Published in final edited form as:

Health Econ. 2018 August ; 27(8): 1160–1174. doi:10.1002/hec.3664.

The dynamic relationships between economic status and health measures among working-age adults in the United States

Abdulkarim M. Meraya^{1,2}, Nilanjana Dwibedi¹, Xi Tan¹, Kim Innes³, Sophie Mitra⁴, and Usha Sambamoorthi¹

¹Department of Pharmaceutical Systems and Policy, School of Pharmacy, West Virginia University, Morgantown, WV, USA

²Department of Clinical Pharmacy, Faculty of Pharmacy, Jazan University, Jazan, Saudi Arabia

³Department of Epidemiology, West Virginia University School of Public Health, Morgantown, WV, USA

⁴Department of Economics, Fordham University, Bronx, NY, USA

Abstract

We examine the dynamic relationships between economic status and health measures using data from 8 waves of the Panel Study of Income Dynamics from 1999 to 2013. Health measures are self-rated health (SRH) and functional limitations; economic status measures are labor income (earnings), family income, and net wealth. We use 3 different types of models: (a) ordinary least squares regression, (b) first-difference, and (c) system-generalized method of moment (GMM). Using ordinary least squares regression and first difference models, we find that higher levels of economic status are associated with better SRH and functional status among both men and women, although declines in income and wealth are associated with a decline in health for men only. Using system-GMM estimators, we find evidence of a causal link from labor income to SRH and functional status for both genders. Among men only, system-GMM results indicate that there is a causal link from net wealth to SRH and functional status. Results overall highlight the need for integrated economic and health policies, and for policies that mitigate the potential adverse health effects of short-term changes in economic status.

Keywords

economic status; family income; labor income; net wealth; self-rated health and functional limitations

Correspondence: Abdulkarim M. Meraya, Department of Pharmaceutical Systems and Policy, School of Pharmacy, West Virginia University, Morgantown, WV, USA. ammeraya@mix.wvu.edu.

ORCID

bdulkarim M. Meraya <http://orcid.org/0000-0002-6876-7270>

CONFLICT OF INTEREST

The authors report no conflicts of interest in this study. This study was supported by the National Institute of General Medical Sciences, U54GM104942. West Virginia University IRB considered this study as a nonhuman subject research.

1 | INTRODUCTION

A positive correlation between economic status and health among adults living in the United States has been documented extensively in economic, epidemiological, and sociological studies (Adams, White, Moffatt, Howel, & Mackintosh, 2006; Berry, 2007; Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Chetty et al., 2016; Fiscella & Franks, 2000; Golberstein, 2015; Hajat, Kaufman, Rose, Siddiqi, & Thomas, 2010a; Hajat, Kaufman, Rose, Siddiqi, & Thomas, 2010b; Halliday, 2016; McDonough & Berglund, 2003; Michaud & van Soest, 2008; Robert et al., 2009). Many studies have used longitudinal data to examine the relationship between economic status and health (Adams et al., 2006; Berry, 2007; Chetty et al., 2016; Do, Frank, & Finch, 2012; Hajat et al., 2010a; Hajat et al., 2010b; McDonough & Berglund, 2003; Meer, Miller, & Rosen, 2003). However, only two studies have used dynamic panel data methods (Halliday, 2016; Michaud & Van Soest, 2008). Most of the aforementioned studies revealed strong positive relationships between various measures of economic status and health. For example, in the United States, Chetty and colleagues reported that men in the top 1% of income distribution can live 15 years longer than the men in the bottom 1% of income distribution. Similarly, women in the top 1% of income distribution can live 10 years longer than the women in the bottom 1% of income distribution. The study by Chetty et al. highlighted the impact of economic status on mortality (Chetty et al., 2016). However, mortality rates are not helpful to explore how (and why) health changes over the life cycle. Therefore, there is a need for studies that evaluate the effect of changes in economic status over time on health states other than mortality (Case & Deaton, 2005). Furthermore, both health and economic status are multidimensional concepts and different economic indicators seem to have different dynamic relationships with different components of health (Michaud & Van Soest, 2008). Therefore, there is a need for studies that evaluate the effect of changes in economic status over time on health measures using different economic and health measures. As changes can include both declines and improvements in income and health, the dynamic relationships between economic loss and health decline as well as between economic gain and health improvement warrant examination.

The relationship between economic status and health is bidirectional. Therefore, the endogeneity between economic status and health needs to be addressed in estimating the effect of economic status on health (Galama, 2015; Galama & Van Kippersluis, 2013). From an economic perspective, healthier individuals may have access to greater economic resources because of their ability to participate in the labor force and earn an income (Galama, 2015; Galama & Van Kippersluis, 2013; Halliday, 2016). On the other hand, from epidemiological and health policy perspectives, individuals with higher financial resources may have better health because they have the ability to invest in their health (Galama, 2015; Galama & Van Kippersluis, 2013; Halliday, 2016). Some studies have addressed this endogeneity by using statistical techniques such as instrumental variables (IVs; Golberstein, 2015; Meer et al., 2003; Michaud & Van Soest, 2008). However, it is very challenging to find plausible and valid IVs that have an effect on health only through economic status (Halliday, 2016; Meer et al., 2003; Michaud & Van Soest, 2008).

Therefore, recent efforts have focused on using information available in panel data, for example, past health, as IVs after the panel-level effects have been removed by first-differencing (Anderson & Hsiao, 1981). These models were further refined by Arellano and Bond (1991), who used the panel structure of the data and derived procedures to determine the optimal number of lagged endogenous and exogenous variables as instruments (Arellano 2016; Roodman, 2009). These types of estimators have become econometric tools to address endogeneity and have been used in many disciplines (Piernas, Ng, Mendez, Gordon-Larsen, & Popkin, 2015; Wawro, 2002).

To our knowledge, only two published studies (Halliday, 2016; Michaud & Van Soest, 2008) to date have examined the causal relationship between economic status and health using the Arellano–Bond dynamic panel data estimators. Halliday (2016) reported better self-rated health (SRH) due to increases in labor income among working-age adults (25–60 years) using data from the Panel Study of Income Dynamics (PSID). Michaud and Van Soest (2008) used wealth to represent economic status, and various mental and physical health measures, as well as a composite index to measure health based on data from the Health and Retirement Study. Although Halliday reported a causal effect of economic status on health (Halliday, 2016), Michaud and van Soest did not find evidence for a causal relationship between the two (Michaud & Van Soest, 2008). These differences in findings may in part reflect discrepancies in the characteristics of the study sample (e.g., retired vs. working age adults) and data source (Health and Retirement Study vs. PSID), as well as in the measurement of economic status. For example, Michaud and van Soest used wealth of older Americans as an economic indicator, while Halliday focused on labor income (earnings) of adults aged 25 to 60. A limitation of both studies was a failure to control for marital status, family size, and other factors that may affect economic status, health, or both.

The main objective of the current study is to extend previous work regarding the impact of short-term economic fluctuations on health by building upon the findings of Michaud and Van Soest (2008) and Halliday (2016). In the current study, with recent data from the PSID and a variety of health measures, we focus on working-age adults as health for this group is potentially more vulnerable than for retired adults to adverse changes in economic status due to health insurance and income being tied to job status. In addition, we use recent PSID data that include more measures of health (functional status in addition to SRH) than were available in the study by Halliday (2016); we also expand the measurement of economic status to include not only earnings but also family income and net wealth. This paper also differentiates the impacts of economic gains versus losses on health rather than simply averaging impacts of any change in economic status. Finally, although Halliday (2016) used PSID data over a period with limited macroeconomic fluctuations (1984 to 1993), our study incorporates data from 1999 to 2013, a period covering both the brief recession of 2001 and the Great Recession of 2007–2009. Our hypothesis is that short-term changes in economic status, whether measured through earnings, family income or wealth, significantly influence SRH, and functional status.

2 | DATA AND METHODOLOGY

2.1 | Data and sample

The PSID was created in 1966 to help inform President Lyndon Johnson's War on Poverty (McGonagle & Schoeni, 2006; McGonagle, Schoeni, Sastry, & Freedman, 2012). The original PSID 1968 sample was drawn from two independent samples: an oversample of 1,872 low-income families from the Survey of Economic Opportunity; and a nationally representative sample of 2,930 families. The two samples constituted a national probability sample of U.S. families in 1968 (McGonagle et al., 2012; McGonagle & Schoeni, 2006). Currently, the individuals in any panel come from three sources: the original 1968 sample, the 1997 refresher sample of post-1968 immigrants, and births and marriages in existing families (Dascola et al., 2015; McGonagle et al., 2012; McGonagle & Schoeni, 2006). In this study, both family and cross-year individual files were combined to gather information on households.

The study utilized a retrospective observational longitudinal design with repeated measures of economic status and health for a period of 15 years using eight waves of the PSID: 1999, 2001, 2003, 2005, 2007, 2009, 2011, and 2013. These waves were selected due to the availability of the same sets of health variables. Data were pooled across years, and thus, each individual had eight observations. The study sample consisted of heads of households and their wives (men: 2,147; women: 2,024) who participated in all the waves of the PSID between 1999 and 2013 and who were aged between 18 and 50 years in 1999.

2.2 | Measures

2.2.1 | Health status measures

Self-rated health status: PSID queried each respondent about "say your health in general is excellent, very good, good, fair, or poor?" This SRH was coded on a scale of 1 to 5 (1 = *excellent*, 2 = *very good*, 3 = *good*, 4 = *fair*, and 5 = *poor*). We follow the procedure by Ware, Kosinski, Dewey, and Gandek (2000) to code SRH. Ware et al. used a reverse coded scale where a higher score reflects better health. Ware et al. also observed that the interval between "excellent" and "very good" is half the size of the interval between "fair" and "good." Therefore, they recalibrated and normalized the scale as follows: 100 = *excellent*, 84 = *very good*, 61 = *good*, 25 = *fair*, and 0 = *poor* (Ware et al., 2000).

Functional status: PSID participants are asked about the activity limitations for each reported chronic condition with a question as follows: "How much does this condition limit your normal daily activities?" The response is a 4-point scale: "not at all," "just a little," "somewhat," and "a lot." Such a question is typically considered to get at functional limitations or disability. We use the term *functional limitation* as defined below. Because the degree of the limitations is the purpose of this measure, we coded the response of each limitation as follows: 0 = *not at all*, 1 = *just a little*, 2 = *somewhat*, and 3 = *a lot*. Then, we summed the responses for all the functional limitations due to asthma, arthritis, cancer, chronic obstructive pulmonary disease, diabetes, heart disease, hypertension, stroke, memory loss, and psychological disorders. Finally, we normalized the sum by transforming the sum of the raw scores to a 0 to 100 scale using the following formula:

$$\text{Functional limitation score} = \frac{(\text{Actual raw score}) - (\text{Minimum score})}{(\text{Maximum score}) - (\text{Minimum Score})} \times 100.$$

The functional limitation score ranges from 0 to 100, with higher scores representing more severe functional limitations.

Change in health: (a) SRH improvement: A binary indicator variable, with the value of 1 representing improvements in SRH from one wave to the next and zero representing no change or a decrease in SRH score from one wave to the next. (b) SRH decline: A binary indicator variable, with the value of 1 representing a decrease in SRH from one wave to the next and zero representing no change or an increase in SRH from one wave to the next. (c) Improving functional status: A binary indicator variable, with the value of 1 representing a decline in functional limitation scores from one wave to the next and zero representing no change or an increase in functional limitation scores from one wave to the next. (d) Worsening functional status: A binary indicator variable, with the value of 1 representing an increase in functional limitation scores from one wave to the next and zero representing no change or a decrease in functional limitation scores from one wave to the next.

2.2.2 | Economic status

Labor income: PSID has labor income of the heads of households and their spouses. It should be noted that, in the PSID, men are usually considered heads of households. Labor income is used at the individual level and includes all money earned from wages and salaries, bonuses, overtime, tips, commissions, and professional practice, as well as or any other job-related income, including farm or business income.

Family income: In the PSID, total family income is defined as taxable income (earnings, interest, and dividends) of the head of household, his wife, and other family unit members. Participants reported the incomes they received in the prior calendar year.

Net wealth: In PSID, family net wealth is calculated as the sum of home equity, farm or business assets, checking or savings accounts, vehicles, stocks and bonds, and net debts. Labor income, family income, and net wealth were reported in U.S. dollars per year.

Some individuals in our study sample reported negative or zero family income or net wealth. In the current study, we recoded negative values to zero and added a small positive amount (\$1) to zero values. To account for inflation, all monetary values were converted to 2013 dollars using the consumer price index for all items wage earners.

It should also be noted that continuous economic status indicators are positively skewed variables. Therefore, estimates from ordinary least square regressions are often biased due to the nonlinear residuals. Using linear-log models in which health outcomes are in its original scale, and economic status are transformed into a natural logarithmic scale can help removing this bias (Halliday, 2016). As a result, when economic status measures were used as continuous, all the economic status measures were transformed into a natural logarithmic

scale. Finally, in a robustness check, we categorized labor income, family income, and net wealth into quintiles on the basis of the distribution of these variables in each wave.

2.2.3 | Other explanatory variables—Prior literature has established that SRH is affected by health behavior and obesity (Okosun, Choi, Matamoros, & Dever, 2001; Tsai et al., 2010). Thus, in our analyses, we controlled for the following variables: body mass index (kg/m²; underweight [<18.5], normal [$18.5\text{--}24.9$], overweight [$25.0\text{--}29.9$], or obese [≥ 30.0]), smoking status (smoker and not a smoker), and alcohol use (user and nonuser). We controlled for other factors that may affect the economic status and/or health of the participants including age, marital status (married, widowed, separated or divorced, and never married), number of children under 18 years of age, health insurance, external financial support, and financial liabilities to others. Additionally, we controlled for number of chronic conditions categories (no condition, one condition, and ≥ 2 chronic conditions) where SRH was the outcome. Halliday (2016) pointed out that the effects on income may vary by gender. As a result, we conducted separate estimations for men and women.

3 | EMPIRICAL STRATEGY

The theoretical framework underlying this paper is a dynamic model of health production and productivity as per Grossman (1972). Health is understood as having stock and flow components. Although some health indicators are fixed (height), most change with time due to unexpected shocks or due to the results of prior investments in health. Our objective here is to isolate the impact of unexpected short-term changes in economic status on health.

3.1 | Ordinary least squares (OLS) regression

The specifications of this model are as follows:

$$h_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 X_{it} + \mu_{it}, \quad (1)$$

where h_{it} is the health of individual i at time t , Y_{it} is the log transformed values or quintile categories of the economic status, X_{it} is the vector of the other explanatory variables as listed earlier, and μ_{it} is the error term. Using OLS for panel data may yield biased coefficient estimates of economic status for several reasons. The error term may be serially correlated and unobserved factors that affect an individual's health will be present at each point in time, leading to unobserved heterogeneity. In particular, OLS regressions may be inconsistent due to unobserved time-invariant individual's characteristics (fixed-effects). Those fixed-effects may be correlated with the explanatory variables, which may introduce omitted variables bias. Equation (1) does not account for: (a) individual-specific fixed effects (time-invariant heterogeneity, including systematic measurement error); (b) the endogeneity between economic status and health status (unobserved time-varying heterogeneity, two-way causality, and random measurement error for health and economic status); (c) the endogeneity between current state of health and lagged health status.

3.2 | First-difference estimator

The first-difference estimator can address the individual fixed effects problem (a) above by using changes between two periods for each individual. Using the first-difference estimator removes the fixed individual-specific effects because they do not change with time. The proposed model for this estimator is as follows:

$$\Delta h_{it} = \beta_1 \Delta Y_{it} + \beta_2 \Delta X_{it} + \Delta \mu_{it}, \quad (2)$$

where h_{it} is the change in health of individual i between time t and time $t-1$, Y_{it} is the change in the log transformed values or quintile categories of the economic status, and X_{it} is the change in the time-varying control variables. In the above models, we allow for clustering at the individual level in the statistical inference.

3.3 | Split first difference

From a policy perspective, it is important to differentiate in model ((2)) above negative changes in health from positive changes in health as the effects of negative and positive changes (h_{it}) in health could be asymmetric. This will be done by focusing separately on negative changes (SRH declines, worsening functional status) and positive changes (SRH improvements, improving functional status). In addition, Y_{it} refers to changes in economic status for the entire sample. And again, because there could be asymmetric effects of economic status on health transitions, we then separate these two types of economic status transitions in our economic independent variable (economic gains and losses). Note that this alters the previously first-difference specification as the differences for two variables are now split: changes in economic status are split into economic gains and losses, and changes in health are now split into improvements and declines. Following Mitra and Jones (2017), this model is now referred to as a split first-difference model. Appendix A displays the specification of this model.

Estimates based on a first difference model, whether simple or split, will address time-invariant omitted variables and systematic measurement error at the individual and family levels. Nevertheless, it will not address random measurement error bias or omitted variables bias owing to the presence of time-varying unobservables. It does not address the problem of reverse causality from health to economic status: even with the biannual data that we use, we cannot rule out that changes in health precede changes in economic status. It also does not address the time-dependence of health.

3.4 | Dynamic panel generalized method of moments (GMM) estimators (Arellano & Bond, 1991; Blundell & Bond, 1998)

It is indeed possible that current health status is influenced by past health and current economic status and other variables as follows:

$$h_{it} = \beta_0 + \beta_1 h_{it-1} + \beta_2 Y_{it} + \beta_3 X_{it} + \mu_{it}, \quad (3)$$

We can first difference the previous equation to the following:

$$\Delta h_{it} = \beta_1 \Delta h_{it-1} + \beta_2 \Delta Y_{it} + \beta_3 \Delta X_{it} + \Delta \mu_{it}, \quad (4)$$

Equation (4) can address (a) individual fixed effects through first differencing and (b) the endogeneity of health and economic status in that it allows for health to impact economic status but with a lag, the Arellano and Bond estimator (1991) can also address limitation (c) the endogeneity between current and past health. Under the Arellano and Bond approach, lags of the dependent variable are used as instruments to compute unbiased consistent estimates of Equation (4). However, a weak instruments problem may occur in the Arellano–Bond approach because lagged values of the endogenous variables may be weakly correlated with the regressors in the first-difference model. Given that we have weak instruments (Halliday, 2016), we use Blundell and Bond (1998)’s system-GMM estimator, which requires stronger moment conditions than differenced GMM. System-GMM estimator uses lagged differences as instruments for the level model and lagged levels as instruments for the first-difference model. Based on the second order autocorrelation test and the Hansen J statistics on overidentifying restrictions, we found that adjusting for three lags of health measures was needed for the model to perform adequately. This is consistent with Michaud and van Soest (2008) and Halliday (2016). We also used only four lags of health measures as IVs to address this issue. This dynamic system GMM strategy thoroughly, albeit not perfectly, addresses the endogeneity concerns noted earlier and gives the preferred estimates for this paper.

4 | RESULTS

The study sample consisted of 2,147 men and 2,024 women who were between ages 18 and 50 years in 1999. Most of the men were White (79.3%), married (73.1%), and lived in a metropolitan area (75.9%). Likewise, most of the women were White (76.2%), married (75.2%), and lived in a metropolitan area (75.4%). Table 1 displays the weighted percentages.

Figures 1 and 2 detail the mean labor income, family income, net wealth, SRH, and functional limitations for men and women across the eight waves. Figure 1 shows there was an upward trend in the average values of income and wealth interrupted by sharp drops during and after the Great Recession of 2007–2008. As per Figure 2, for both men and women, over the 15-year period, SRH steadily deteriorated whereas the functional limitation score increased. This deterioration in health is to be expected as this cohort ages. Our goal then is to examine the impact that short-term changes in economic status might have had on health for this cohort.

Table 2 summarizes results of the OLS and first difference models. Table 3 gives results for the split first-difference model whereas Table 4 summarizes the Blundell-Bond system-GMM estimators for SRH and functional limitations. Starting with the OLS results in Table 2, SRH and functional limitation scores were consistently and significantly associated with economic status. For instance, OLS regressions indicated a significant positive relationship

between labor income and SRH among both men ($\hat{\beta} = 1.548, p < .001$) and women ($\hat{\beta} = 0.905, p < .001$). Of economic status measures, family income showed the strongest association with functional health for both men and women. For the functional limitation score, OLS regressions revealed a significant relationship with family income among men ($\hat{\beta} = -1.457, p < .001$) and women ($\hat{\beta} = -1.504, p < .001$).

The first-difference results in Table 2 stand in contrast with OLS results. Using first-difference, there was no relationship between economic status and health among men and women, with the exception of labor income and the functional score for men. First-difference models indicated a negative relationship between labor income and the functional limitation score among men ($\hat{\beta} = -0.276, p < .001$).

Results from the split first-difference model in Table 3 indicate that for men and women, gains in economic status, whether in labor income, family income, or net wealth, are not significantly associated with improvements in SRH or the functional score. In contrast, for men, losses in economic status in terms of labor income and family income are associated with worsening SRH and functional status. Men are also found to have a decline in SRH when experiencing a loss in terms of net wealth. Drops in labor income, family income, and net wealth were associated respectively with 2.5, 2.5, and 2.9 percentage point increases in the probability of a decline in SRH among men. Decreases in labor income and family income were associated with 4.8 and 5.2 percentage point increases, respectively, in the probability of functional limitations increases among male participants. In contrast, there was no relationship between losses in economic status and decline in SRH or functional status among women.

In Table 4, our preferred system-GMM model indicates a causal relationship from labor income to SRH (men [$\hat{\beta} = 0.790, p < .001$] and women [$\hat{\beta} = 0.511, p < .001$]) and from labor income to functional limitations (men [$\hat{\beta} = -0.525, p < .001$] and women [$\hat{\beta} = -0.293, p < .001$]). Considering family income, the model finds also a causal relationship for men only from family income to SRH ($\hat{\beta} = 1.242, p < .001$). The model finds also a causal relationship from family income to functional limitations for both men ($\hat{\beta} = -0.919, p < .01$) and women ($\hat{\beta} = -0.319, p < .05$). Finally, the model finds a relationship for men only from net wealth to SRH ($\hat{\beta} = 0.253, p < .01$) and to functional status ($\hat{\beta} = -0.149, p < .01$). However, for the latter result on functional status, it should be noted that this model did not pass the overidentification test with $p = .043$. It has to be noted that the results of the system-GMM with age as the only control in Appendix B versus the system-GMM with the full set of controls in Table 4 are overall consistent, and as expected coefficient estimates for the economic indicator are often smaller in the latter. However, for women, family income or net wealth is no longer significant in the model with the full set of controls for both health measures.

It is possible that the results could be driven by specific subgroups of individuals in the income/wealth distribution, perhaps the bottom of the distribution given more economic insecurity. To check the potential heterogeneity of the results across the income/wealth distribution, we replaced each continuous economic indicator by categorical variables indicating quintiles. Table 5 reports results of the system-GMM when economic status is

measured in terms of quintiles in turn for labor income, family income, and net wealth. Results are overall consistent with those in Table 4. For labor income, results include larger coefficients for lower quintiles. This suggests that the causal effect of short-term changes in economic status may have differential effects on SRH or functional status for persons depending on where a person stands in the earnings distribution, with seemingly worse effects for persons in the lower quintiles. For net wealth for men, consistent with Table 4, a significant effect is found in all quintiles, but the effect is larger for upper quintiles for both SRH and functional status.

5 | CONCLUSIONS

The current study examined the dynamic relationships between economic status measures (family income, labor income, and net wealth) and two health measures (SRH and functional limitations). Our preferred method system-GMM estimation revealed positive relationships between all measures of economic status and SRH among men, but a significant relationship only between labor income and SRH among women. The preferred system-GMM estimation indicated a negative relationship between labor income and functional limitations among men and women, although net wealth was inversely related to functional status only among men. These findings suggest that the relationship between economic status and health may vary by gender, with overall stronger relationships observed among men. Findings also varied according to the economic indicator used; in general, labor income was the economic measure that most consistently predicted change in of health status in both genders. Economic status significantly influenced health in all quintiles of income and wealth.

The current study has several strengths. First, we examined the dynamic relationships between economic status and health using a variety of economic and health measures. Second, we controlled for a comprehensive array of potentially confounding variables, including age, marital status, number of children under 18 years of age, number of chronic conditions (only for SRH), body mass index, alcohol use, smoking status, light physical activity, health insurance status, external financial support, and financial liabilities to others. We also conducted separate analyses for men and women, allowing us to identify differing patterns by gender. Third, we used longitudinal data that spanned a 15-year period, allowing us to assess the dynamic links of health and economic status over time. Fourth, we used dynamic panel data estimators, specifically system-GMM estimators, to overcome the lack of readily available valid IVs.

However, this study also has some important limitations. First, information on all variables was based on self-reported data, raising the possibility of recall bias. Second, SRH and functional limitations do not capture all aspects of health. Third, although we employed statistical techniques to address endogeneity from reverse causality and omitted variables, we do not completely address potential random measurement error for health and economic status. Finally, although attrition in the PSID is limited, restriction of our sample to participants who were followed in all eight waves of the study may limit the generalizability of our findings.

Our results suggest a relationship from labor income to health status among both men and women, a relationship which seems stronger among lower earnings quintiles. In the 1999–2013 period with fluctuations in the economic situation of the United States, results indicate that changes in earnings negatively impacted health in the short term, which add to the literature that explores the effects of acute economic shocks on health (Ólafsdóttir, Hrafnkelsson, Thorgeirsson, & Ásgeirsdóttir, 2016).

Our results support the need to integrate economic and health policies and, in particular, to have programs that mitigate the potential adverse effects of economic loss on health. Our findings highlight the need to incorporate health considerations into decision making across all policy areas. This is consistent with the *Health in All Policies* initiative proposed by public health facilitators (Rudolph, Caplan, Ben-Moshe, & Dillon, 2013) in which reshaping individuals' economic, physical, social, and service environments help to improve overall health and well-being.

Overall, our results indicate that the relationship between economic status, and health is weaker in women than in men, consistent with findings in previous studies (Muennig, Kuebler, Kim, Todorovic, & Rosen, 2013). We also found that men in this sample were more sensitive to negative economic shocks than were women. In contrast, previous studies have indicated women to be more sensitive than men to the adverse health effects of cumulative exposure to economic hardships and poverty (McDonough & Berglund, 2003; McDonough, Sacker, & Wiggins, 2005). In contrast, we found that losses in family income and net wealth negatively influence health in men only, although the effects of economic gain and loss in women may be heterogeneous across economic groups (see Appendix B).

Findings of this study suggest that labor income causally affects health among men and women. Changes in labor income can be due to multiple factors, including reduced work hours, job loss, and wage changes. Because our study period covers the Great Recession of 2007–2009, it is plausible that many adults in our sample experienced reductions in earnings due to job loss (Goodman & Mance, 2011). Decline in labor or family income due to loss of employment has important potential implications for the future health of these adults and their families. Although unemployment insurance may provide some relief in the short term (East & Kuka, 2015), it may not cover many expenses, including those related to health care. For example, the majority of employed adults (58%) in the United States receive employer-sponsored health insurance (Sonier, Fried, Au-Yeung, & Auringer, 2013) and may lose health insurance coverage due to the loss of employment. Such loss of insurance coverage may contribute to further deterioration in health status due to lack of access to medical care.

Acknowledgments

Funding information

The National Institute of General Medical Sciences, Grant/Award Number: U54GM104942

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number U54GM104942. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. West Virginia University IRB considered this study as a nonhuman subject research.

References

- Adams J, White M, Moffatt S, Howel D, Mackintosh J. A systematic review of the health, social and financial impacts of welfare rights advice delivered in healthcare settings. *BMC Public Health*. 2006; 6(1):81. [PubMed: 16571122]
- Anderson TW, Hsiao C. Estimation of dynamic models with error components. *Journal of the American Statistical Association*. 1981; 76(375):598–606.
- Arellano M. Modelling optimal instrumental variables for dynamic panel data models. *Research in Economics*. 2016; 70(2):238–261.
- Arellano M, Bond S. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*. 1991; 58(2):277–297.
- Berry B. Does money buy better health? Unpacking the income to health association after midlife. *Health*. 2007; 11(2):199–226. [PubMed: 17344272]
- Blundell R, Bond S. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*. 1998; 87(1):115–143.
- Braveman PA, Cubbin C, Egerter S, Williams DR, Pamuk E. Socioeconomic disparities in health in the United States: What the patterns tell us. *American Journal of Public Health*. 2010; 100(S1):S186–S196. [PubMed: 20147693]
- Case, A., Deaton, AS. Analyses in the economics of aging. Chicago: University of Chicago Press; 2005. Broken down by work and sex: How our health declines; p. 185–212.
- Chetty R, Stepner M, Abraham S, Lin S, Scuderi B, Turner N, ... Cutler D. The association between income and life expectancy in the United States, 2001–2014. *Jama*. 2016; 315(16):1750–1766. [PubMed: 27063997]
- Dascola, M., Freedman, V., Insolera, N., Pfeffer, F., McGonagle, K., Sastry, N. PSID main interview user manual: Release 2015. 2015.
- Do DP, Frank R, Finch BK. Does SES explain more of the Black/White health gap than we thought? Revisiting our approach toward understanding racial disparities in health. *Social Science & Medicine*. 2012; 74(9):1385–1393. [PubMed: 22405688]
- East CN, Kuka E. Reexamining the consumption smoothing benefits of unemployment insurance. *Journal of Public Economics*. 2015; 132:32–50.
- Fiscella K, Franks P. Individual income, income inequality, health, and mortality: What are the relationships? *Health Services Research*. 2000; 35(1 Pt 2):307–318. [PubMed: 10778817]
- Galama TJ. A contribution to health-capital theory. RAND Working Paper. 2015
- Galama, TJ., Van Kippersluis, H. Health and inequality. Bingley, West Yorkshire, England: Emerald Group Publishing Limited; 2013. Health inequalities through the lens of health-capital theory: Issues, solutions, and future directions; p. 263–284.
- Golberstein E. The effects of income on mental health: Evidence from the social security notch. *The Journal of Mental Health Policy and Economics*. 2015; 18(1):27–37. [PubMed: 25862202]
- Goodman CJ, Mance SM. Employment loss and the 2007–09 recession: An overview. *Monthly Labor Review*. 2011; 134(4):3–12.
- Grossman M. On the concept of health capital and the demand for health. *Journal of Political Economy*. 1972; 80(2):223–255.
- Hajat A, Kaufman J, Rose K, Siddiqi A, Thomas J. Do the wealthy have a health advantage? Cardiovascular disease risk factors and wealth. *Social Science & Medicine*. 2010a; 71(11):1935–1942. [PubMed: 20970902]
- Hajat A, Kaufman JS, Rose KM, Siddiqi A, Thomas JC. Long-term effects of wealth on mortality and self-rated health status. *American Journal of Epidemiology*. 2010b; 173(2):192–200. [PubMed: 21059808]
- Halliday TJ. Earnings growth and movements in self-reported health. *Review of Income and Wealth*. 2016; 63:760–776.
- McDonough P, Berglund P. Histories of poverty and self-rated health trajectories. *Journal of Health and Social Behavior*. 2003; 44:198–214. [PubMed: 12866390]

- McDonough P, Sacker A, Wiggins RD. Time on my side? Life course trajectories of poverty and health. *Social Science & Medicine*. 2005; 61(8):1795–1808. [PubMed: 16029777]
- McGonagle, KA., Schoeni, RF. The panel study of income dynamics: Overview and summary of scientific contributions after nearly 40 years. Paper presented at the conference Longitudinal Social and Health Surveys in an International Perspective; Montreal. 2006.
- McGonagle KA, Schoeni RF, Sastry N, Freedman VA. The panel study of income dynamics: Overview, recent innovations, and potential for life course research. *Longitudinal and Life Course Studies*. 2012; 3(2):180.
- Meer J, Miller DL, Rosen HS. Exploring the health–wealth nexus. *Journal of Health Economics*. 2003; 22(5):713–730. [PubMed: 12946455]
- Michaud PC, van Soest A. Health and wealth of elderly couples: Causality tests using dynamic panel data models. *Journal of Health Economics*. 2008; 27(5):1312–1325. [PubMed: 18513809]
- Mitra S, Jones K. The impact of recent mental health problems on labor supply: New evidence from longitudinal data. *Applied Economics*. 2017; 49(1):96–109.
- Muennig P, Kuebler M, Kim J, Todorovic D, Rosen Z. Gender differences in material, psychological, and social domains of the income gradient in mortality: Implications for policy. *PLoS one*. 2013; 8(3):e59191. [PubMed: 23527129]
- Okosun IS, Choi S, Matamoros T, Dever GA. Obesity is associated with reduced self-rated general health status: Evidence from a representative sample of White, Black, and Hispanic Americans. *Preventive Medicine*. 2001; 32(5):429–436. [PubMed: 11330993]
- Ólafsdóttir T, Hrafnkelsson B, Thorgeirsson G, Ásgeirsdóttir TL. The tax-free year in Iceland: A natural experiment to explore the impact of a short-term increase in labor supply on the risk of heart attacks. *Journal of Health Economics*. 2016; 49:14–27. [PubMed: 27372576]
- Piernas C, Ng SW, Mendez MA, Gordon-Larsen P, Popkin BM. A dynamic panel model of the associations of sweetened beverage purchases with dietary quality and food–purchasing patterns. *American Journal of Epidemiology*. 2015; 181(9):661–671. [PubMed: 25834139]
- Robert SA, Cherepanov D, Palta M, Dunham NC, Feeny D, Fryback DG. Socioeconomic status and age variations in health–related quality of life: Results from the national health measurement study. *Journals of Gerontology: Series B*. 2009; 64(3):378–389.
- Roodman D. A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*. 2009; 71(1):135–158.
- Rudolph, L., Caplan, J., Ben–Moshe, K., Dillon, L. Health in all policies: A guide for state and local governments. DC/Oakland, CA: American Public Health Association Washington; 2013.
- Sonier, J., Fried, B., Au–Yeung, C., Auringer, B. State-level trends in employer-sponsored health insurance, a state-by-state analysis. Minneapolis, Minn: State Health Access Data Center and Robert Wood Johnson Foundation; 2013.
- Tsai J, Ford ES, Li C, Zhao G, Pearson WS, Balluz LS. Multiple healthy behaviors and optimal self-rated health: Findings from the 2007 Behavioral Risk Factor Surveillance System Survey. *Preventive Medicine*. 2010; 51(3):268–274. [PubMed: 20647019]
- Ware, JE., Kosinski, M., Dewey, JE., Gandek, B. SF-36 health survey: Manual and interpretation guide. Lincoln, RI: Quality metric Inc; 2000.
- Wawro G. Estimating dynamic panel data models in political science. *Political Analysis*. 2002; 10(1): 25–48.

APPENDIX A. SPECIFICATIONS OF SPLIT FIRST DIFFERENCE ESTIMATORS

First difference-health improvement	$hi_{it} = \beta_1 Yg_{it} + \beta_2 X_{it} + \mu_{it}$	hi_{it} : A binary indicator variable measuring one-period change in health with the value of 1 representing improvements in health and zero representing no change or worsening health.
-------------------------------------	---	--

Yg_{it} : One-period positive change or transition from lower quintile to upper quintile.

X_{it} : The change in the matrix of time-varying control variables.

μ_{it} : The change in the error term.

First difference-health decline

$$hd_{it} = \beta_1 Yl_{it} + \beta_2 X_{it} + \mu_{it}$$

hd_{it} : A binary indicator variable measuring one-period change in health with the value of 1 representing decline in health and zero representing no change or health improvement.

Yl_{it} : One-period negative change or transition from upper quintile to lower quintile.

X_{it} : The change in the matrix of time-varying control variables.

μ_{it} : The change in the error term.

APPENDIX B. BLUNDELL-BOND (SYSTEM-GENERALIZED METHOD OF MOMENT) REGRESSIONS

	Men	Women	Men	Women	Men	Women
	Labor income		Family income		Net wealth	
Dependent variable: Self-rated health						
Economic indicator (labor income, family income, or net wealth)	0.810 *** (0.119)	0.638 *** (0.115)	1.294 *** (0.296)	1.054 ** (0.370)	0.262 ** (0.088)	0.349 *** (0.102)
Self-rated health status _{t-1}	0.319 *** (0.017)	0.304 *** (0.021)	0.327 *** (0.017)	0.305 *** (0.022)	0.330 *** (0.017)	0.316 *** (0.021)
Self-rated health status _{t-2}	0.198 *** (0.019)	0.139 *** (0.020)	0.199 *** (0.018)	0.145 *** (0.019)	0.188 *** (0.018)	0.142 *** (0.020)
Self-rated health status _{t-3}	0.106 *** (0.019)	0.091 *** (0.021)	0.117 *** (0.019)	0.108 *** (0.021)	0.096 *** (0.020)	0.106 *** (0.021)
#IV	49					
Hansen J	chi2(43): 50.32; <i>p</i> = .206	chi2(43): 34.45; <i>p</i> = .821	chi2(43): 52.63; <i>p</i> = .149	chi2(43): 43.55; <i>p</i> = .448	chi2(43): 40.79; <i>p</i> = .568	chi2(43): 46.29; <i>p</i> = .338
Dependent variable: Functional limitation score						
Economic indicator (labor income, family income, or net wealth)	-0.462 *** (0.066)	-0.310 *** (0.0589)	-0.770 *** (0.206)	-0.444 ** (0.135)	-0.166 *** (0.049)	-0.122 ** (0.0467)
Functional limitation _{t-1}	0.484 *** (0.043)	0.488 *** (0.0282)	0.564 *** (0.032)	0.514 *** (0.0265)	0.562 *** (0.035)	0.514 *** (0.0288)
Functional limitation _{t-2}	0.231 *** (0.031)	0.196 *** (0.0270)	0.242 *** (0.033)	0.201 *** (0.0259)	0.259 *** (0.033)	0.232 *** (0.0257)
Functional limitation _{t-3}	0.072 (0.040)	0.186 *** (0.0326)	0.129 *** (0.035)	0.175 *** (0.0292)	0.161 *** (0.039)	0.221 *** (0.0283)
#IV	49					
Hansen J	chi2(43): 47.82; <i>p</i> = .284	chi2(43): 33.84; <i>p</i> = .840	chi2(43): 51.37; <i>p</i> = .179	chi2(43): 35.99; <i>p</i> = .767	chi2(43): 53.79; <i>p</i> = .125	chi2(43): 50.93; <i>p</i> = .190

Note. Sample is as described in Table 1. Each coefficient is from a separate regression model. The dependent/independent variable of interest is listed in the column/row heading. For the definitions of the dependent variables (see text). Controlled for age only. Standard errors are shown in parentheses; they are clustered at the individual level.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

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

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

FIGURE 1.

Average economic indicators by gender [Colour figure can be viewed at wileyonlinelibrary.com]

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

Note. The sample is for heads of households and their wives aged 18 to 50 in 1999, and for whom data were available for all years between 1999 and 2013. Statistics are weighted.

FIGURE 2.

Average self-rated health and functional limitations by gender [Colour figure can be viewed at wileyonlinelibrary.com]

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

Note. The sample is for heads of households and their wives aged 18 to 50 in 1999, and for whom data were available for all years between 1999 and 2013. Statistics are weighted. For Functional limitations, the graph shows the sum of raw scores.

TABLE 1

Descriptive statistics

		Men	Women
Age	18–39 years	53.3	50.4
	40–49 years	42.2	44.1
	50 years	4.5	5.5
Race	White	79.3	76.2
	African American	8.6	11.8
	Latino	8.1	8
	Other	4	4.1
Marital status	Married	73.1	75.2
	Widowed	0.3	0.9
	Separated/divorced	9.8	11.5
	Never married	16.8	12.4
Number of children <18 years	No. children	41.3	35.4
	One child	20.8	24.2
	More or equal 2 children	37.9	40.3
Education	LE high school	13.7	13.7
	High school	27.1	28.4
	Some college	24.1	23.9
	College, +	35.2	34.0
Metro status	Metro	75.9	75.4
	Urban	20.9	21.9
	Rural	3.3	2.8
Region of residence	Northeast	19.7	19.4
	North central	27.5	26.7
	South	28.6	30.2
	West	23.2	22.8
	Alaska, Hawaii	0.4	0.2
	Other	0.6	0.6
Employment status	Employed	92.8	76.1
	Not employed	7.2	23.9
External financial support	Yes	11.4	9.5
	No	88.6	90.5
Financial liabilities to others	Yes	13.7	10.2
	No	86.4	89.8
Have health insurance	Yes	92.6	95.0
	No	7.4	5.0
Smoking status	Smoker	22.4	17.4
	Nonsmoker	77.6	82.6
Alcohol use	Yes	71.3	55.4
	No	28.7	44.6

		Men	Women
Body mass index categories	Underweight	0.4	3.6
	Normal	32.5	54.9
	Overweight	46.3	23.3
	Obese	20.8	18.2
Light physical activity	Greater than or equal to 3 times/week	64.3	68.5
	Less than 3 times/week	35.7	31.5
Heavy physical activity	Greater than or equal to 3 times/week	33.6	29.8
	Less than 3 times/week	66.4	70.2
Chronic physical conditions	No conditions	73.3	70.2
	One condition	19.4	21.0
	Greater than or equal to 2 conditions	7.3	8.8
<i>N</i>		2,147	2,024

Note. The sample is for heads of households and their wives aged 18 to 50 in 1999, and for whom data were available for all years between 1999 and 2013. Statistics are weighted.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999.

TABLE 2

Ordinary least squares regression and first difference regressions

	Men	Women	Men	Women
	Self-rated health		Functional limitation score	
Ordinary least squares regressions				
Labor income	1.548 ^{***} (0.154)	0.905 ^{***} (0.097)	−0.891 ^{***} (0.077)	−0.545 ^{***} (0.057)
Family income	3.099 ^{***} (0.449)	3.442 ^{***} (0.414)	−1.457 ^{***} (0.259)	−1.504 ^{***} (0.217)
Net wealth	0.724 ^{***} (0.093)	0.680 ^{***} (0.108)	−0.211 ^{***} (0.046)	−0.203 ^{***} (0.046)
First Difference				
Labor income	0.211 (0.131)	0.128 (0.087)	−0.276 ^{***} (0.057)	−0.125 (0.069)
Family income	0.392 (0.288)	0.118 (0.330)	−0.595 (0.307)	0.297 (0.343)
Net wealth	0.146 (0.078)	0.117 (0.102)	−0.052 (0.039)	−0.059 (0.054)

Note. Sample is as described in Table 1. Each coefficient is from a separate regression model. The dependent/independent variable of interest is listed in the column/row heading. Standard errors are shown in parentheses: they are clustered at the individual level. Control variables include the following: age, marital status, number of children under 18 years of age, body mass index, alcohol use, smoking status, light physical activity, health insurance, external financial support, and financial liabilities to others. For self-rated health, the number of chronic conditions was also included on the right-hand side.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

 $p < .001$.

**
 $.001 \leq p < .01$.

*
 $.01 \leq p < .05$.

TABLE 3

Split first difference regressions

	Men	Women	Men	Women
	Self-rated health improvement		Improving functional status	
Gain in labor income	0.012 (0.008)	−0.002 (0.009)	−0.007 (0.013)	−0.025 (0.017)
Gain in family income	0.020* (0.008)	0.003 (0.009)	0.007 (0.014)	0.011 (0.018)
Gain in net wealth	0.019* (0.008)	0.018* (0.008)	0.005 (0.013)	0.004 (0.015)
	Self-rated health decline		Worsening functional status	
Loss in labor income	0.025** (0.009)	0.012 (0.010)	0.048*** (0.014)	−0.001 (0.017)
Loss in family income	0.025** (0.009)	0.010 (0.009)	0.052*** (0.014)	0.022 (0.017)
Loss in net wealth	0.029*** (0.008)	0.015 (0.010)	0.027 (0.014)	0.003 (0.016)

Note. Sample is as described in Table 1. Each coefficient is from a separate regression model. The dependent/independent variable of interest is listed in the column/row heading. For the definitions of the dependent variables (see text). Standard errors are shown in parentheses: they are clustered at the individual level. Control variables include the following: age, marital status, number of children under 18 years of age, metro status, body mass index, alcohol use, smoking status, light physical activity, health insurance, external financial support, and financial liabilities to others. For self-rated health, the number of chronic conditions was also included on the right-hand side.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

 $p < .001$.

**
 $.001 \leq p < .01$.

*
 $.01 \leq p < .05$.

TABLE 4

Blundell-Bond (system-generalized method of moment) regressions

	Men	Women	Men	Women	Men	Women
	Labor income		Family income		Net wealth	
Dependent variable: Self-rated health						
Economic indicator (labor income, family income, or net wealth)	0.790 *** (0.125)	0.511 *** (0.108)	1.242 *** (0.376)	0.340 (0.388)	0.253 ** (0.091)	0.130 (0.098)
Self-rated health status _{t-1}	0.252 *** (0.020)	0.280 *** (0.027)	0.257 *** (0.021)	0.279 *** (0.028)	0.271 *** (0.021)	0.292 *** (0.027)
Self-rated health status _{t-2}	0.140 *** (0.020)	0.138 *** (0.024)	0.138 *** (0.020)	0.130 *** (0.023)	0.141 *** (0.020)	0.137 *** (0.024)
Self-rated health status _{t-3}	0.073 *** (0.020)	0.077 ** (0.022)	0.081 *** (0.020)	0.091 *** (0.023)	0.066 ** (0.021)	0.101 *** (0.023)
#IV	64					
Hansen J	chi2(34): 43.51; $p = .127$	chi2(34): 33.9; $p = .471$	chi2(34): 43.81; $p = .121$	chi2(34): 30.35; $p = .647$	chi2(34): 41.44; $p = .178$	chi2(34): 40.36; $p = .210$
Dependent variable: Functional limitation score						
Economic indicator (labor income, family income, or net wealth)	-0.525 *** (0.074)	-0.293 *** (0.0604)	-0.919 ** (0.309)	-0.319 * (0.151)	-0.149 ** (0.050)	-0.0620 (0.0563)
Functional limitation _{t-1}	0.402 *** (0.049)	0.480 *** (0.0311)	0.550 *** (0.037)	0.497 *** (0.0263)	0.546 *** (0.039)	0.524 *** (0.0299)
Functional limitation _{t-2}	0.200 *** (0.030)	0.194 *** (0.0274)	0.240 *** (0.033)	0.203 *** (0.0251)	0.287 *** (0.033)	0.234 *** (0.0246)
Functional limitation _{t-3}	0.027 (0.042)	0.164 *** (0.0350)	0.112 ** (0.038)	0.162 *** (0.0310)	0.141 *** (0.040)	0.179 *** (0.0291)
#IV	62					
Hansen J	chi2(35): 42.79; $p = .171$	chi2(35): 40.73; $p = .233$	chi2(35): 47.86; $p = .072$	chi2(35): 33.66; $p = .533$	chi2(35): 50.62; $p = .043$	chi2(35): 49.69; $p = .051$

Notes: Sample is as described in Table 1. Each coefficient is from a separate regression model. The dependent/independent variable of interest is listed in the column/row heading. For the definitions of the dependent variables (see text). Control variables include the following: age, marital status, number of children under 18 years of age, body mass index, alcohol use, smoking status, light physical activity, health insurance, external financial support, and financial liabilities to others. For self-rated health, the number of chronic conditions was also included on the right-hand side. Standard errors are shown in parentheses; they are clustered at the individual level.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

*** $p < .001$.

** .001 $p < .01$.

* .01 $p < .05$.

TABLE 5
Blundell-Bond (system-generalized method of moment) regressions with economic indicator quintiles

	Labor income		Family income		Net wealth	
	Men	Women	Men	Women	Men	Women
Dependent variable: Self-rated health						
Quintile 1 (ref)						
Quintile 2	5.536*** (1.052)	3.481*** (1.013)	3.751** (1.350)	2.731* (1.330)	2.112* (0.931)	-0.437 (0.952)
Quintile 3	5.700*** (1.142)	3.131** (1.146)	4.148** (1.435)	2.282 (1.423)	2.241* (1.058)	2.077 (1.093)
Quintile 4	4.046*** (1.122)	4.226*** (1.257)	4.456** (1.553)	1.282 (1.453)	3.874** (1.215)	3.031* (1.235)
Quintile 5	4.380*** (1.199)	2.853* (1.354)	3.955* (1.635)	3.098* (1.569)	4.288** (1.408)	3.353* (1.321)
Self-rated health status _{t-1}	0.275*** (0.018)	0.271*** (0.023)	0.277*** (0.020)	0.291*** (0.023)	0.256*** (0.018)	0.295*** (0.023)
Self-rated health status _{t-2}	0.145*** (0.018)	0.135*** (0.021)	0.133*** (0.019)	0.148*** (0.020)	0.148*** (0.018)	0.144*** (0.021)
Self-rated health status _{t-3}	0.082*** (0.018)	0.080*** (0.019)	0.080*** (0.019)	0.075*** (0.019)	0.079*** (0.018)	0.094*** (0.019)
#IV	145					
Hansen J	chi2(111):120.76; <i>p</i> = .248	chi2(111):130.32; <i>p</i> = .102	chi2(111):107.16; <i>p</i> = .585	chi2(111):133.80; <i>p</i> = .069	chi2(111):138.54; <i>p</i> = .039	chi2(111):135.70; <i>p</i> = .056
Dependent variable: Functional limitation score						
Quintile 1 (ref)						
Quintile 2	-3.486*** (0.544)	-1.708*** (0.449)	-2.072*** (0.529)	-0.718 (0.522)	-0.806* (0.354)	-0.321 (0.423)
Quintile 3	-3.193*** (0.525)	-4.111*** (0.530)	-2.389*** (0.589)	-1.509** (0.559)	-1.361** (0.446)	-0.504 (0.481)
Quintile 4	-2.419*** (0.564)	-3.611*** (0.532)	-2.806*** (0.628)	-1.429* (0.585)	-1.725*** (0.439)	-0.423 (0.515)
Quintile 5	-3.566*** (0.617)	-3.528*** (0.551)	-3.940*** (0.678)	-2.057*** (0.614)	-1.763*** (0.506)	-1.379* (0.574)
Functional limitation _{t-1}	0.580*** (0.026)	0.498*** (0.0217)	0.598*** (0.029)	0.517*** (0.0239)	0.580*** (0.026)	0.526*** (0.0206)
Functional limitation _{t-2}	0.218*** (0.020)	0.160*** (0.0188)	0.263*** (0.025)	0.219*** (0.0171)	0.218*** (0.020)	0.239*** (0.0190)
Functional limitation _{t-3}	0.150*** (0.024)	0.168*** (0.0229)	0.162*** (0.027)	0.155*** (0.0250)	0.150*** (0.024)	0.224*** (0.0212)
#IV	143					
Hansen J	chi2(112): 118.98; <i>p</i> = .308	chi2(112):120.75; <i>p</i> = .270	chi2(112): 116.80; <i>p</i> = .359	chi2(112): 107.98; <i>p</i> = .590	chi2(112): 116.80; <i>p</i> = .359	chi2(112): 139.96; <i>p</i> = .038

Notes: Sample is as described in Table 1. Each coefficient is from a separate regression model. The dependent/independent variable of interest is listed in the column/row heading. For the definitions of the dependent variables (see text). Control variables include the following: age, marital status, number of children under 18 years of age, body mass index, alcohol use, smoking status, light physical activity,

health insurance, external financial support, and financial liabilities to others. For self-rated health, the number of chronic conditions was also included on the right-hand side. Standard errors are shown in parentheses; they are clustered at the individual level.

Source: Authors' calculations based on Panel Study of Income Dynamics, 1999–2013.

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