Does Literacy Predict Self-Rated Health and Chronic Illness in Mid-Life?

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Brief Abstract

This paper contributes to the literature on literacy and health across the life course. Literacy is associated with a range of poor health-related outcomes, including mortality among older adults in the United States. However, evidence that literacy contributes to poor health in earlier stages of the life course is limited and is based on cross-sectional studies which limit the ability to disentangle literacy from other social determinants of health. Using data for respondents from the National Longitudinal Survey of Youth (NLSY) 1979, who were followed through 2006 and who completed a Health Module at age 40 (n=7,667), we examine whether literacy assessed at ages 16-24 is independently associated with poor/fair self-reported health status and chronic conditions at midlife. Results from logistic regression analyses reveal that respondents with low literacy (<7th Reading Grade Level (RGL)) had significantly higher odds of reporting fair/poor self-rated health compared to those with high literacy (≥12th grade RGL) even after controlling for socio-demographic variables, including educational attainment. Less than high school education was also a significant predictor of poor/fair self-rated health, controlling for literacy. Although low literacy also exhibited significant bivariate association with chronic illness, neither literacy nor educational attainment retained a significant association with chronic disease in the fully adjusted model. Together these results indicate that literacy contributes to the risk of poor/fair self-rated health status in mid-life independent of educational attainment and poverty history. The lack of association between chronic illness and literacy may be a result of the age of the sample for whom cardiovascular health is not yet a major factor.

INTRODUCTION

Prior research indicates that literacy, generally measured through assessments of reading skill, is associated with major health outcomes (Berkman ND *et al.*, 2004; Dewalt, Berkman, Sheridan, Lohr, & Pignone, 2004). Within the United States, literacy has been associated with preventive health care utilization (e.g. screening for illness, physician visits), chronic illness (e.g. asthma, diabetes, HIV care), stage of cancer diagnosis, and all-cause and cardiovascular mortality among the elderly (Baker *et al.*, 2007; Bennett *et al.*, 1998; Berkman ND *et al.*, 2004; Dewalt *et al.*, 2004). Literacy has also been shown to contribute, along with other social determinants of health, to race/ethnic disparities in health (Bennett, Chen, Soroui, & White, 2009).

Literacy is also associated with other determinants of health such as poverty and educational attainment. However, literacy is also distinct from these social determinants in important ways. First, literacy represents a skill rather than a fixed risk factor and is thus potentially modifiable throughout the life course. Second, literacy has potentially distinct mechanisms through which it influences health outcomes, and it is associated with distinct policy prescriptions for reducing health disparities. Finally, literacy appears both to account for at least some of the risk of poor health outcomes associated with other social risk factors (i.e. poverty) and to provide additional information to more traditional measures such as educational attainment. Despite these considerations literacy has not been a major area of research in sociology or demography, particularly in regard to the study of health disparities in developed nations. Most of the evidence for the role of literary in health thus comes from the medical literature where the role of

other social determinants is less often considered. Increased attention from social scientists could provide additional insights regarding how literacy relates to health.

Although there is a sizeable literature examining the association between literacy and health, few studies have assessed this relationship in midlife. Yet a consideration of mid-life health outcomes is important because interventions to improve outcomes related to low literacy are likely to have limited benefit when targeted at the elderly as cumulative exposure to adverse circumstances over the life course are related to late life chronic disease and mortality (Geronimus, Hicken, Keene, & Bound, 2006; Seeman, Singer, Ryff, Love, & Levy-Storms, 2002). Thus understanding the role of literacy in producing health disparities earlier in the life course is critical to better defining the role of literacy in chronic illness and mortality later in life.

Another important limitation of the current literature on literacy and health is the lack of studies which use longitudinal data. Although cross-sectional studies provide information about the association between literacy and health outcomes at a point in time, it is difficult to disentangle the importance of low literacy from other factors that contribute to poor health outcomes and whose effects cumulate over the life course. We are not aware of any previous studies that assess the relationship between literacy early in the life course and health outcomes occurring decades later.

In this study, we use data from the National Longitudinal Study of Youth 1979 (NLSY 79). This national longitudinal study of men and women includes an oversampling of low income minority populations and follows adults from age 14-21 through adulthood. In the current analysis, health outcomes are based on responses to a health module administered when the participants were about age 40. We assess the

association between literacy and two health outcomes: 1) respondent's self-rated health at about age 40, and 2) whether or not the respondent had ever been diagnosed with a chronic illness associated with cardiovascular health (e.g., hypertension, heart problems, or diabetes). Both outcomes fall within a general conceptual model linking social factors with health through the life course.

DATA and METHODS

Although discussed briefly below, details regarding sample selection, response rate, and interview procedure are reviewed extensively elsewhere (NLSY79 Users Guide, 2004).

Sample

In 1979, the National Longitudinal Survey of Youth (NLSY79) began conducting interviews with 12,686 youth who were ages 14 to 21 at initial interview in 1979. Annual interviews were conducted until 1994 and biennial interviews thereafter. The 7,667adults included in our sample represent 79% of the 9,763 NLSY 79 participants followed prospectively; an additional 2,923 respondents were members of the military and poor white supplemental samples which were discontinued in 1985 and 1990 respectively and whom we did not include as eligible respondents for this study. Figure 1 shows the selection of study participants included in these analyses and the reason for why they were dropped from our sample.

Measures

Outcome Variables

We use the health module administered to NLSY79 respondents at the first interview completed when the participant was age 40 or above (Health Module 40) and create

two health outcome measures: (1) self-rated health; and (2) diagnosed chronic illness. Self-rated health is based on a five item scale (coded as (1) Excellent; (2) Very Good; (3) Good; (4) Fair; (5) Poor) that has been found to be highly predictive of objective measures of poor health and mortality (Ware & Sherbourne, 1992). In our regression models, we follow a standard approach and use a dichotomous measure of self-rated health coded as 1: fair or poor health or 0: excellent, very good or good health. We create a dichotomous measure of chronic illness indicating whether the respondent had ever been diagnosed with hypertension, diabetes or heart disorders. We code chronic illness as 1 if the respondent reported ever being diagnosed with any of these chronic health problems and 0 otherwise.

Explanatory Variables

Literacy

We measure literacy based on the Armed Services Vocational Aptitude Battery (ASVAB) verbal (VE) composite score, which is comprised of word knowledge and paragraph comprehension subtests administered to study participants in 1980. We code this measure into five categories reflecting literacy levels that have been widely associated with poor outcomes in adulthood, including economics, health, and incarceration (Kutner M, Greenberg E, & J, 2005). We code our literacy measure as: 1: < 5^{th} grade reading level; 2: 5^{th}–6^{th} grade reading level; 3: 7^{th}–8^{th} grade reading level; 4: 9^{th}–11^{th} grade reading level; and 5: 12^{th}+ grade reading level. The categories are based on the Department of Defense Reading Grade Level (RGL), which was established among 20,422 military recruits in comparison with a range of standard adult literacy assessments (Waters, Barnes, Foley, Steinhaus, & Brown, 1988).

Socio-demographic Variables

We include several socio-demographic variables in the analysis which may confound the association between literacy and health outcomes. These include educational attainment at age 35 coded as follows: 1: less than high school; 2: high school diploma/GED; 3: at least some college. We also include gender (male/female), race/ethnicity (non-Hispanic white/Black/Hispanic/Other), and poverty status at ages 14-21 (yes, no, missing), all measured at the time of the 1979 interview. We also control for age and marital status (never married, currently married, separated/divorced/widowed, missing) at the time when the health module was administered. In addition, we include a poverty history variable between ages 25 and 40, calculated as the proportion of years in poverty between these ages, which is introduced as a linear variable in the regression analysis.

Statistical Analysis

We use multiple logistic regression to estimate a set of nested models assessing the risk of poor/fair self-rated health and whether respondent had ever been diagnosed with a chronic illness. Model 1 includes our key literacy measure and controls for age; Model 2 incorporates additional demographic controls (gender, race/ethnicity, and marital status); and Model 3 also includes controls for socioeconomic characteristics (educational attainment, poverty at ages 14-21 and poverty history at ages 25-40). A *p* value of 0.05 was used to determine statistical significance.

PRELIMINARY RESULTS

We report sample characteristics in Table 1. As shown in Table 1, 13 percent of the sample reported fair or poor health and 22 percent reported chronic illness at the time

when the Health Module 40 was administered. Literacy levels in our sample were consistent with national studies of literacy for this age group with 30 percent having reading levels below 7th grade (Kutner M *et al.*, 2005). About 12 percent of the sample had less than high school education, an estimate also consistent with national data for these birth cohorts (Laird, 2008).

Table 2 reports the results from our regression models for self-rated health. In Model 1, respondents with lower literacy had significantly higher risk of "fair/poor" self-rated health compared to those with at least a 12th grade reading level. In model 2, which includes additional demographic controls, the odds ratios are not markedly altered. In Model 3, which adds controls for socioeconomic characteristics, the odds ratios for low levels of literacy are reduced by one half or more and only the two lowest literacy levels remain statistically significant (< 5th grade and 5th-6th grade). Low educational attainment is also a significant predictor of fair/poor self-rated health, controlling for literacy in all models. Thus, it appears that literacy captures unmeasured aspects of educational attainment and the two tap into different determinants of self-rated health.

Table 3 shows results for chronic disease. In Model 1, only low literacy (less than 7th grade reading level) was significantly associated with being diagnosed with a chronic illness by age 40. With the addition of demographic controls in Model 2, only lowest literacy level remained significant (< 5th grade reading level). In Model 3, once socioeconomic controls were incorporated into the model, literacy was no longer a significant predictor of chronic illness. The results were similar for educational attainment.

PRELIMINARY CONCLUSIONS

Our preliminary results regarding the association between literacy and health outcomes in midlife are consistent with those of previous studies. Literacy level at age 14-21 predicts “fair/poor” self-rated health independent of socio-demographic characteristics, including educational attainment. Consistent with earlier cross-sectional studies, both literacy and educational attainment retain an independent association with poor/fair self-rated health. This same profile was not present for presence of chronic illness.

Our results indicate that literacy measured at ages 16-24 is a significant predictor of self-rated health in midlife and should be considered in studies of health outcomes. Self-rated health has been shown to be correlated with objective measures of poor health as well as an independent predictor of mortality (Ware & Sherbourne, 1992). However, we did not find evidence that either literacy or educational attainment were associated with diagnosis of hypertension, diabetes, or heart disorders by age 40. These chronic illnesses were selected because they represent important predecessors to cardiovascular mortality which has been associated with low literacy in the elderly (Baker *et al.*, 2007). It is possible that at age 40, there is not a high enough prevalence of these disorders to make the link between early literacy and later cardiovascular health. Further work is needed to address this question using data sets with longer follow up.

We will extend these analyses to include additional health measures included in the NLSY 79 Health Module 40. Specifically, we will examine the association between literacy and the SF12 physical components scale and mental components scale.

Because of the widespread use of these scales in epidemiologic research, these additional results will complement the analyses presented above.

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Table 1. Sample Characteristics of NLSY Respondents Completing Health Module for Persons aged 40 and over (n = 7, 667).

	Percent
Outcome Variables	
Self-Rated Health	
Excellent	20.7
Very Good	38.3
Good	28.0
Fair	10.6
Poor	2.5
Ever diagnosed with chronic illness (*Hypertension, Diabetes, Heart Problem*)	22.0
Explanatory Variables	
Literacy: Reading Grade Level (RGL)	
<5th grade	16.5
5th - 6th grade	13.2
7th - 8th grade	15.3
9th -11th grade	32.7
12th grade and greater	22.4
Demographic Variables	
Age at Health Module 40 (*Mean (S.D.) reported)*	41.2 (0.96)
Gender	
Male	51.8
Female	48.2
Nativity (*US born*)	93.3
Race/Ethnicity	
White	47.1
Black	29.8
Hispanic	16.1
Other	7.0
Marital History	
Never Married	15.7
Married	58.0
Divorced/Separated/Widowed	17.6
Missing	8.6
Socioeconomic Characteristics	
Educational Attainment	
Less than high school	11.9
High school graduate/GED	45.2
Some college or more	43.0
In Poverty age 14-21	24.0
Missing	5.7
Number of Years in Poverty Age 25-40- Mean (SD)	0.18 (0.29)

Table 2. Odds Ratios from Logistic Regressions Predicting Fair/Poor Self Rated Health by Reading Skill in ASVAB Reading Grade Level (N=7,667) *Omitted category in parentheses*

	Model 1[A] Bivariate	**Model 2**[A,B] With Demographic Controls	**Model 3**[A,C] With Demographic & SES Controls
Literacy: Reading Grade Level			
(*>= 12th grade reading level*)			
<5th grade	5.70***	5.76***	2.08***
5th - 6th grade	3.75***	3.57***	1.75***
7th - 8th grade	1.93***	1.85***	1.15
9th -11th grade	1.58***	1.54***	1.20
Educational Attainment by age 35			
(*Some college or more*)			
Less than high school	5.68***		2.40***
High school graduate/GED	2.69***		1.84***

[A] All models control for age of respondent when the health module was administered.
[B] Model 2 includes controls for gender, race/ethnicity, nativity, and marital status.
[C] Model 3 includes controls for educational attainment at age 35, poverty status at age 14-21, and proportion of years in poverty between ages 25 and 40.
* p<0.05; ** p<0.01; *** p<0.001

Table 3. Odds Ratios from Logistic Regressions Predicting Chronic Illness[A] by Reading Skill in ASVAB Reading Grade Level (N=7,667) *Omitted category in parentheses*

	Model 1[B] Bivariate	**Model 2**[B,C] With Demographic Controls	**Model 3**[B,D] With Demographic & SES Controls
Literacy: Reading Grade Level			
(*>= 12th grade reading level*)			
<5th grade	1.51***	1.26*	0.95
5th - 6th grade	1.41***	1.20	1.00
7th - 8th grade	1.17	2.03	0.93
9th -11th grade	1.09	1.04	0.99
Educational Attainment by age 35			
(*Some college or more*)			
Less than high school	1.37***		1.15
High school graduate/GED	1.21***		1.12

[A] Chronic illness (Yes/No) = Respondent was ever diagnosed with hypertension, diabetes, or heart disorder.
[B] All models control for age of respondent when the health module was administered.
[C] Model 2 includes controls for gender, race/ethnicity, nativity, and marital status.
[D] Model 3 includes controls for educational attainment at age 35, poverty status at age 14-21, and proportion of years in poverty between ages 25 and 40.
* p<0.05; ** p<0.01; *** p<0.001

Figure 1. NLSY 79 Sample Selection for Analysis of Literacy (Reading Grade Level)