

# The Nonequivalent Health of High School Equivalents\*

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*Objectives.* Millions of U.S. adults are recipients of the high school (HS) *equivalency* (General Education Development [GED]) diploma. Virtually nothing is known about the health of this large group, although literature suggests GED recipients are considerably worse off than HS graduates in numerous economic and social outcomes. We analyze general health among working-age adults with a HS diploma, GED recipients, and HS dropouts. *Methods.* Ordered and binary logistic models of self-rated health and activity limitations were estimated using data from the 1997–2009 National Health Interview Surveys ( $N = 76,703$ ). *Results.* GED recipients have significantly and substantially worse health than HS graduates, among both sexes. In fact, the GED recipients' health is generally comparable to that of HS dropouts. Health behaviors and economic factors explain a large proportion of the difference but the gap remains significant. *Conclusions.* In terms of health, adults with a terminal GED are not equivalent to HS graduates. GED recipients report considerably worse general health and activity limitations. The disadvantage is only partly due to the worse economic outcomes and health behaviors; a significant difference remains unexplained and may be due to other, unobserved pathways, or to selection mechanisms.

Over 17 million adults have earned the General Education Development (GED) diploma since its inception (American Council on Education, 2009). In recent years, over half a million GEDs have been awarded annually, representing over 10 percent of all secondary degrees (Snyder and Dillow, 2011; Heckman, Humphries, and Mader, 2010). The GED is referred to as the high school (HS) *equivalency* diploma under the assumption that GED recipients have comparable knowledge and skills as traditional HS graduates. For instance, the Census and the National Center for Education Statistics do not distinguish the GED and HS diplomas in tabulating the educational attainment of U.S. adults.

Over the past two decades, however, education researchers and econometricians have accumulated persuasive evidence that the GED is associated with significantly worse labor market outcomes compared to HS diplomas (Cameron and Heckman, 1993; Tyler, 2003; Heckman and LaFontaine, 2006;

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Heckman, Humphries, and Mader, 2010; Heckman and Rubinstein, 2001; Murnane, Willett, and Boudett, 1997). In employment rates, wages, and other economic indicators, adults with a terminal GED were often found to be comparable to HS dropouts rather than regular HS graduates.

In population health research, much attention has been paid to the gradients in health outcomes by education in general (Ross and Mirowsky, 1999; Herd, 2010; Mirowsky and Ross, 2003). Little is known, however, about how the two secondary credentials, GED, and a regular HS diploma, translate into adult health. Is it justifiable to consider GED recipients as equivalent to HS graduates in terms of health? The health gradient literature would suggest so: different levels of education are known to be associated with correspondingly different levels of health; we could assume that two equivalent educational credentials might be associated with equivalent levels of health. Among the few papers that compared the two secondary schooling credentials, however, there is some disagreement. A 2005 study of about 2,000 adults aged 40–45 found no significant differences between HS and GED with respect to self- and physician-reported illnesses (Caputo, 2005). In contrast, a recent paper using a nationally representative sample of adults aged 25 and above found that GED recipients had higher mortality than HS graduates, especially among younger birth cohorts (Rogers et al., 2010). For emotional health, GED was found associated with higher rates of depressive symptoms compared to a regular diploma among inner-city youth (Ou, 2008).

Ours is the first study to focus in depth on the general health among HS graduates and GED recipients. These two groups represent millions of U.S. adults who are assumed to be comparable in their skills and thus presumably also obtain *equivalent* returns to their credentials in terms of outcomes like health.

### ***The GED and Its Recipients***

The GED is an examination-based credential consisting of five tests (science, reading, writing, social studies, and science/mathematical skills). The credential is intended to certify that its recipients have cognitive skills and knowledge comparable to those of HS graduates (Heckman, Humphries, and Mader, 2010; Tyler, 2005). The GED was created in 1942 to enable young WWII veterans who interrupted their secondary education when they enrolled in the military to complete HS requirements (Tyler, 2005). Over the following decades, the proportion of young adults who completed secondary education via the GED examination rather than the HS diploma has systematically increased (Heckman, 2008). In recent years, up to 18 percent of young adults who completed HS did so via the GED (Heckman, Humphries, and Mader, 2010).

In varied outcomes, GED recipients differed significantly from regular HS graduates. Although the GED is widely accepted as a satisfactory prerequisite

for college admission, relatively few GED recipients enroll in and graduate from four-year colleges (Heckman, Humphries, and Mader, 2010). GED earners also appear to drop out of the military at much higher rates than conventional HS graduates (i.e., see Heckman and LaFontaine, 2010; Boesel, 1998). Ou (2008) examined a range of outcomes among inner-city youth, including incarceration, childbearing, life satisfaction, and substance use. She found a “gradient” where HS dropouts fared worse than GED recipients, who in turn fared considerably worse than HS graduates. Caputo (2005) found a similar gradient with respect to depression in a study of mid-life adults.

### ***Pathways from Education to Health***

Among the explanatory factors that link education and health outcomes, two stand out as important factors in the general literature, and specifically in the GED-HS comparison: economic status and health behaviors. The economic resources include higher income, greater wealth, and more stable employment, all of which are associated with better health (Adams et al., 2003; Backlund, Sorlie, and Johnson, 1996; Elo, Martikainen, and Smith, 2006; Sorlie and Rogot, 1990). Health behaviors comprise a rich set of lifestyle factors: higher education is often associated with more exercise, moderate alcohol intake, less obesity, and less smoking (Cowell, 2006; Lantz et al., 1998).

In the economics literature, studies have consistently reported that relative to regular HS graduates, GED recipients have substantially worse outcomes in employment, hourly wages, income, and other labor-market indicators (Cameron and Heckman, 1993; Heckman and LaFontaine, 2006; Heckman and Rubinstein, 2001; Clark and Jaeger, 2006; Tyler, 2005; Caputo, 2005). The comparison between GED recipients and other dropouts without the credential has been more inconsistent, with some (but not all) studies reporting a significant benefit of the GED for wages and earnings (Heckman and LaFontaine, 2006; Heckman, Humphries, and Mader, 2010; Tyler, 2003).

Literature that has explicitly compared health behaviors between HS graduates and persons who have received GEDs is modest but motivates the inclusion of these variables in our analyses. With respect to smoking, HS graduates have been found to have significantly lower rates than GED earners, who were at best only marginally less likely to smoke than HS dropouts (Kenkel, Lillard, and Mathios, 2006; Ou, 2008; Barbeau, Krieger, and Soobader, 2004). No significant differences between these three educational groups were found in being overweight (Kenkel, Lillard, and Mathios, 2006). Although not traditionally conceptualized as a key health behavior, substance abuse was also reported more frequently among GED recipients than standard graduates (Ou, 2008).

## ***Research Questions***

The study is organized around three questions: (1) How large are the differences in self-rated health (SRH) and activity limitations among persons with GED certificates and HS diplomas? (2) Can the observed gross differences be explained by health behaviors and labor-market characteristics of the GED and HS graduates? (3) Do the results hold for major demographic groups?

## **Data and Method**

### ***Data Source and Analytic Sample***

The analyses are based on data collected in the National Health Interview Surveys (NHIS) from 1997 to 2009. The NHIS consists of annual surveys conducted since 1957; information is collected in face-to-face interviews by the National Center for Health Statistics (NCHS). NHIS uses a complex sampling design to obtain a sample representative of the civilian noninstitutionalized U.S. population. In 1997, the NHIS underwent a major redesign that included a new way of collecting education information. Prior to 1997, education was collected in completed years of schooling, so GED and HS graduates were coded identically, as 12 years of education. Since the redesign, these two credentials have been recorded separately. We obtained the data via the Integrated Health Interview Surveys (IHISs), an aggregated source of the NHIS compiled by the Minnesota Population Center and State Health Access Data Assistance Center (2010).

We defined the analysis sample as U.S.-born adults aged 30–65, who reported their highest level of educational achievement as 9–12 years (HS dropouts), GED, or a HS diploma. We included HS dropouts because they are roughly comparable to the average years of schooling reported by GED recipients in other surveys—about 10 years (Tyler, 2005). Respondents who reported having achieved any postsecondary education or less than 9 years of education were not pertinent to the analyses and therefore excluded from the sample. As a side note, the health of these excluded educational categories followed the gradient: those with 0–8 years of schooling had worse health and more limitations than HS dropouts, and respondents with postsecondary education had better health and fewer limitations. Results are available on request; alternatively, recent studies have reviewed general health across the educational spectrum (Zajacova, Hummer, and Rogers, ??). Foreign-born respondents were excluded because of potential confounding of the age at immigration and region of origin for our research questions. The age range, 30–65 years, was intended to capture working-age population, before the ages when transition to retirement and mortality selection complicate drawing conclusions from model findings. Two respondents from this group were

missing both health outcomes and were also excluded; our final sample size was 76,703 respondents.

### ***Variables***

Information about education was asked in terms of completed years of schooling for respondents with less than a HS degree and in terms of attained credentials for those with at least a HS completion or alternatives. During the interview, respondents were handed a card with all educational categories and asked to place themselves in the appropriate category. We focused on a subset of adults who reported 9–12 years of schooling without a diploma (HS dropouts), GED, or a HS diploma as their highest schooling level.

The two measures of health were SRH and activity limitations. SRH was ascertained with a question: “Would you say your health in general is excellent, very good, good, fair, or poor?” The variable is used in analyses as the original five-category health outcome; for the figure it is collapsed into a binary response, coded 1 for fair or poor health and 0 otherwise. Activity limitation indicated whether the respondent had any limitations versus none (reference). This variable was constructed within NHIS from seven questions that focused on specific limitations, comprising (1) needing help with personal care needs like eating or bathing, (2) needing help with routine needs like household chores, (3) health problems keeping a respondent from working, (4) health problems limiting the kind or amount of work, (5) difficulty walking, (6) difficulty remembering, and (7) limitations in any other activities.

Basic demographic variables included age (measured in single years and centered on the mean age of 47 years), sex (male = reference), and race/ethnicity (non-Hispanic white = reference, non-Hispanic black, Hispanic, and “other”). Census region of residence was coded as Northeast, North Central, South (reference), and West.

For the following variables, the reference was chosen to reflect the most advantageous category as it likely related to health outcomes. Marital status was coded as married (reference), widowed, divorced or separated, and never married. Health insurance was categorized as insured (reference) versus not insured. Economic status was captured by two variables: the respondent’s family poverty-income ratio and own employment status. The poverty-income ratio was defined as the ratio of a family’s income to the federally defined poverty threshold, taking into account household composition. The variable was categorical, with levels from “under 0.5” for a family with income less than half the poverty threshold, up to “5 and over” for a family with income five or more times the threshold. We recoded the variable into the median value of each category and used it as a continuous predictor of health. Employment status was a nominal variable coded as employed (reference), unemployed, or not in labor force.

Finally, we included three predictors to capture health behaviors: smoking, alcohol use, and obesity. Smoking was categorized as never (reference), former, and current smoker. Alcohol use was coded as never, former use, and current use (reference). Body size was captured using the body mass index (BMI), calculated from self-reported height and weight, and used in models as a dichotomous indicator coded as nonobese (reference) versus obese ( $\text{BMI} \geq 30$ ).

### *Analysis*

First, univariate and bivariate descriptive analyses were used to examine the distribution of the variables individually and across the three education groups. Variables with significant differences across schooling categories were particularly likely to be important explanatory factors in the multivariate models. Second, we estimated a series of nested ordered logistic models of SRH and logistic models of activity limitations. Each series comprised four models; the first model controlled for age, sex, and race; the second model added marital status, region, and access to health care. The next models added the major explanatory pathways linking education and health: economic resources and health behaviors. Third, we estimated the baseline models separately by age (30–45 and 46–65 years), sex, and race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic). The purpose of these stratified models was to examine to what degree the all-sample findings hold for demographic subgroups, an important validity check given that the effect of education on health in general is known to vary by age, sex, and race (Hill and Needham, 2006; Liu and Hummer, 2008; Dupre, 2008).

In order to provide a clear visual impression of the health differences between HS and GED credentials, we calculated predicted probability of fair/poor health and activity limitations by age for GED and HS diploma recipients. The probabilities were calculated from age, sex, and race-adjusted logistic models of each outcome. In order to allow the data to reveal the actual shape of the likelihood of an outcome by age, we fitted each model using age, age squared, and age cubed, as well as the interactions of these age terms with the GED dummy.

There were no missing data on basic demographic variables. For all categorical control variables from marital status to health behaviors, we included a category of “unknown.” Most variables had a low proportion of missing observations, ranging 0.2 percent for employment status to 4.8 percent for obesity information. The poverty-income ratio was the only predictor with a high proportion missing values (20 percent). We imputed them using a regression-based imputation. To establish how robust the findings were to different methods of dealing with the missingness on income, we also estimated models using categorized income with a missing category, and models where adults with missing income were dropped. These different specifications yielded comparable results (all are available on request).

Additional validity checks included testing the proportional odds assumption for the ordered logistic model of SRH. The global tests (both Brant Wald test and the approximate likelihood ratio test) were significant, indicating violation of the proportional odds assumptions. The Brant test for the primary coefficient of interest, for GED versus HS diploma, however, had  $p$ -value = 0.83, indicating that the coefficient was statistically identical across all binary equations. Since these tests are not available for data collected using the complex sampling design, their findings are difficult to interpret. We have therefore also estimated models of dichotomized SRH (fair/poor vs. excellent to good), obtaining comparable findings. The results are available on request. All analyses adjusted for complex sampling design using svy suite of commands in Stata 11.0.

## Results

Table 1 shows that among adults in the analysis sample, 70 percent were HS graduates, about 8 percent had a GED, and 22 percent dropped out of HS without a credential. Just over half the respondents reported excellent or very good health; 18 percent had fair or poor health. About one in five adults reported some activity limitations. There was considerable variation across the three educational groups in both health outcomes and most control variables. The direction of the differences was as expected; a more unexpected pattern was that the GED recipients resembled HS dropouts more than HS graduates. For instance, both GED recipients and dropouts were substantially more likely than graduates to be in fair or poor health, have activity limitations, be unmarried, uninsured, unemployed, have low income, and smoke.

The descriptive analyses suggested health differences among the educational groups. Tables 2 and 3 show the differences in a multivariate context, taking into account the different distribution of explanatory factors among the three education groups. The results were similar for SRH and activity limitations, so we comment on both sets of results together. Controlling for key demographic variables in Model 1, we obtained a startling finding: adults with a GED, assumed to be equivalent to the HS credential, had significantly and substantially worse health compared to HS graduates: they were about *twice* as likely as HS graduates to report “worse” health and activity limitations. In fact, GED recipients were only slightly better off than dropouts in SRH and statistically indistinguishable from dropouts in activity limitations (see notes to Tables 2 and 3).

Figure 1 illustrates how the relative differences between HS graduates and GED recipients translate into absolute inequalities. The predicted probabilities of fair/poor self-assessed health and activity limitations by age showed an enormous health gap. Best expressed in age equivalents, 30-year-old GED recipients have health similar to that of HS graduates in their early 40s; when the GED recipients are about 42–43 years old, their health is comparable to that of 60-year-old HS graduates.

TABLE 1

Characteristics of the Analysis Sample, by Education ( $N = 76,703$ )

Education	9–12 Years	GED	High School Graduate	Total
9–12 years (dropouts)				22.1%
GED				7.9%
High school graduates				70.0%
Health ( $N = 76,636$ )				
Excellent	14.7%	15.2%	23.6%	21.0%
Very good	23.3%	26.8%	33.4%	30.6%
Good	33.1%	33.8%	29.3%	30.5%
Fair	20.1%	17.1%	10.5%	13.2%
Poor	8.8%	7.1%	3.2%	4.8%
Activity limitations ( $N = 76,564$ )				
No activity limitations	69.9%	72.1%	83.3%	79.4%
Any activity limitations	30.1%	27.9%	16.7%	20.6%
Control variables				
Age—mean ( <i>SE</i> )	47.5 (.09)	45.7 (.15)	47.0 (.05)	47.0 (.04)
Female	53.4%	51.7%	53.8%	53.6%
Marital status				
Married	44.8%	46.8%	56.0%	52.8%
Widowed	6.6%	4.8%	4.4%	4.9%
Divorced	29.2%	32.7%	24.6%	26.2%
Never married	18.8%	15.1%	14.5%	15.5%
Unknown	0.6%	0.5%	0.6%	0.6%
Race/ethnicity				
Non-Hispanic white	67.0%	78.5%	80.8%	77.6%
Non-Hispanic black	23.8%	12.5%	13.8%	15.9%
Hispanic	7.5%	7.1%	4.1%	5.1%
Other	1.8%	2.0%	1.3%	1.5%
Geographic region				
Northeast	15.2%	14.7%	19.3%	18.1%
North Central	22.8%	25.0%	29.5%	27.7%
South	47.6%	44.0%	37.1%	39.9%
West	14.4%	16.4%	14.0%	14.3%
Health insurance				
Uninsured	23.9%	23.1%	14.6%	17.4%
Insured	75.8%	76.6%	85.0%	82.3%
Unknown	0.3%	0.3%	0.3%	0.3%
Employment				
Employed	55.3%	63.2%	72.6%	68.0%
Unemployed	4.5%	5.6%	2.7%	3.3%
Not in labor force	40.1%	31.2%	24.5%	28.5%
Unknown	0.1%	0.1%	0.2%	0.2%
Income-to-poverty ratio				
Continuous	2.2	2.5	3.3	3.0
Categorized				
Low	51.6%	49.2%	29.9%	36.2%
Mid	19.8%	23.2%	28.5%	26.1%



TABLE 1—continued

Education	9–12 Years	GED	High School Graduate	Total
High	9.6%	11.4%	21.0%	17.7%
Unknown	19.0%	16.2%	20.7%	20.0%
Body weight				
Not obese	63.3%	63.5%	66.8%	65.7%
Obese	32.6%	32.3%	28.2%	29.5%
Unknown	4.1%	4.3%	5.0%	4.8%
Smoking				
Never smoked	32.5%	24.7%	44.9%	40.5%
Past smoker	20.8%	22.9%	22.6%	22.2%
Current smoker	45.9%	51.6%	31.4%	36.2%
Unknown	0.9%	0.8%	1.1%	1.0%
Alcohol use				
Never	22.0%	15.4%	18.1%	18.7%
Former	23.4%	23.1%	17.5%	19.3%
Current	52.2%	59.5%	61.7%	59.4%
Unknown	2.5%	2.0%	2.7%	2.6%

NOTE: U.S.-born adults age 30–65, NHIS 1997–2009. Adjusted for sampling design. All variables are significantly different across education categories at  $p < 0.001$  except sex ( $p = 0.018$ ).

Adjusting for region of residence and marital status in the second model in Tables 2 and 3 explained relatively little of the HS-GED differential: GED recipients remained about twice as likely to report “worse” health and activity limitations, compared to HS graduates.

Economic status, added in Model 3, explained a much larger proportion of the HS-GED difference. The odds ratio decreased to 55 percent higher odds of “worse” health from 88 percent in Model 2, and to 48 percent higher odds of reporting a limitation for GED recipients relative to HS graduates from 204 percent, a reduction of 30–45 percent of the GED disadvantage from the previous model. Finally, health behaviors were also significant predictors of health, and further attenuated the HS-GED inequality. However, the differences remained significant: in Model 4, taking into account multiple potential confounders and mediators, GED recipients still reported 35–39 percent higher odds of worse health outcomes relative to HS graduates, a significant and considerable disadvantage.

A consistent finding across all models and both outcomes was that the GED earners were more similar to HS dropouts than graduates. Adjusted for economic outcomes and health behaviors, adults with a GED and HS dropouts were statistically identical in terms of their self-reported health; for activity limitations, HS dropouts actually reported 13 percent lower odds of any limitations than adults with a GED ( $p < 0.001$ ).

Table 4 summarizes the GED-HS differences in major demographic subgroups. The key finding was that the difference between graduates and the two other education groups was consistent in direction and significance across

TABLE 2  
 Ordered Logistic Models of SRH on Select Predictors, NHIS 1997–2009  
 (N = 76,636)

	Model 1	Model 2	Model 3	Model 4
Education (reference = HS diploma)				
HS dropouts	2.14***	2.05***	1.56***	1.45***
GED	1.96***	1.88***	1.55***	1.39***
Key demographics				
Age	1.04***	1.04***	1.03***	1.03***
Female	1.11***	1.12***	0.90***	0.92***
Race/ethnicity (reference = non-Hispanic white)				
Black	1.57***	1.38***	1.17***	1.17***
Hispanic	1.12***	1.14***	1.06	1.09*
Other	1.39***	1.36***	1.19**	1.12
Year of interview	1.03***	1.03***	1.03***	1.02***
Marital status (reference = married)				
Widowed		1.20***	0.88***	0.88***
Divorced		1.41***	1.24***	1.22***
Never married		1.48***	1.17***	1.18***
Unknown		1.03	0.85*	0.88
Region (reference = South)				
Northeast		0.84***	0.86***	0.87***
North Central		0.94**	0.96	0.95*
West		0.82***	0.81***	0.84***
Health insurance (reference = insured)				
Uninsured		1.10***	0.90***	0.91***
Unknown		1.17	0.99	1.02
Economic factors				
Family income			0.80***	0.82***
Employment (reference = employed)				
Unemployed			1.29***	1.27***
Not in LF			2.79***	2.71***
Unknown			0.98	1.06
Body weight (reference = not obese)				
Obese				1.88***
Unknown				1.51***
Smoking (reference = never smoked)				
Past smoker				1.23***
Current smoker				1.72***
Unknown				1.19
Alcohol use (reference = current use)				
Never				1.20***
Former				1.48***
Unknown				1.09
Cutpoints				
1	-1.03	-0.97	-1.81	-1.22
2	0.44	0.51	-0.25	0.37
3	1.99	2.08	1.46	2.13
4	3.52	3.62	3.11	3.81

NOTE: When we reestimate these models with GED as the omitted education category, the results show that HS dropouts have 9 percent higher odds of "worse" health than GED recipients in Models 1 and 2 ( $p < 0.01$ ); there are no significant difference between GEDs and dropouts in Models 3 and 4.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

TABLE 3

Logistic Models of Activity Limitations on Select Predictors ( $N = 76,564$ )

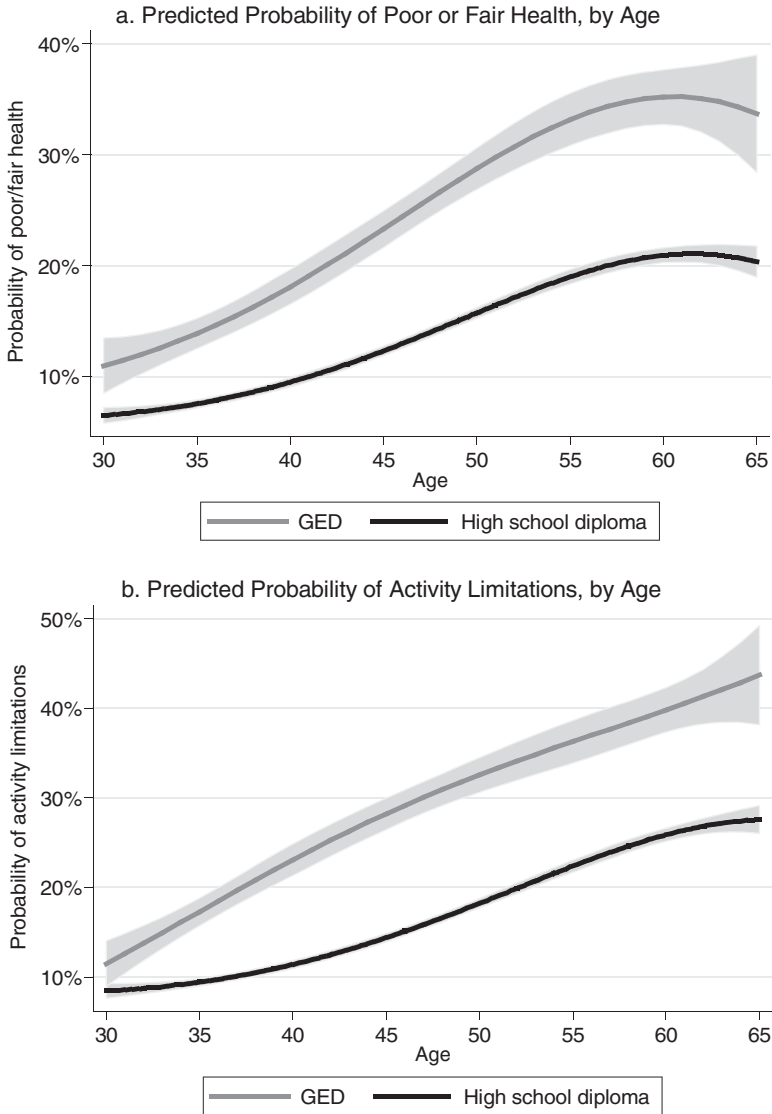
	Model 1	Model 2	Model 3	Model 4
Education (reference = HS diploma)				
HS dropouts	2.10***	2.06***	1.26***	1.17***
GED	2.09***	2.04***	1.48***	1.35***
Control variables				
Age	1.05***	1.05***	1.03***	1.03***
Female	1.04	1.03	0.67***	0.68***
Race/ethnicity (reference = non-Hispanic white)				
Black	1.27***	1.05	0.77***	0.77***
Hispanic	0.89**	0.82***	0.69***	0.71***
Other	1.51***	1.35***	1.08	1.01
Year of interview	1.02***	1.02***	1.02***	1.01**
Marital status (reference = married)				
Widowed		1.93***	1.35***	1.38***
Divorced		2.04***	1.91***	1.92***
Never married		2.55***	1.87***	1.94***
Unknown		1.32*	1.06	1.21
Region (reference = South)				
Northeast		0.97	1.03	1.03
North Central		1.05	1.14***	1.13***
West		1.16***	1.18***	1.21***
Health insurance (reference = insured)				
Uninsured		0.74***	0.58***	0.59***
Unknown		0.64	0.46**	0.50**
Economic factors				
Family income			0.71***	0.73***
Employment (reference = employed)				
Unemployed			1.84***	1.85***
Not in LF			8.05***	7.95***
Unknown			0.69	0.80
Body weight (reference = not obese)				
Obese				1.64***
Unknown				1.35***
Smoking (reference = never smoked)				
Past smoker				1.28***
Current smoker				1.54***
Unknown				0.99
Alcohol use (reference = current use)				
Never				1.19***
Former				1.72***
Unknown				0.96

NOTE: When we reestimate these models with GED as the omitted education category, the results show that HS dropouts and GEDs are not significantly different in Models 1 and 2; the dropout group actually has significantly lower odds of limitations than GED recipients (OR = 0.85,  $p < 0.001$  in Model 3; OR = 0.87,  $p < 0.01$  in Model 4).

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

FIGURE 1

- a. Predicted Probability of Poor or Fair Health, by Age
- b. Predicted Probability of Activity Limitations, by Age



all demographic groups: GED recipients had worse health and more functional limitations than graduates. The health gap between HS and GED was marginally larger for older adults and women in SRH and for younger adults and men in activity limitations. Auxiliary interaction models

TABLE 4

Models of Self-Rated Health (SRH) and Activity Limitations on Education, for Total Sample and by Demographic Subpopulations, NHIS 1997–2009

	By Age		By Sex		By Race/Ethnicity		
	30–45	46–65	Men	Women	White	Black	Hispanic
A. SRH							
Education (reference = HS diploma)							
9–12	2.07***	2.20***	2.02***	2.24***	2.23***	1.82***	1.89***
GED	1.89***	2.02***	1.90***	2.00***	2.14***	1.45***	1.52***
B. Activity limitations							
Education (reference = HS diploma)							
9–12	2.14***	2.09***	1.98***	2.21***	2.14***	1.88***	2.19***
GED	2.20***	2.00***	2.09***	2.07***	2.18***	1.63***	2.14***

NOTE: U.S.-born adults age 30–65, NHIS 1997–2009. The models also controls for age and interview year, as well as sex and race/ethnicity in those models not stratified on these predictors. Adjusted for sampling design.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

(available on request) showed that these differences were not statistically significant. Racial/ethnic differences in the HS-GED gap were more pronounced, reaching statistical significance in the interaction models. For both health outcomes, the gap was largest among whites, smaller among Hispanics, and smallest among black adults. This variation may occur either because black and Hispanic adults gain less from a HS diploma than whites, or because they are penalized less for having a GED than white adults.

## Discussion

For nearly 70 years, the GED has existed as an alternative to a regular HS diploma, predicated on the *equivalence* between the two credentials. We asked whether these two credentials translated into equivalent health among working-age adults. Other outcomes of GED recipients have been studied for two decades, primarily focusing on labor market outcomes (Heckman and LaFontaine, 2010; Cameron and Heckman, 1993). Despite calls for extending the comparison of GED and HS diplomas to other areas (Tyler, 2003), no previous study analyzed the general health of GED recipients and HS graduates. Using nationally representative NHIS data, we showed that GED recipients face a substantial health disadvantage compared to HS graduates. The supposedly equivalent GED credential is associated with about *twice* the odds of self-reported “worse” health and physical limitations than a HS diploma. This relative difference is even more clearly illustrated using absolute differentials. Adults with GEDs have health comparable to HS graduates who are up to 20 years older. In fact, GED recipients are not only systematically

worse off than their HS graduate peers, but they appear worse off than high school dropouts.

The gross HS-GED difference is partly due to the lower income and employment, as well as worse lifestyle profile, of the latter group. Controlling for these mediating factors, the difference between GED and HS decreases; however, it remains significant and substantively large in both SRH and functional limitations. The explanatory inputs of economic and lifestyle variables corroborates the literature, which has established that the GED is associated with worse outcomes ranging from employment, wages, college attendance and completion, military retention, life satisfaction, depression, and smoking (Tyler and Lofstrom, 2010; Kenkel, Lillard, and Mathios, 2006; Ou, 2008; Heckman, Humphries, and Mader, 2010; Caputo, 2005).

On the other hand, our findings differ from the literature in one crucial aspect. Some previous studies reported that GED recipients had advantage over HS dropouts in various educational and social outcomes (Caputo, 2005; Tyler, 2003; Boesel, Alsalam, and Smith, 1998); we found the opposite for health outcomes. With respect to general health, GED recipients appear consistently *worse* than HS dropouts—a finding that held across population subgroups and taking into account varied explanatory factors. A possible exception to these patterns occurs among black and Hispanic adults, where differences among the three educational categories were smaller than among whites. Some theorists might find this pattern consistent with expectations: racial/ethnic minorities face racism and discrimination that impedes their ability to convert higher education into other resources, including health (Williams, 1997; Williams and Collins, 1995). Empirical studies, however, tend to report that the effect of schooling on health is comparable for whites and blacks, or that the black disadvantage is “slight” (Zajacova, 2006; Cutler and Lleras-Muney, 2008). One reason for the apparent similarity might be gleaned from Christenson and Johnson’s (1995) study, which found that black adults benefited less than whites from schooling at the postsecondary level, but more at the presecondary to secondary level, the range we studied here.

The key question is why do the HS equivalents have such “nonequivalent” health. Although our data and study design did not permit a causal analysis, we can draw on several theoretical perspectives to speculate about the findings. One explanation of the striking disadvantage of GED recipients might draw on the human capital theory, in particular its conceptualization within the health literature (Becker, 1964; Ross and Mirowsky, 1999). Human capital comprises both cognitive skills like writing, reading, and quantitative reasoning, and noncognitive skills. Noncognitive factors comprise psychological traits like the ability to defer gratification (Mischel, Shoda, and Rodriguez, 1989), time preference (Barsky et al., 1997), self-control (Tangney, Baumeister, and Boone, 2004), self-efficacy (Bandura, 1986), personal control (Mirowsky and Ross, 1998), and numerous other factors.

These noncognitive characteristics have been linked to important outcomes, including health. For instance, Mirowsky and Ross (1998, 2003) suggest that

education affects health by increasing the sense of personal control, a noncognitive skill, which promotes a healthy lifestyle via persistence and active decisions about appropriate health behaviors. Thus, social epidemiologists have already considered how education and health may be linked via noncognitive skills. With respect to the HS-GED comparison, Heckman and colleagues (Heckman and Rubinstein, 2001; Heckman, Humphries, and Mader, 2010; Heckman, 2008) have shown that the cognitive skills of GED and HS diploma earners are comparable; however, they posit that the GED recipients have considerably weaker noncognitive skills. If the GED recipients have personality characteristics that influence their time preference or the ability to defer gratification (Mischel, Shoda, and Rodriguez, 1989; Barsky et al., 1997), their life choices may generally lead to a trajectory that is less optimal for health, whether via jobs, relationships, social support, or general lifestyles that may negatively impact their health in adulthood.

Given the importance of noncognitive skills in explaining the differences among the education groups, an obvious limitation of this study is an absence of direct measures of noncognitive characteristics. The next step in untangling the relationship between educational credentials and health depends on the availability of data, which needs to include health outcomes, detailed educational information, and valid measures of noncognitive skills. We hope that the increasing awareness of the high-risk status of the GED recipients will help add noncognitive measures to educational and health surveys, and conversely that existing surveys will add information about GED diploma as a separate educational category.

Another limitation concerns the self-reported nature of the health outcomes. We cannot isolate the underlying latent health differences from possible reporting biases: if adults with a GED report their health as worse, given some true level of health, compared to HS graduates, the differences we described would be biased upward. There is now a growing literature examining group differences in how respondents form health judgments (Dowd and Zajacova, 2010; Subramanian, Huijts, and Avendano, 2010; Zajacova and Dowd, 2011; Crossley and Kennedy, 2002). It is becoming clear that there are group differences in self-ratings of health, but it is not yet clear to what degree or even in what direction they may affect our research on health disparities. It is also helpful to keep in mind that there is extensive literature that has repeatedly found high predictive and concurrent validity of SRH (Mossey and Shapiro, 1982; Idler, Russell, and Davis, 2000; Bailis, Segall, and Chipperfield, 2003).

Our findings extend economic and educational literatures, which previously documented the nonequivalent outcomes of GED recipients in labor market and other early-adulthood outcomes, to health. The substantial health gap between adults with a GED versus a HS diploma has both policy and research implications. In terms of health policy, the GED group comprises millions of adults in the United States. It is clear that their health is considerably worse than would be implied by their supposed equivalence to their HS diploma peers; consequently, they may require earlier medical interventions and more

health-care resources in the coming decades. In terms of research, the findings suggest that we need to exercise caution when putting adults with GED and HS diploma on equal footing in our studies. These two groups do not have comparable health, and ignoring this fact might bias findings and lead to erroneous conclusions about population health inequalities.

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