Spring 4-2013

Type of High-School Credentials and Older Age ADL and IADL Limitations: Is the GED Credential Equivalent to a Diploma?

Sze Yan Liu
Montclair State University, lius@montclair.edu

Niraj R. Chavan
Flushing Hospital Medical Center

M. Maria Glymour
Harvard School of Public Health

Type of High-School Credentials and Older Age ADL and IADL Limitations: Is the GED Credential Equivalent to a Diploma?

Sze Yan Liu, PhD,[*,1] Niraj R. Chavan, MD, MPH,[2] and M. Maria Glymour, PhD[1]

[1]Department of Society, Human Development and Health, Harvard School of Public Health, Boston, Massachusetts.
[2]Department of Obstetrics and Gynecology, Flushing Hospital Medical Center, Flushing, New York.

*Address correspondence to Sze Yan Liu, PhD, Department of Society, Human Development and Health, Harvard School of Public Health, 401 Park Drive, Room 28E, Boston, MA 02215. E-mail: szeliu@hsph.harvard.edu

Purpose: Educational attainment is a robust predictor of disability in elderly Americans: older adults with high-school (HS) diplomas have substantially lower disability than individuals who did not complete HS. General Educational Development (GED) diplomas now comprise almost 20% of new HS credentials issued annually in the United States but it is unknown whether the apparent health advantages of HS diplomas extend to GED credentials. This study examines whether adults older than 50 years with GEDs have higher odds of incident instrumental or basic activities of daily living (IADLs) limitations compared with HS degree holders. **Methods:** We compared odds of incident IADL limitations by HS credential type using discrete-time survival models among 9,426 Health and Retirement Study participants followed from 1998 through 2008. **Results:** HS degree holders had lower odds of incident IADLs than GED holders (OR = 0.72, 95% CI = 0.58, 0.90 and OR = 0.69, 95% CI = 0.56, 0.86 for ADLs and IADLs, respectively). There was no significant difference in odds of incident IADL limitations between GED holders and respondents without HS credentials (OR = 0.89, 95% CI = 0.71, 1.11 for ADLs; OR = 0.88, 95% CI = 0.70, 1.12 for IADLs). **Implications:** Although GEDs are widely accepted as equivalent to high school diplomas, they are not associated with comparable health advantages for physical limitations in older age.

Key Words: ADL, IADL, Education

Educational attainment is a remarkably robust predictor of morbidity and mortality for older adults (Berkman et al., 1993; Grundy & Glaser, 2000; Hoogendijk, van Groenou, van Tilburg, & Deeg, 2008; Kawachi, Adler, & Dow, 2010). Despite the overwhelming evidence that educational attainment, including high-school (HS) completion, influences later-life health outcomes, there has been very little prior research on whether the associations differ by type of HS credential. This possibility has important implications for theoretical understanding of mechanisms via which education affects older adult health, policy relevance when considering returns to social investments in schooling, and consequences for projections of how cohort differences in educational attainment predict future trends in disability.

Since 1943, the General Educational Development (GED) test has certified an American HS level of academic knowledge. Annually, GEDs account for 15%–20% of all new HS credentials (Heckman & Lafountaine, 2008). Public health research often combines GED credentials with
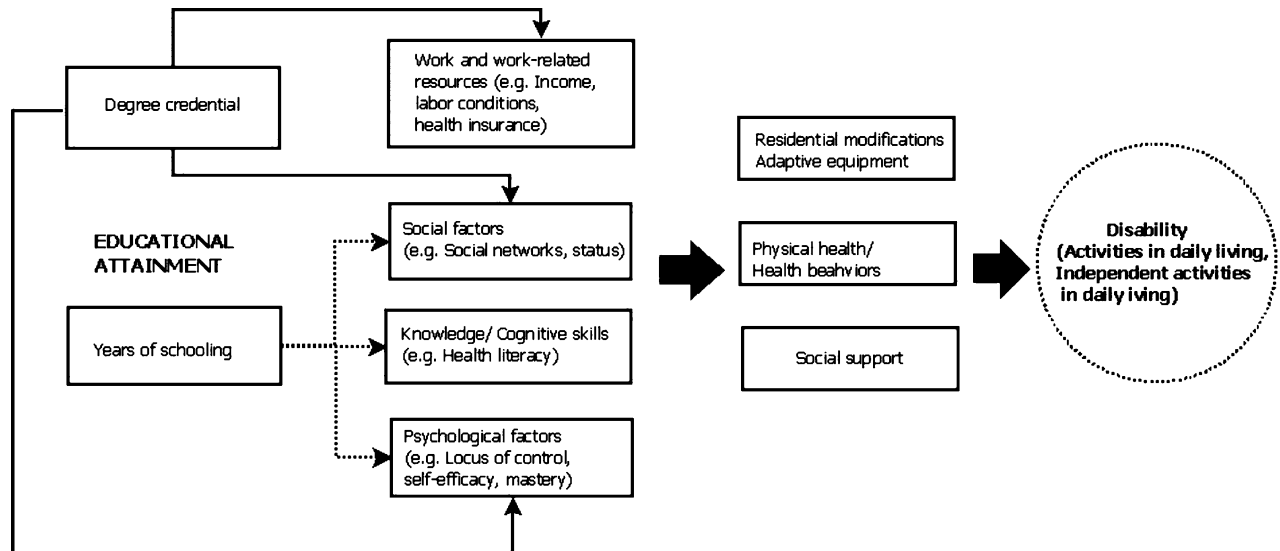
Figure 1. Potential pathways linking educational attainment and disability older age.

HS diplomas when estimating health benefits associated with completion of school. For example, the National Health and Nutrition Examination Survey (NHANES) and the Behavior Risk Factor Surveillance Surveys (BRFSS) categorize HS diploma and GED together. However, theoretical understanding of mechanisms by which education affects health suggests there may be considerable heterogeneity in health returns by HS credential type.

Education is thought to affect health and disability in later life through multiple pathways (Figure 1). Hypothesized mechanisms include improvements in financial and working conditions; benefits via higher social status and connections to other relatively advantaged social network members; increases in knowledge of and ability to adopt healthful behaviors; and improved access to medical care (Kubzansky, Berkman, Glass, & Seeman, 1998; Shaw & Spokane, 2008). It is unclear whether these mechanisms all operate equivalently for GED holders compared to individuals with traditional HS diplomas. Credentialing theory suggests society uses educational qualifications as an indicator of unobservable skills and traits (Spence, 1976). Therefore, receiving a GED in lieu of a HS diploma may lead to reduced socioeconomic opportunities which, in turn, may lead to worse health outcomes (Kawachi, Adler, & Dow, 2010). Empirical evidence on the labor market and financial returns to GEDs is mixed. Some research reports that GED recipients have worse employment and post-secondary education

outcomes than HS graduates (Boesel, Alsalam, & Smith, 1998; Cameron & Heckman, 1991; Entwisle, Alexander, & Olson, 2004; Tyler & Lofstrom, 2010) but others find GED recipients have wages similar to HS degree holders (Song & Hsu, 2008; Tyler, 2004). Furthermore, human capital theory has long posited education as an investment leading to better life opportunities via improvements in knowledge and skills (Agodini & Dynarski, 1998; Becker, 1964). Because receipt of the GED requires relatively little time investment and therefore potentially less learning compared to a HS diploma, health returns to the GED may not be comparable. On the other hand, mastery of basic skills and knowledge may be enough for individuals to access necessary health information and tools to acquire help and resources for better health. In theory, GEDs denote the achievement of knowledge and skills equivalent to a HS degree, albeit attained outside a traditional classroom setting, such as work-related experiences or independent study. Limited cross-sectional research on health suggests higher depression rates and smoking prevalence among GED holders compared to HS degree holders (Caputo, 2005a, 2005b; Kenkel, Lillard, & Mathios, 2006; Ou, 2008).

Because these hypothesized mechanisms linking education and health work primarily through the sociocultural and physical environment, education may be especially important for health outcomes where these play a major role such as limitations in basic and instrumental activities of daily living

(IADLs). Conceptual models of disablement emphasize that disability is not an intrinsic feature of an individual but rather emerges in relation to the individual's ability to perform a task within his specific environment (International Classification of Functioning, Disability and Health, 2001; Jette, 2006; Verbrugge & Jette, 1994). Having more education or better education may help older adults bridge the gap between environmental demands and physical capacity. For example, education may provide greater socioeconomic resources to obtain residential modifications and adaptive equipment that would prevent a physiologic impairment from translating into a disability or improve sense of efficacy to circumvent environmental barriers. Education may also provide greater access and knowledge to navigate the health care system and lower incidence of chronic disease and unhealthy behaviors that contributes to disabilities (Cutler, Landrum, & Stewart, 2006; Cutler & Lleras-Muney, 2008; Ou, 2008; Verbrugge & Jette, 1994). Among community-dwelling elders, the prevalence of functional limitations has declined significantly since the 1970s (Freedman, Martin, & Schoeni, 2002; Martin, Schoeni, & Andreski, 2010; Murabito et al., 2008), a trend partially attributable to increases in education (Freedman & Martin, 1999; Schoeni, Freedman, & Martin, 2008). If GEDs do not convey similar disability advantages, the increasing prevalence of the GED as a high-school credential may dilute the population health advantages of improvements in education among successive cohorts of older adults. This study compares the odds of incident IADL limitations associated with different HS credential types. We hypothesize HS diploma holders have lower IADL risk than respondents with no HS credentials and GED holders have IADL risk comparable to respondents with no HS credentials.

Methods

Data were from RAND version of the Health and Retirement Study (HRS), a well-documented longitudinal survey of a nationally representative sample of individuals 50 years of age or older and their spouses (RAND HRS Data, Version J, 2010; Juster & Suzman, 1995). Our sample consists of HRS participants who met the following criteria: (1) enrolled in HRS by the 1998 wave; (2) reported a GED, HS diploma, or less then HS as their highest educational attainment; (3) reported no IADL limitations in 1998; and (4) 50 years or older at enrollment. From 10,398 HRS participants eligible for analysis, we excluded 10% (n = 917) born outside the United States because of potential noncomparability of non-U.S. educational credentials and less than 1% (n = 2) missing information on race/ethnicity. HRS uses a stratified sampling scheme consisting of individuals in primary stage sampling units nested within strata. Addressing the multistage probability sample design of HRS necessitated excluding a small number of our sample respondents (n = 53) who were assigned to a stratum with only one primary sampling unit.

We used RAND HRS-constructed variables indicating whether the respondent had difficulty with any IADL tasks. Respondents were asked "Because of a health or memory problem do you have any difficulty with…" Difficulties expected to last less than 3 months were excluded. Participants who answered "Yes" to any of the following were classified as having an ADL limitation: difficulty eating; bathing; dressing; walking across a room; and getting in and out of bed (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963). Participants who answered "Yes" to any of the following were classified as having an IADL limitation: using a telephone; taking medication; managing money; shopping for groceries; or preparing meals (Lawton & Brody, 1969).

We present unadjusted Kaplan–Meier survival curves to describe age of onset of IADL limitations by educational credential. Data were restructured to a person-period file (i.e., one observation for each person for each interview wave until IADL limitation onset, death, dropout, or study end) and analyzed using discrete-time survival models. The odds ratio from these models approximates a ratio of hazards. All respondents entered the risk period in 1998 and were followed as a closed cohort through 2008 for development of the outcome. The adjusted model included time-invariant covariates that are potential confounders (i.e., may influence both educational credential and disability risk): race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Non-Hispanic Other), retrospective rating of childhood health (Excellent/Very Good, Good, Fair/Poor, Unknown), father's education (less than 8 years, 8 years or more, unknown), whether or not the respondent was born in the South (per the U.S. Census designation), and veteran status. We also show results

Table 1. Selected Sociodemographic Characteristics for Study Sample by Type of HS Credentials, HRS 1992–2008[a]

	Less than HS	GED	HS degree
N	2,644	515	6,267
ADL: Average follow-up years (range)	5.9 (0–10)	6.8 (0–10)	7.0 (0–10)
IADL: Average follow-up years (range)	5.9 (0–10)	6.9 (0–10)	7.1 (0–10)
Sociodemographics			
Age in 1998 (range)	68 (50–95)	62 (50–90)	64 (50–97)
Male (%)	45 (43–48)	60 (55–65)	42 (41–44)
Born in the South (%)	49 (45–52)	46 (40–52)	29 (26–32)
Non-Hispanic White (%)	74 (70–79)	84 (79–88)	90 (89–91)
Non-Hispanic Black (%)	18 (14–21)	10 (7–13)	7 (6–8)
Hispanic (%)	7 (4–9)	5 (1–9)	2 (1–3)
Military veteran (%)	20 (18–22)	45 (40–50)	28 (27–29)
Father's education: less than 8 years of schooling	40 (37–42)	33 (28–38)	22 (20–23)
Excellent/very good childhood health	35 (33–38)	46 (40–52)	41 (39–42)
Years of schooling (SE)	9 (0.07)	11 (0.09)	13 (0.02)
Cognitive skill at enrollment in HRS (SE)	20 (0.17)	23 (0.21)	24 (0.10)

[a]All percentages and means are weighted and account for survey sampling.

adjusted for years of completed schooling and baseline cognitive score, an indicator of cognitive skills. Cognitive score was measured using an HRS constructed composite variable that sums the correct responses to immediate and delayed 10-word list recall, a counting backwards task, and a brief vocabulary assessment (Herzog & Wallace, 1997). Adult income and health indicators were not included because they may be mediators between HS credential and older age disability. We examined whether the value of a GED differed by gender, race or veteran status by including appropriate interaction terms. To assess the possibility that the value of the GED credential has changed for more recent birth cohorts, we estimated birth-cohort (1930 or before vs. after 1930) stratified models. All analyses were completed in Stata (11.2), applying the individual's 1998 HRS survey weights and accounting for the complex survey sample design. The final sample consisted of 9,426 individuals with 40,569 person-years for the analyses of ADLs and 41,215 of follow-up waves for IADLs.

Results

Among the 9,426 individuals in our sample, 515 (5%) were GED recipients, 6,267 (66%) HS degree holders and 2,644 (28%) did not have any HS credential. Demographic characteristics differed by HS credential type. For example, 35% of the individuals with no HS credential reported excellent/very good childhood health compared with 46% of GED recipients and 41% of HS

degree holders (Table 1). Similarly, the average cognitive score at time of enrollment was 20 for respondents with no HS credential compared to 24 and 23 for HS graduates and GED holders, respectively. Kaplan–Meier curves show an educational gradient: respondents with no HS credential experienced incident ADL and IADL limitations the earliest followed by GED recipients and HS degree holders (Figure 2).

HS degree holders had lower odds of incident limitations compared to GED recipients (adjOR = 0.72, 95% CI = 0.58, 0.90 for ADL and adjOR = 0.69, 95% CI = 0.56, 0.86 for IADL limitations, Table 2). No significant difference was found between GED holders and those with less than a HS degree. These patterns were unchanged in models allowing for interactions between HS credentials and gender, HS credentials and race, or HS credentials and military veteran status (Table 3). While the estimates for HS degree compared to GED holders were similar in analyses stratified by birth cohort, only the estimate for IADL outcome among those born before 1931 was statistically significant (adjOR = 0.65, 95% CI = 0.48, 0.88, Table 4). Estimates were similar for persistent ADL and IADL limitations (i.e., reporting an IADL limitation for two consistent waves) but confidence intervals were wider and only statistically significant for IADLs (results not shown).

Discussion

In a nationally representative sample of older Americans, we found lower odds of incident IADL
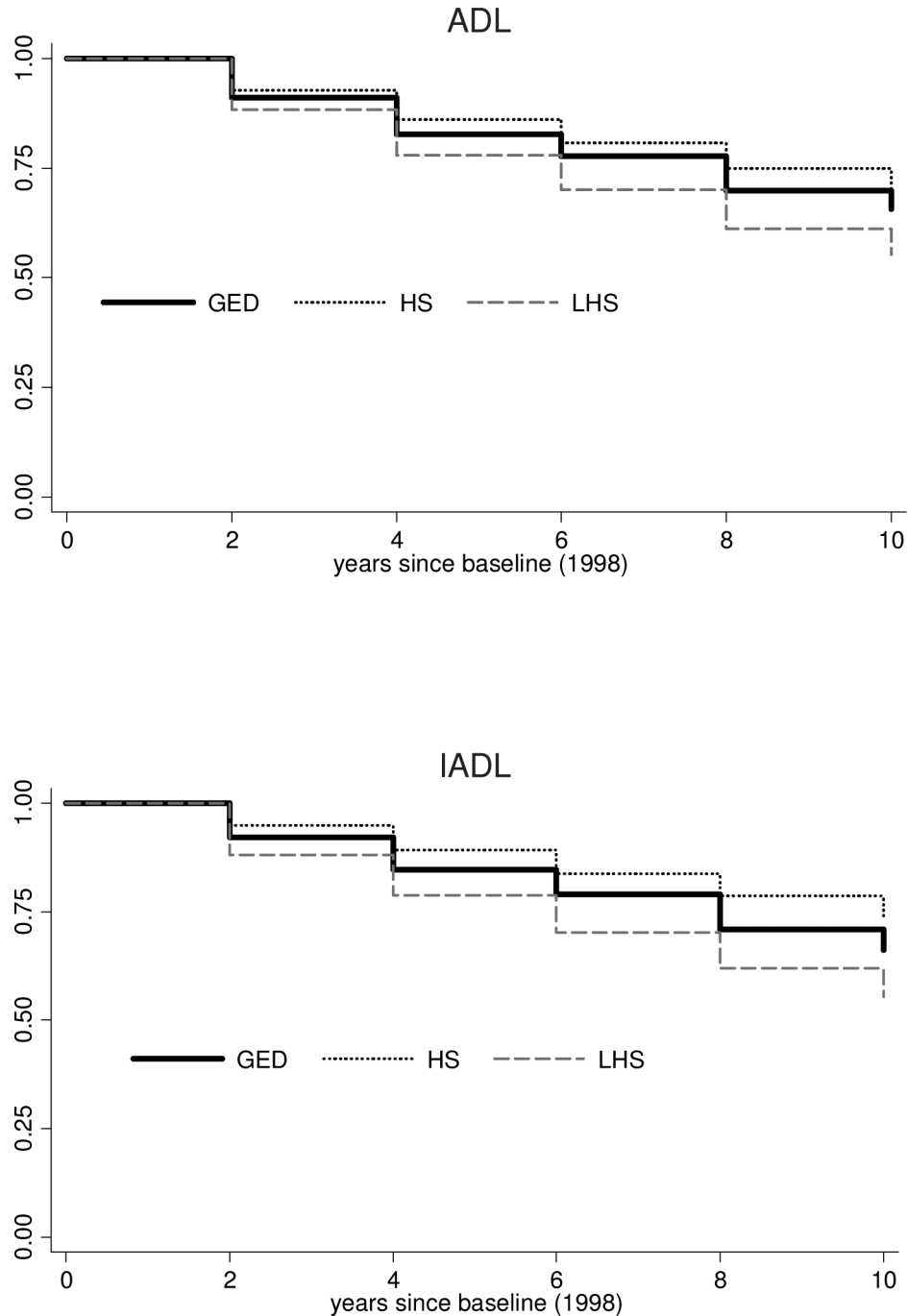
ADL

IADL

Figure 2. Kaplan–Meier Curves by Educational Credentials. Kaplan–Meier curves for individuals with less than HS education (gray dash line), GED recipients (solid black line) and individuals with HS degree (black dotted line) for difficulties with activities of daily living (ADL) and independent activities of daily living (IADL).

limitations for HS degree holders than GED recipients. There was no significant difference in incident IADL limitations for GED recipients compared to individuals with no HS credential. Our study adds to a small existing literature on the health effects of non-traditional educational activities. This finding has important implications for projections of population levels of disability, as the GED becomes an increasingly common credential.

Despite the strengths of a nationally representative, prospective cohort for addressing this research question, our study has several limitations. Our outcome addresses long-term disability episodes because HRS asks about current disability status for conditions expected to last more than 3 months. Incidences of disability that resolve prior to the subsequent interview wave are not captured in this dataset. Residual confounding from unobserved

Table 2. OR for Ìncident ADL and IADL Limitations for Study Sample from Discrete Time Event-History Models, HRS 1998–2008

	ADL			IADL		
	Age-adjusted	Partially adjusted	Fully adjusted	Age-adjusted	Partially adjusted	Fully adjusted
Person-waves	40,569	40,569	38,005	41,215	41,215	38,656
Less than HS	1.00 (0.81, 1.24)	0.90 (0.74, 1.1)	0.89 (0.71, 1.11)	1.04 (0.82, 1.31)	0.96 (0.77, 1.20)	0.88 (0.70, 1.12)
GED (reference)	—	—	—	—	—	—
HS degree	0.72 (0.58, 0.89)	0.73 (0.59, 0.90)	0.72 (0.58, 0.90)	0.62 (0.50, 0.76)	0.64 (0.53, 0.78)	0.69 (0.56, 0.86)
Age: <64 years	0.82 (0.71, 0.95)	0.80 (0.69, 0.93)	0.81 (0.69, 0.94)	0.73 (0.62, 0.85)	0.70 (0.60, 0.81)	0.77 (0.66, 0.89)
Age: 65–74 years (reference)	—	—	—	—	—	—
Age: 75–84 years	2.10 (1.86, 2.36)	2.08 (1.85, 2.35)	2.03 (1.79, 2.30)	2.20 (1.98, 2.44)	2.18 (1.96, 2.42)	2.13 (1.90, 2.38)
Age: 85+ years	5.54 (4.82, 6.37)	5.26 (4.57, 6.06)	5.14 (4.38, 6.02)	6.64 (5.79, 7.62)	6.36 (5.57, 7.27)	6.04 (5.20, 7.02)

[a]All models are weighted and account for survey sampling. Partially adjusted models also included gender (male vs. female), race/ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White, non-Hispanic API/Other), father's education (less than 8 years, 8 or more years, unknown), health in childhood (excellent/very good, good, fair/poor, unknown), military service (yes vs. no) and US region of birth (South vs. Non-South). Fully adjusted models included all covariates above with the addition of years of schooling and baseline cognitive skill.

characteristics may also bias our results. While we have included father's highest level of schooling attained in all our adjusted models, there may still be important differences in childhood socioeconomic background according to HS credential type. Respondents with GEDs may also differ from those with HS diplomas in a wide variety of unobserved characteristics, including age at receipt of HS credentials, differences in cognitive ability (Cao, Stromsdorfer, & Weeks, 1996), motivation, or time preference (Heckman & LaFontaine, 2010).

Circumstances associated with pursuit of GED in lieu of a HS diploma are likely to be complex and vary depending on contextual factors such as birth cohort, larger socioeconomic conditions, and state of residence. For example, the GED was originally developed in 1943 for World War II veterans whose education was interrupted and were no longer age-eligible to attend high school. Currently, a third of individuals who pass the GED test are between 16 and 18 years old (Zhang & Becker Patterson, 2010). The motivations to pursue a GED instead of a high school diploma may also change as the tests continue to evolve. More rigorous passing requirements for the GED have been instituted in 1978, 1988, 1997, and 2002. Such changes in passing requirements are likely to affect selection into the GED program.

For high-school dropouts who are no longer an appropriate age to enroll in HS, pursuing the GED credential is the only option still available to them to achieve a HS credential. Such "second-chance" programs are designed to help HS dropouts improve their labor market outcomes. Although

our findings suggest GEDs do not offer health returns comparable to traditional diplomas, special population groups may have disproportionate health gains from completing a GED. For example, Murnane et al., found that GED labor market gains were specific to recipients with low cognitive skills (Murnane, Willett, & Tyler, 2000).

Extensive investments in education during the early to mid-20th century had tremendous benefits for the health of those birth cohorts in their old age, reducing physical disability, and improving memory function (Cutler & Lleras-Muney, 2008; Freedman, Martin, Schoeni, & Cornman, 2008; Glymour, Kawachi, Jencks, & Berkman, 2008; Martin, Schoeni, & Andreski, 2010). Since 1966, the federal government has provided funds for basic education programs specifically for individuals age 16 and over who have not completed high school. Recently, considerable federal funding has been directed to GED preparation programs. According to combined date from the 2001 and 2005 Adult Education Survey of the National Household Education Surveys Program, 1% of adults 16 to 64 years old in the United States participated in some form of adult basic education programs (O'Donnell & Chapman, 2006), but very little is known about possible health effects of these nontraditional educational experiences. Disaggregating these types of educational experiences will help explain the effects of education on health and anticipate how current educational trends may manifest in future population health of older adults.

Table 3. OR for Incident ADL and IADL Limitations from Models with Interaction Terms with Gender, Veteran Status, and Race/Ethnicity, HRS 1998–2008[a]

Modifying factor	ADL			IADL		
	Gender	Veteran	Race	Gender	Veteran	Race
Person-waves	38,005	38,005	38,005	38,871		38,871
Less than HS	0.90 (0.67, 1.21)	0.93 (0.72, 1.20)	0.88 (0.69, 1.12)	1.00 (0.74, 1.37)	0.86 (0.66, 1.13)	0.86 (0.67, 1.11)
GED (reference)	—					
HS degree	0.71 (0.53, 0.96)	0.71 (0.56, 0.91)	0.70 (0.56, 0.88)	0.78 (0.58, 1.04)	0.66 (0.51, 0.85)	0.66 (0.53, 0.83)
Male	0.99 (0.68, 1.44)	1.00 (0.88, 1.14)	1.00 (0.88, 1.15)	1.25 (0.92, 1.70)	1.02 (0.88, 1.18)	0.87 (0.69, 1.08)
Veteran	0.79 (0.68, 0.92)	0.80 (0.52, 1.24)	0.79 (0.68, 0.93)	0.89 (0.76, 1.05)	0.82 (0.58, 1.15)	0.99 (0.78, 1.26)
Race/ethnicity: White (reference)	—	—	—	—	—	—
Black	1.26 (1.04, 1.52)	1.25 (1.03, 1.51)	0.82 (0.47, 1.44)	1.02 (0.86, 1.21)	1.01 (0.85, 1.20)	0.85 (0.33, 2.20)
Hispanic	1.11 (0.83, 1.49)	1.104 (0.83, 1.47)	1.03 (0.45, 2.35)	1.14 (0.85, 1.53)	1.14 (0.85, 1.52)	0.48 (0.09, 2.69)
Other	1.36 (0.98, 1.88)	1.35 (0.97, 1.88)	2.74 (1.60, 4.71)	1.09 (0.64, 1.84)	1.08 (0.64, 1.81)	2.51 (0.85, 7.44)
Age: <64 years	0.81 (0.69, 0.94)	0.80 (0.69, 0.94)	0.80 (0.69, 0.94)	0.77 (0.67, 0.89)	0.77 (0.66, 0.89)	0.77 (0.66, 0.89)
Age: 65–74 years (reference)	—	—	—	—	—	—
Age: 75–84 years	2.03 (1.79, 2.31)	2.03 (1.79, 2.31)	2.03 (1.79, 2.30)	2.14 (1.91, 2.40)	2.14 (1.92, 2.40)	2.14 (1.92, 2.40)
Age: 85+ years	5.13 (4.38, 6.01)	5.12 (4.38, 6.00)	5.12 (4.37, 6.00)	6.09 (5.24, 7.07)	6.09 (5.24, 7.07)	6.10 (5.24, 7.09)
Male * less than HS	0.95 (0.64, 1.42)	—	—	0.81 (0.56, 1.18)	—	—
Male * HS	1.05 (0.74, 1.50)	—	—	0.80 (0.57, 1.14)	—	—
Veteran * less than HS	—	0.81 (0.49, 1.33)	—	—	1.06 (0.73, 1.54)	—
Veteran * HS	—	1.07 (0.71, 1.63)	—	—	1.13 (0.80.1.59)	—
Black * less than HS	—	—	1.48 (0.75, 2.90)	—	—	1.15 (0.62, 2.12)
Black *HS	—	—	1.67 (0.95, 2.93)	—	—	1.09 (0.67,1.76)
Hispanic * less than HS	—	—	1.01 (0.43, 2.39)	—	—	2.75 (0.74, 10.22)
Hispanic * HS	—	—	1.21 (0.36, 4.06)	—	—	4.50 (0.75, 27.02)
Other race * less than HS	—	—	0.30 (0.14, 0.65)	—	—	0.42 (0.15, 1.24)
Other race * HS	—	—	0.56 (0.19, 1.65)	—	—	0.53 (0.20, 1.39)

[a]All models are weighted and account for survey sampling and included gender (male vs. female), race/ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White, non-Hispanic API/Other), years of schooling, father's education (Less than 8 years, 8 or more years, unknown), health in childhood (excellent/very good, good, fair/poor, unknown), baseline cognitive skill, military service (yes vs. no) and US region of birth (South vs. non-South).

Table 4. OR for Incident ADL and IADL Limitations Stratified by Birth Cohort, HRS 1998–2008[a]

	ADL		IADL	
	Born before 1931	Born after 1930	Born before 1931	Born after 1930
Person-waves	39,845	38,729	40,733	39,578
Less than HS	0.82 (0.61, 1.12)	1.00 (0.74, 1.36)	0.82 (0.59, 1.13)	1.00 (0.69, 1.46)
GED (reference)	—	—	—	—
HS degree	0.73 (0.53, 1.01)	0.74 (0.55, 1.01)	0.65 (0.48, 0.88)	0.75 (0.53, 1.06)
Age: <64 years	—	0.77 (0.65, 0.90)	—	0.69 (0.60, 0.80)
Age: 65–74 years (reference)	—	—	—	—
Age: 75–84 years	2.46 (2.03, 2.97)	1.86 (1.36, 2.56)	3.01 (2.47, 3.66)	1.42 (0.98, 2.04)
Age: 85+ years	6.21 (5.04, 7.65)	—	8.38 (6.65, 10.56)	—

[a]All models are weighted and account for survey sampling and included gender (male vs. female), race/ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White, non-Hispanic API/Other), years of schooling, father's education (less than 8 years, 8 or more years, unknown), health in childhood (excellent/ very good, good, fair/poor, unknown), baseline cognitive skill, military service (yes vs. no) and US region of birth (South vs. Non-South).

The Gerontologist

References

Agodini, R., & Dynarski, M. (1998). Understanding the trend toward alternative certification for high school graduates. Retrieved from http://www.mathematica-mpr.com/publications/PDFs/dod-ged.pdf

Becker, G. S. (1964). *Human capital*. New York, NY: Columbia University Press.

Berkman, L. F., Seeman, T. E., Albert, M., Blazer, D., Kahn, R., Mohs, R., . . . McClearn, G. (1993). High, usual and impaired functioning in community-dwelling older men and women: Findings from the MacArthur Foundation Research Network on successful aging. *Journal of Clinical Epidemiology*, 46, 1129–1140. doi:10.1016/0895-4356(93)90112-E

Boesel, D., Alsalam, N., & Smith, T. M. (1998). *Educational and labor market performance of GED recipients*. Washington, DC: National Library of Education.

Cameron, S. V., & Heckman, J. J. (1991). *The nonequivalence of high school equivalents*. Cambridge, MA: National Bureau of Economic Research.

Cao, J., Stromsdorfer, E. W., & Weeks, G. (1996). The human capital effect of general education development certificates on low income women. *Journal of Human Resources*, 31, 206–228.

Caputo, R. K. (2005a). The GED as a predictor of mid-life health and economic well-being. *Journal of Poverty*, 9, 73–97.

Caputo, R. K. (2005b). The GED as a signifior of later-life health and economic well-being. *Race, Gender & Class*, 12, 81–103. doi:10.1300/J134v09n04_05

Cutler, D., Landrum, M., & Stewart, K. (2006). How do the better educated do it? Socioeconomic status and the ability to cope with underlying impairment. *Working papers 12040*. Cambridge, MA: National Bureau of Economic Research.

Cutler, D., & Lleras-Muney, A. M. N. Y. (Eds.). (2008). *Education and health: Evaluating theories and evidence*. New York, NY: Russell Sage Foundation.

Entwisle, D., Alexander, K., & Olson, L. (2004). Temporary as compared to permanent high school dropout. *Social Forces*, 82, 1181–1205. doi:10.1353/sof.2004.0036

Freedman, V., & Martin, L. (1999). The role of education in explaining and forecasting trends in functional limitations among older Americans. *Demography*, 36, 461–473. doi:10.2307/2648084

Freedman, V. A., Martin, L. G., & Schoeni, R. F. (2002). Recent trends in disability and functioning among older adults in the United States. *JAMA: The Journal of the American Medical Association*, 288, 3137–3146. doi:10.1001/jama.288.24.3137

Freedman, V. A., Martin, L. G., Schoeni, R. F., & Cornman, J. C. (2008). Declines in late-life disability: The role of early- and mid-life factors. *Social Science & Medicine*, 66, 1588–1602. doi:10.1016/j.socscimed.2007.11.037

Glymour, M. M., Kawachi, I., Jencks, C. S., & Berkman, L. F. (2008). Does childhood schooling affect old age memory or mental status? Using state schooling laws as natural experiments. *Journal of Epidemiology and Community Health*, 62, 532–537. doi:10.1136/jech.2006.059469

Grundy, E., & Glaser, K. (2000). Socio-demographic differences in the onset and progression of disability in early old age: A longitudinal study. *Age and Ageing*, 29, 149. doi:10.1093/ageing/29.2.149

Heckman, J., & LaFontaine, P. (2010). The American high school graduation rate: Trends and levels. *The Review of Economics and Statistics*, 92, 244–262. doi:10.1162/rest.2010.12366

Heckman, J. J., & Lafountaine, P. A. (2008). *The declining American high school graduation rate: Evidence, sources, and consequences*. Cambridge, MA: National Bureau of Economic Research.

Herzog, A., & Wallace, R. (1997). Measures of cognitive functioning in the AHEAD study. *Journal of Gerontology B Psychological Science Social Science*, 52B, 37–48. doi:10.1093/geronb/52B.Special_Issue.37

Hoogendijk, E., van Groenou, M. B., van Tilburg, T., & Deeg, D. (2008). Educational differences in functional limitations: Comparisons of 55–65-year-olds in the Netherlands in 1992 and 2002. *International Journal of Public Health*, 53, 281–289. doi:10.1007/s00038-008-8079-9

International Classification of Functioning. (2001). *Disability and health*. Geneva: World Health Organization.

Jette, A. M. (2006). Toward a common language for function, disability, and health. *Physical Therapy*, 86, 726–734.

Juster, F., & Suzman, R. (1995). An overview of the Health and Retirement Study. *Journal of Human Resources*, 30, S7–S56.

Katz, S., Ford, A., Moskowitz, R., Jackson, B., & Jaffe, M. (1963). Studies of illness in the aged. The index of ADL: A standardized measure of biological and psychosocial function. *JAMA*, 21, 914–919. doi:10.1001/jama.1963.03060120024016

Kawachi, I., Adler, N. E., & Dow, W. H. (2010). Money, schooling, and health: Mechanisms and causal evidence. *Annals of the New York Academy of Sciences*, 1186, 56–68. doi:10.1111/j.1749-6632.2009.05340.x

Kawachi, I., Adler, N. E., & Dow, W. H. (2010). Money, schooling, and health: Mechanisms and causal evidence. *Annals of the New York Academy of Sciences*, 1186, 56–68.

Kenkel, D., Lillard, D., & Mathios, A. (2006). The roles of high school completion and GED receipt in smoking and obesity. *Journal of Labor Economics*, 24, 635–660.

Kubzansky, L. D., Berkman, L. F., Glass, T. A., & Seeman, T. E. (1998). Is educational attainment associated with shared determinants of health in the elderly? Findings from the MacArthur Studies of Successful Aging. *Psychosomatic Medicine*, 60, 578–585.

Lawton, M., & Brody, E. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist*, 9, 179–186. doi:10.1093/geront/9.3_Part_1.179

Martin, L., Schoeni, R., & Andreski, P. (2010). Trends in health of older adults in the United States: Past, present, future. *Demography*, 47, S17–S40. doi:10.1353/dem.2010.0003

Murabito, J. M., Pencina, M. J., Zhu, L., Kelly-Hayes, M., Shrader, P., & D'Agostino, R. B., Sr. (2008). Temporal trends in self-reported functional limitations and physical disability among the community-dwelling elderly population: The Framingham Heart Study. *American Journal of Public Health*, 98, 1256–1262. doi:10.2105/ajph.2007.128132

Murnane, R. J., Willett, J. B., & Tyler, J. H. (2000). Who benefits from obtaining a GED? Evidence from high school and beyond. *Review of Economics and Statistics*, 82, 23–37. doi:doi:10.1162/003465300558605

O'Donnell, K., & Chapman, C. (2006). *Adult education participation in 2004-05* (NCES 2006-077). US Department of Education, Retrieved from http://nces.ed.gov/pubs2006/2006077.pdf

Ou, S.-R. (2008). Do GED recipients differ from graduates and school dropouts? *Urban Education*, 43, 83–117. doi:10.1177/0042085907305187

Schoeni, R., Freedman, V., & Martin, L. (Eds.). (2008). *Socioeconomic and demographic disparities in trends in old-age disability*. Chicago, IL: University of Chicago Press.

Shaw, B. A., & Spokane, L. S. (2008). Examining the association between education level and physical activity changes during early old age. *Journal of Aging and Health*, 20, 767. doi:10.1177/0898264308321081

Song, W., & Hsu, Y.-c. (2008). Economic and noneconomic outcomes for GED® credential recipients: GED Testing Service® Research Study.

Spence, M. (1976). Competition in salaries, credentials, and signaling prerequisites for jobs. *The Quarterly Journal of Economics*, 90, 51–74. doi:10.2307/1886086

Tyler, J., & Lofstrom, M. (2010). Is the GED an effective route to post-secondary education for school dropouts? *Economics of Education Review*, 29, 813–825. doi:10.1016/j.econedurev.2010.03.001

Tyler, J. H. (2004). Does the G.E.D. improve earnings? Estimates from a sample of both successful and unsuccessful G.E.D. candidates. *Industrial & Labor Relations Review*, 57, 579–598.

Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Social Science and Medicine*, 38, 1–14. doi:10.1016/0277-9536(94)90294-1

Zhang, J., & Becker Patterson, M. (2010). *Repeat GED tests examinees: who persists and who passes?* Washington, DC: American Council on Education.