyses of effects find that Women ∗ Hispanic and Women ∗ Other ethnic group interactions are not significant, we do not report variable significance in equation contrasts. A model with youth health effects only (not shown, available by request) finds better SRYH significantly reduces the relative risk of dropping out or obtaining GEDs versus diplomas and increases the risk of college or higher attainment. Increased height, in contrast, significantly reduces the relative risk of dropping out versus diplomas. It also increases the risk of some college or college or higher attainment versus stopping at the diploma.

The first outcome shown in Table 2 is dropping out versus completing high school with a diploma. Ethnic minority men (represented by coefficients for African American, Hispanic and Other race), across models (1a–1c), have a higher relative risk of dropping out versus getting a diploma, compared to European American men (reference). European American women (coefficient of female), however, are less likely to have remained in "dropped out" status throughout adulthood, compared

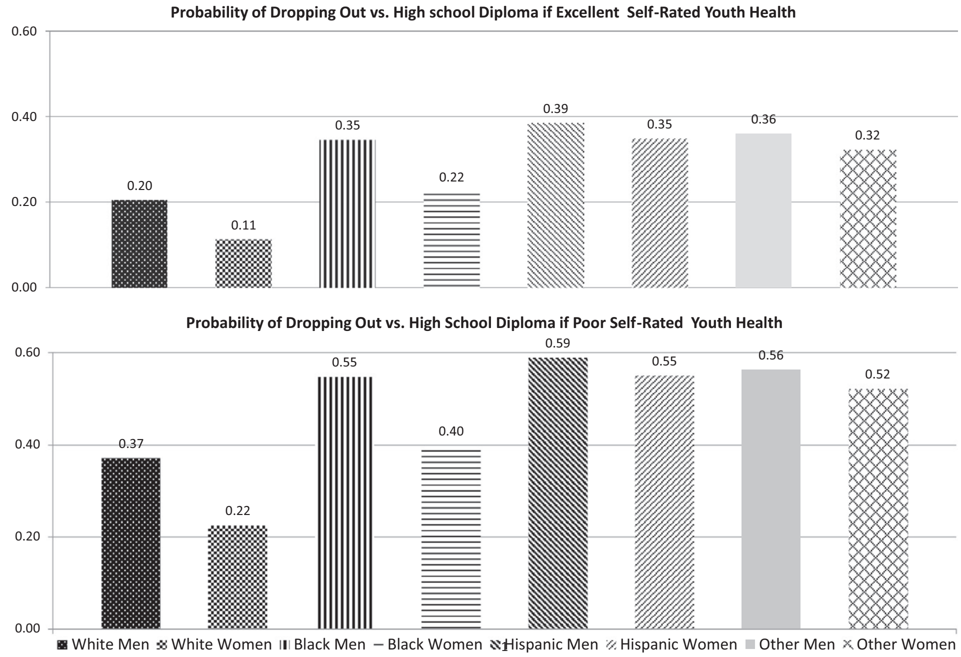

Fig. 4. (a) Probability of dropping out versus high school diploma if excellent self-rated youth health. (b) Probability of dropping out versus high school diploma if poor self-rated youth health.

to ethnic male peers. The addition of socioeconomic resource variables in model 1b attenuates ethnicity-based risk ratios but they remain significant. Each year of parent schooling reduces the relative risk of dropping out versus getting a diploma by about 17%. Also, compared to well-off youth (reference), growing up in a poor family of origin increases the risk of dropping out by about 84% (model 1b). Model 1c adds youth health variables. They are significant, consistent with health selection effects; a one level increase in SRYH leads to a 19% reduction in the relative risk of dropping out of high school. Greater height reduces, while learning problems and risk behaviors in youth increases the risk. Veterans have a lower relative risk than non-veterans, and original HRS cohort members have a higher relative risk of dropping out of high school versus not earning diplomas compared to Early Boomers. The drop out risk is not significantly different for members of the War Baby cohort than Early Boomers. Comparing models 1b and 1c, only small changes occur with the addition of the health variables.

Although race/ethnicity does not moderate the effect of SRYH on attainment (not shown), ascription and SRYH can combine in ways to strongly shape lifetime attainment. Fig. 4 presents the probability of high school dropout versus diploma status by late life, for men and women with different ethnic backgrounds. This is based on full equation coefficients in model 1c, calculated at the point of "excellent SRYH" in the top panel and "poor SRYH" in the lower panel, at the variable means for all non-ascription group variables plus intercept. Results suggest that, based on SRYH value shifts alone, the probability that European American men, members of an educationally advantaged subgroup, dropped out of high school versus gained a diploma, ranged from .20 (excellent health) to 0.37 (poor health), net of other effects. Based on this, European American men with poor SRYH were more likely to drop out versus get a diploma than all HRS subgroups in the figure, given their excellent SRYH, save Hispanic men (probability of dropping out 0.39). Other comparisons are less extreme but these results illustrate youth health's considerable impact on this one educational outcome.

The second set of equations (columns 2a, 2b, 2c) models the relative risk of completing high school with a GED versus a high school diploma. In model 2a, with ascription group effects, Hispanic men have a significantly higher risk of obtaining GEDs versus diplomas, compared to European American men. Also, African American women have a higher risk while European American women have a lower risk of obtaining GEDs than male ethnic peers. The addition of socioeconomic variables (2b) finds that growing up in a poor family increases the risk of having obtained a GED versus diploma by later life; risk is not significantly different based on growing up in "average" socioeconomic status families.

The final model (2c) adds youth health variables. Of interest is that ascription effects become non-significant. Also of interest is that youth health variables differ in significance: better SRYH reduces GED versus diploma odds, apparently facilitating "on time" rather than delayed high school completion, while height and past learning problems do not directly influence this form of attainment. This may be because GED tests are often taken and passed with relatively little intensity of learning (Heckman and LaFontaine, 2010); consistent with this, a history of learning problems does not pose a barrier to this form of attainment. But youth risk behaviors promote GEDs versus high school diplomas; perhaps risk-taking both precludes the timely earning of diplomas and yet facilitates retracing steps to take the GED exam. As the GED was developed for veterans it is not surprising that they are more likely to get GEDs than diplomas. Consistent with Figs. 1 and 2 cohorts do not significantly differ in getting GEDs versus diplomas.

The third set of equations explores postsecondary entry ("some college"). In the first two contrasts (models 3a and b), Other ethnicity adults have a higher relative risk of postsecondary entry than European American men (reference). European American women have a lower risk of entry than European American men. Model 3b shows that youth socioeconomic resources strongly influence postsecondary attainment by late life. Each year of parent schooling increases the relative risk of postsecondary entry by about 16% and growing up in a poor family reduces the lifetime risk of postsecondary entry by 35%. Indeed, even growing up in a family of average means versus being well off reduces the lifetime risk of postsecondary entry by about 42%.

The third contrast (model 3c) adds youth health variables which again vary in significance. Greater height is associated with an increased relative risk of some college attainment, perhaps signifying better early nutrition or other developmental advantages. Consistent with this, learning problems are barriers to higher learning. Veterans are more likely to have some college. With adjustment for these effects, Hispanic and Other ethnic adults' relative risks of having some college versus stopping at diplomas are significantly higher than, and African Americans' risks are comparable to that of European American men (we do not graph this outcome). With adjustments in the third contrast, European American women have a higher risk than European American men of postsecondary participation versus having stopped at a high school diploma.

The final outcome in this table is attainment of a baccalaureate degree or higher versus a high school diploma (models 4a–4c). Negative ascription group effects, as barriers to credential attainment, strongly re-emerge. Hispanics have significantly lower attainment than European Americans (model 4a) and European American women and African American men have significantly lower attainment than ethnic gender peers.[6] Greater socioeconomic resources in youth (model 4b), particularly being "well off" versus being poorer or of average means significantly boost lifetime college-level or higher attainment. However, adjustment for socioeconomic resources eliminates the Hispanic ethnic attainment gap and significantly widens the attainment gap in favor of persons of Other ethnicity relative to European Americans.

In the final contrast (model 4c), all youth health variables are significant: a unit increase in SRYH increases the relative risk of having baccalaureate or higher attainment versus stopping with a diploma, by 15%. Learning problems and risk behaviors significantly reduce college degree attainment. Members of the War Baby cohort are as likely to complete college as the Early Boomers when youth resources are considered. But, surprisingly, veteran status is not significant; the policy incentives associated with veteran status that boost attainment of some college, do not promote the completion of higher degrees. Fig. 5 illustrates the probability of college completion or higher, for men and women with different race/ethnic backgrounds, based on full equation coefficients in model 4c, calculated at the point of "excellent SRYH" in the top panel and "poor SRYH" in the lower panel, at the variable means for the non-ascription group variables and intercept. Although Other ethnic background adults and European American men have relatively high probabilities of baccalaureate or higher attainment, the contrasts show, as in Fig. 4, that the impact of SRYH on attainment is considerable across subgroups.

To summarize our findings in Table 2, the impact of youth socioeconomic resources on attainment are marked (H_1): adults from poor versus well off families were significantly less likely to complete high school at all (remaining in dropout status), were less likely to earn diplomas versus GEDs if they did complete (indicative of non-normative degree timing) and were less likely to enter or complete postsecondary schooling at the baccalaureate level. Even youth from "average" families were less likely to have entered or completed postsecondary schooling by late life. With the addition of youth health variables, across outcomes, family resource coefficient sizes, signs and significance changed relatively little: socioeconomic resource disadvantage blocked attainment. However, poorer youth health status (H_2) also significantly impeded high school and college degree completion. We found some ambiguity about health selection effects with regard to earning GEDs versus diplomas or postsecondary entry versus diplomas because findings differ for SRYH and height across outcomes. These health indicators appear to measure different health domains, which may or may not play a role in different attainment outcomes. We return to this in the discussion.

We find partial support for H_3: veteran status promoted educational attainment in these cohorts, although to a point; it did not promote college completion or higher. Postsecondary completion for veterans may have reflected contemporaneous life course and family events or institutional factors (Tinto, 1987) as much or more than national policies. Unfortunately, the HRS does not contain retrospective event history data or contextual data to examine this. We also find partial support for H_4 across outcomes: African American, Hispanic and Other ethnic males and females faced significant barriers to "on time" or "on track" high school completion (diplomas). However, if ethnic minority men and women could complete high school they gained considerable access to "some college" by late life. In other words, postsecondary entry, measured in late life, most reflected youth socioeconomic resource dis/advantage and health status possibly via developmental forces as tapped in height. Adjusting for this, ascription-as barrier-effects disappeared or reversed, for college entry. While ascription barriers re-emerged for college completion, results also reflect a fading of life course barriers to participation given U.S. policies that promoted postsecondary educational expansion.

4.2. Vocational skills attainment

We test a further pathway in the process of socioeconomic stunting (Haas et al., 2011), where attainment of human capital skills associated with work and occupation might be blocked, over time and life stage, due to poor youth health status

[6] A Bonferroni correction for multiple ascription group comparisons shows, for models 1c–4c, that ascription group coefficients are all significant at an adjusted $p = 0.0018$ with the exception of Hispanic in Model 3c which fails a test of significance at this level.

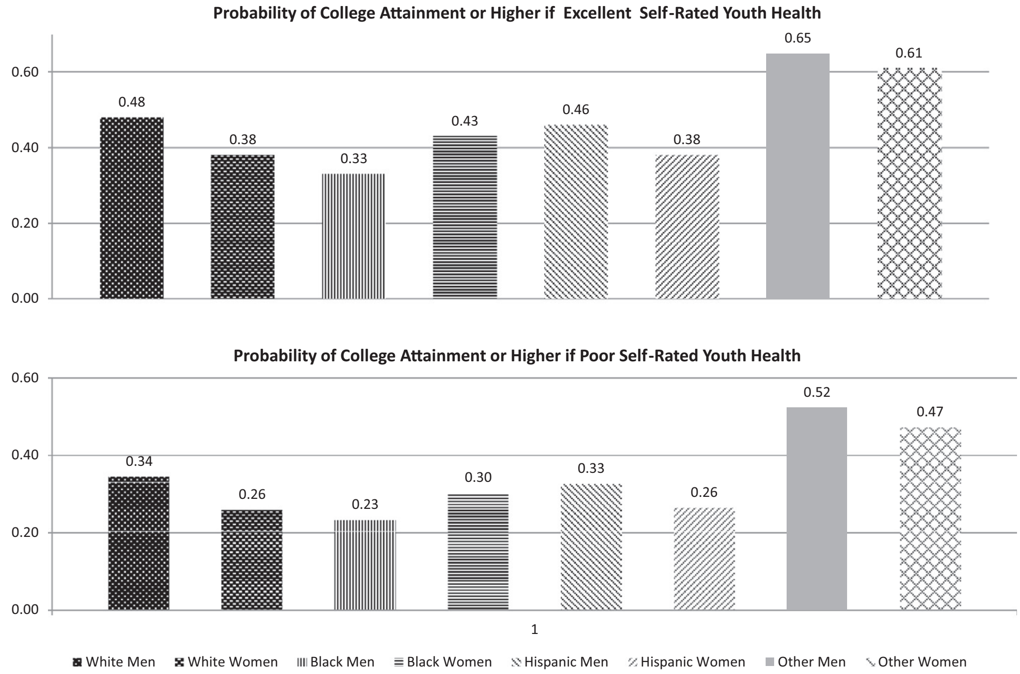

Fig. 5. (a) Probability of college attainment or higher if excellent self-rated youth health. (b) Probability of college attainment or higher if poor self-rated youth health.

among other factors (Palloni et al., 2009). Job training confers specific employer or job-related skills that, once learned, are remunerated by current employers. There is also growing evidence that employer-sponsored job training is remunerated by future employers (Elman and Weiss, forthcoming; Loewenstein and Spletzer, 1999; Veum, 1999). This type of learning, for HRS cohorts, "built upon" a human capital foundation of formal education, hence was cumulative from youth (Becker, 1964). Questions about receipt of 100+ hours of vocational training were asked of all HRS respondents who did not have college-level education. Thus this analysis includes, along with high school completers, the most educationally disadvantaged of HRS adults – those who never completed high school, whether by diploma or GED, late in life. We further constrain the sample to only include respondents who ever worked for pay. We expect to find that youth health deficits reduced work-related human capital, net of parental socioeconomic resources, ascription group, prior level of high school attainment, such as having a diploma or GED (versus neither), and veteran status, indicative of prior non-cognitive skills training if not occupational skills training.

Table 3 presents a two-stage analysis; Models 1 and 2 present coefficients and standard errors for *nocollege* and *job training* equations. Column 1 in the first model predicts not attending college (*nocollege* = 1). Better childhood resources (H_1), better SRYH and greater height (H_2) and veteran status (H_3) decrease the likelihood of *nocollege* status or not attending college. Other ethnicity adults are significantly less likely, Hispanic adults are equally likely and African American men are significantly more likely to have had *nocollege*, relative to European American men; African American women are more likely to have attended college than their ethnic male peers. The second column of the first model adds youth health effects only, finding that height and prior risk behavior, not SRYH or learning problems, significantly increase the likelihood of job training.

Model 2 presents the full bivariate equations[7] and there are again few differences in *nocollege* estimates (column 1). In the full job training equation, African American women are significantly more likely to receive job training than ethnic male peers.[8] Otherwise, significant effects reference school attainment: respondents with diplomas and GEDs[9] are more likely to have job training than adults without high school credentials. Also, veteran status (H_3) promotes job training. Net of these effects we find little support, in the full model, for enduring socioeconomic resources (H_1) or health selection (H_2) effects. However stratification in human capital, as diplomas, GEDs and veterans training, had occurred earlier in the life course, strongly shaped by childhood resources and youth health.

5. Discussion

Recent research establishes that early life course health deficits reduce educational attainment although the current studies limit the period of observation to the teen years or to the years surrounding the transition to adulthood. Our study adds to

[7] We tested bivariate probit equations with *job training* effects for ascription only; this is available by request.
[8] We cannot link vocational training to specific jobs held as this is not reported.
[9] We do not know whether GEDs preceded or followed job training.

Table 3
Bivariate probit models: Factors predicting job training if no college.

	Model 1				Model 2			
	No College		Job Training		No College		Job Training	
	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE	Parameter Estimate	SE
Intercept	1.734***	0.145	−1.472***	0.346	1.818***	0.148	−0.948	0.605
Ascription group								
Women	−0.034	0.020	–	–	−0.037	0.020	−0.084	0.076
African American	0.101***	0.026	–	–	0.095***	0.027	−0.007	0.094
Hispanic	0.025	0.346	–	–	0.002	0.036	−0.206	0.126
Other Ethnic	−0.148**	0.047	–	–	−0.162**	0.049	−0.048	0.192
Women * African American	−0.127***	0.031	–	–	−0.106**	0.033	0.255*	0.119
Women * Hispanic	−0.036	0.044	–	–	−0.035	0.046	0.110	0.160
Women * Other Ethnic	0.071	0.058	–	–	0.064	0.061	−0.070	0.232
Health selection								
Self-Rated Youth Health	−0.024***	0.006	−0.011	0.020	−0.024***	0.006	−0.010	0.022
Height (Tallest recorded adult)	−0.320***	0.080	0.543**	0.202	−0.367***	0.082	0.116	0.316
Learning Problems	0.137***	0.038	0.022	0.119	0.138***	0.038	0.041	0.130
Risk Behaviors	0.058***	0.014	0.195**	0.048	0.056***	0.014	0.168	0.052
Parent resources								
Parent Schooling (years)	−0.051***	0.002	–	–	−0.052***	0.002	−0.005	0.016
Poor Child SES	0.023*	0.012	–	–	0.027*	0.012	0.058	0.044
Human capital								
Veteran	−0.123***	0.017	–	–	−0.102***	0.017	0.252**	0.077
GED	–		–	–	–	–	0.565***	0.079
Diploma	–		–	–	–	–	0.460***	0.053
Rho	–		0.458***	0.039	–		0.293*	0.118
LL	−6603				−6526			
N	6578				6578			

* $p < .05$.
** $p < .01$.
*** $p < .001$.

the literature by exploring health effects on attainment across a wider range of educational outcomes and at the end of a longer span of years: middle to older age. We examine the most heavily researched outcomes, years of school completed and high school dropout versus completion, but are interested in the credentials and educational activities associated with "non-traditional" students as well: GEDs, postsecondary school entry and adult human capital as job-related training. Although we cannot account for the life course timing of attainment with HRS data, we find that three older U.S. cohorts had considerable exposure to these transitions. High school dropout status declined, in small part due to GED policies adopted in 1942. In addition, postsecondary attainment, especially having some college, steeply rose in succeeding birth cohorts, across U.S. ascription groups, although Hispanic adults had relatively less.

We examined factors that facilitated or impeded school and job-related human capital attainment for these older adults. With regard to formal schooling, we found patterns of social advantage: limited early life course resources (H_1) led to fewer years of completed schooling. Lower resources also increased the likelihood that an adult had: never completed high school or completed it after dropping out (GED) versus on-time and on-track (diploma); not entered college or earned a college degree versus stopping at the high school diploma. Unfortunately, we cannot distinguish with HRS data whether early, high status advantage was maintained or grew over the life course (Ferraro and Kelley-Moore, 2003; O'Rand, 1996). We also examined whether youth health status independently contributed to limiting attainment and found significant effects across outcomes, save job training, in evidence of health selection (H_2). Overall, we cannot reject H_1 or H_2 with regard to school attainment outcomes in HRS cohorts. Socioeconomic resource effects neither overrode nor fully explained youth health status effects in estimating different forms of school attainment.

The association or link between youth health and educational attainment, however, differed by attainment outcome and health domain. For example, adult height significantly impacted all educational outcomes, save earning GEDs versus diplomas, where ability may matter less (Heckman and LaFontaine, 2010). Adult height was also implicated, indirectly, in job training. Did poorer youth health impair the lifetime ability to learn higher order material, especially important in postsecondary education and employment? Case and Paxson (2008) find that adult height – underpinned by earlier life course patterns pertaining to low birth weight, nutritional deficits, exposure to illness and other potential health shocks – is indeed strongly correlated with ability and cognitive functioning. In contrast, poorer youth self-rated health reduced the probability of high school completion, of getting a high school diploma versus a GED if completed, of completing college versus stopping with high school, but was not a barrier to postsecondary school entry. Thus, poorer global health status may indicate reduced capacity to partake in higher intensity activities associated with completing degrees, involving non-cognitive competencies as well as ability (Palloni et al., 2009). Poor self-rated health might limit the aspirations or the intention to complete school (Jacobs and King, 2002). Our findings raise many questions about how and why youth health effects limit learning over different portions of the educational life course.

We also cannot reject H_4, pertaining to ascription group differences in attainment, especially for outcomes involving years of school completed, dropout status and college completion (versus diplomas). But youth resources and health status predict GED receipt more than race/ethnicity and unmeasured factors associated with ascription group membership not only eliminated attainment gaps but *increased* postsecondary entry probabilities for some ascription groups relative to European American men. Also, ascription had less impact on job training, in the full model. This pattern of findings is important: negative health selection and ascription group effects, while present, are relatively weaker, by significance and effect size, for outcomes associated with delayed or adult attainment: GEDs, postsecondary entry and job training. In addition, veteran status (H_3) is strongly significant in these outcomes. The pattern of findings hints at powerful "push factors" underlying educational expansion over the life course, especially among nontraditional students, perhaps defined in terms of age and/or minority group membership, due to national and state educational policies, work and family circumstances described earlier. In this context, formal schooling or job training appears to have been gained, despite earlier health deficits.

Most youth health studies use young samples to study high school dropout or postsecondary entry and find significant selection effects, attributed to poor youth health. The effects we find in the HRS sample, where attainment is measured late in life, suggests that, at least for some forms of attainment, including high school dropout or postsecondary entry, youth health effects may be over-estimated. But it is important to understand that the relatively open U.S. educational system is critically important here as well. The powerful "push factors" toward enrollment that we find reflects U.S. policies that facilitated and promoted adult education. If studies of youth health effects on attainment have ignored age/life stage issues, they also have not raised the issue of potentially strong, confounding effects in the health-education correlation due to different policies (Cutler and Lleras-Muney, 2012). This latter issue is important because findings in UK and Canadian data are often generalized to the U.S. If considerable U.S. adult attainment is possible despite youth health deficits, it is partly because mid-twentieth century U.S. policies facilitated population access to formal schooling via expanded postsecondary capacity, public tuition supports, the development of new credentials and veteran's policies. As policies boosted enrollment in postsecondary schooling and off-site job-related training (Attewell and Lavin, 2007; Jacobs and Stoner-Eby, 1998; Lynch, 1991; Maralani, 2011), older HRS birth cohorts considerably narrowed gender and race-ethnic attainment gaps in postsecondary entry by late life.

But poorer youth health status, across health domains, remained a barrier for high school and especially college degree completion and this finding is sobering. Past "strong forces" constrained attainment in these youth, perhaps due to poverty, or lack of medical care, or illness-producing environments. We also differ from other countries in the production of youth health and economic well-being. The U.S. higher education system might allow adults to, theoretically, "catch up" if human capital gains were deferred or delayed. But, in spite of later life educational access, youth health effects limited secondary and baccalaureate and higher attainment. So, in these older U.S. cohorts, greater life course educational opportunities, as facilitated by educational policies, still resulted in considerable social inequality in school attainment outcomes, attributable to poor youth health, even to midlife and beyond.

Our study has limitations. Most obvious is that unmeasured heterogeneity in life course health transitions, including in selective mortality, as well as in educational transitions, play a role in the education–health correlation we find; we cannot explore either with the current longitudinal database at hand. Also, it is not clear what health "differences" due to socioeconomic status and race/ethnicity signify; untangling this will be complex. In the U.S. case, race/ethnic variations in the prevalence of health problems reflect reporting issues, the specific health problems under study, different causal mechanisms underlying health conditions, and/or differences in medical treatment. In addition, economic disadvantage, a fundamental cause of illness, plays a substantial role in the health outcomes of minority youth (Aber et al., 1997) as well as educational outcomes (Guo, 1998).

Another shortcoming of our study is that youth economic status is self-reported and a one-time measurement; level of family income is not available in the HRS, so income-to-need ratios or other more robust or dynamic indicators of poverty cannot be tested directly. This exacerbates the problem that a given level of socioeconomic status may have substantively different meanings for HRS respondents across ascription groups (Williams and Collins, 1995). Finally, we cannot assess the important yet variable roles that schools, at all levels, play in the health–education association (Pallas, 1993) or in the age–education association (Tinto, 1987). Schools vary in the quality of student resources they provide to remediate health problems and/or special needs of young and older students, which then facilitates attainment. So, for example, contingent on resources and policies, schools may mediate (or not) health effects on learning by interfacing with the medical community, monitoring health, providing nutrition, health screenings, referrals to specific health providers, and, most importantly, alternate routes to educational gains for sick or disabled youth and adults. In addition, schools also may (or may not) mediate the effects of students being older or "nontraditionally aged" on retention and completion by providing flexibility in course requirements, scheduled hours or age-friendly campus activities (Tinto, 1987).

In summary, our findings paint a complex picture. Older U.S. birth cohorts were comparatively lucky to reach maturity around or just after the mid-20th century, coincident with an economic boom. Social policies of educational expansion facilitated adult school enrollment, just as the life course constraint on school transition timing was fading. A surprising proportion of adults reached relatively high (some college) attainment and could compensate, at least in part, for earlier poorer health or barriers associated with ascription group membership. But growing up poor, or even middle class, was a considerable barrier to attainment; ultimately, poor health and/or ascription did block attainment for many and the highest attainment for most. By late adulthood, human capital gains reflected individuals' differing abilities to draw on policy-related resources and/or education and job training systems over the different portions of the life course (Attewell et al., 2011; Taniguchi and Kaufman, 2007). By late adulthood, educational attainment would also become a key – if not the main – component in the social gradient of adult health in these cohorts (Wray et al., 1998). If nothing else, the human capital – health gradient should be seen is dynamic. Narrow windows of observation will miss much of it; the interrelationship needs to be considered over all portions of the life course.

Appendix A

Demographic, health and economic characteristics of the study sample and sources of HRS data.

	Wtd. Mean (SE) or Proportion	Variable Source(s)
Ascription group		
Women	0.59	RAND J
African American	0.10	RAND J
Hispanic	0.04	RAND J
Other Ethnicity	0.05	RAND J
Socioeconomic resources		
Parent Schooling (years)	10.09 (3.2)	RAND J
"Well-off" as child	0.07	HRS 2008, supplemented with HRS 1996–2006
Average Family SES	0.65	
Poor Family SES	0.28	
Health selection		
Self Rated Youth Health (1–5)	4.27 (.98)	HRS 2008, supplemented with HRS 1996–2006
Height (inches)	67.04 (3.97)	RAND-J
Learning Problems	0.03	HRS 2008
Health Risk Behavior	0.20	HRS 2008
Human capital		
High School Dropout	0.14	RAND J
GED	0.05	RAND J
High School Diploma	0.30	RAND J
Some College	0.25	RAND J
College BA or Higher	0.26	RAND J
Veteran	0.21	RAND J
HRS Cohort (1931–1941)	0.42	RAND J
Warbaby Cohort (1942–1947)	0.30	RAND J
N = 11,134		

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