The Causal Pathway from Socioeconomic Status to Disability Trajectories in Later Life: The Importance of Mediating Mechanisms for Onset and Accumulation

Miles G. Taylor, Ph. D.
University of North Carolina-Chapel Hill

Background:

The past two decades have witnessed an overall decline in disability among older adults in the United States. One factor of noted importance these declines is socioeconomic status, and particularly education. However, recent research has yet to examine the interplay of mechanisms in the causal pathway leading to disability over time. Two main arguments have been presented in the connection of individual-level socioeconomic factors and health. The first suggests that education is primary and robust as a predictor and may work mainly to prevent or delay poor health. The second focuses on financial resources, suggesting that they serve both a preventive role and a "muting" effect on level once a health condition, etc. has occurred. Both arguments point to shared and independent mediators through which education and financial resources are thought to affect health over time. It is possible that both strains of thought correctly hypothesize the protective effects of these measures of socioeconomic status. I test the independent effects of education and income on individual transitions and growth in disability over time. I then test the effects of mediators hypothesized to be both shared and independent mechanisms through which education and income affect disability.

Research Objectives/Hypotheses:

(1) I hypothesize that **education** will work mainly to delay disability (prevention) and that **financial resources** will work to both delay disability *and* to decrease the growth of disability among those disabled. (2) Further, I expect that the mediators through which these measures affect health are both shared and independent. (2a) **Social support** has been noted as an important mediator in the disablement process (Verbrugge and Jette 1994). Therefore, it is expected to mediate the effects of education and income equally on disability. (2b) **Health behaviors** and **mastery** have been cited as the most important pathways through which education works independently on health, therefore I expect these to mainly mediate the effect of education on disability. (2c) **Assets**, **insurance**, and **access to health care** have been suggested as types of "capital" through which income effects health as it is rooted in a material world. Therefore, these mechanisms are expected to primarily mediate the effect of income on disability.

Research Design:
Study Sample and Variables

The data source used to test these hypotheses is the *Established Populations for Epidemiologic Studies of the Elderly (EPESE)* at Duke University. The Duke sample consists of individuals aged 65 and older residing in the community at baseline. Respondents participated in four in-person and four telephone based interviews. The original sample size was 4,162. Disability was measured at all four waves, and all covariates were measured at baseline with the exception of mastery, which was not collected until the second wave in 1989. Therefore the subsample used only those

individuals surviving and self-reporting in 1989 (N=3,058). Of these individuals, listwise deletion of predictor variables resulted in a final sample size of 2,547. Although this subsample is only roughly 60% of the original sample size and is more robust due to survival/noninstitutionalization to the second wave, the descriptive statistics for predictor variables at baseline are similar to those in the entire sample.

Analytic Method

Latent growth curves may be estimated using a number of strategies, but a structural equation approach and *Mplus* software (see Muthén and Muthén, 2004) are chosen for flexibility. Based on a multivariate normality assumption, growth curves estimate individual intercepts and slopes of trajectories over time/age and may be used to measure individual deviation from the mean intercept and slope though the inclusion of covariates. If the outcome of interest is the timing of onset versus the growth (in severity) of an outcome, discrete-time event history analysis may be incorporated into the growth model using binary latent variables (Muthén and Masyn 2005) to separate out the effects of covariates on onset versus progression (see Taylor 2005). This means that the latent growth curve is separated into two parts: a discrete-time hazard portion modeling onset, and a conventional growth curve modeling progression once onset has occurred. The time structure of this hazard model is analogous to the piecewise exponential model used in conventional discrete-time hazard models (Allison 1995).

Results:

Table 1 reports the coefficients of effects of covariates on disability onset and growth. The coefficients for disability onset must be interpreted differently than on growth since η_u is a latent variable with dichotomous indicators. The coefficients are presented for consistency, but the values for η_u must be exponentiated in order to produce the proportional hazard odds ratio. Model 3 introduces mediators by which education is hypothesized to primarily affect disability over time. The effects of these factors were mainly isolated to disability delay. Smoking and obesity had positive effects on disability onset, with heavy drinking and mastery protective for disability onset. Of these risk factors, mastery was the only one to significantly predict growth in disability. With these factors introduced into the model, the effect of education on onset decreased from 26 to 32% but remained highly significant. The effects of income were mediated slightly less, decreasing 13 to 21% for onset. The protective muting effects of income on disability growth decreased by 12% but remained significant.

The mechanisms through which income are hypothesized to work are introduced in Model 4. Home ownership and low access to health care due to cost were both significant for the onset of disability. Home ownership was also protective for the growth of disability, decreasing growth by .07 units per wave. Reporting Medicaid increased the intercept of the disability growth by .16 units. The effects of education on onset decreased by 19 to 23% but remained significant. The effects of income on onset decreased by 23 to 25%, remaining significant. The effects of income on growth, however, decreased by 22% and became nonsignificant.

The final model, Model 5, includes all mediators. The education mediators, including health behaviors and mastery, remained relatively stable in magnitude and significance. The mediators for income remained fairly stable, with the effects of owning

one's home reduced to nonsignificance for disability onset and Medicaid producing a significant negative effect on the growth of disability. The effects of education remained significant in delaying disability, but were reduced by 41 to 43% in magnitude. The effects of income on disability onset were reduced by 35% (10 to 20 thousand), but the effects of $20 thousand or more and all effects on the growth of disability were reduced to nonsignificance.

Discussion:

        Overall, the findings support the hypotheses, with some exceptions. Gender and age acted somewhat as expected, but race was nonsignificant and at times worked in the opposite direction than hypothesized. Education and income also acted as expected, with both education and income working to delay the onset of disability, but income also working to mute the progression of disability (growth) given onset. Of those mediators primarily expected to mediate the effect of education, obesity, smoking, and mastery were significant in their effects on disability among the sample. The effect of mastery was particularly strong on disability growth. These mediators did successfully mediate the effects of education more than those of income.

        Among the mediators of income, only home ownership and decreased access to heath care were significant in predicting disability. As with education, the inclusion of these measures worked more to mediate income than education, as hypothesized. Like social support, the inclusion of these variables reduced the muting effects of income to nonsignificance. In the final model, the effects of socioeconomic status were reduced by 35-43% for the onset of disability, with the muting effect of income reduced to nonsignificance. Overall, these findings suggest that education and income do work through both shared and independent mediators to effect health as suggested by Evans (2002) and others. The effects of health behaviors and mastery were most salient for educational effects, while assets and access to health care were most salient for income effects. Social support seemed to be most salient for income, although the marital status variable was nonsignificant. Finally, the fact that education and income effects were only reduced by 35-43% in the final model suggests that other mechanisms are at work besides those included here.

References:

Allison, Paul D. 1995. *Survival Analysis Using the SAS System: A Practical Guide*. Cary, NC: SAS Institute, Inc.

Evans, Robert. 2002. *Interpreting and Addressing Inequalities in Health: From Black to Acheson to Blair to ... ?* London: Office of Health Economics.

Muthén, Bengt and Katherine Masyn. 2005. "Discrete-Time Survival Mixture Analysis." *Journal of Educational and Behavioral Statistics* 30:27-58.

Muthén, L., and B. Muthén 2004. *Mplus User's Guide. Third Edition*. Los Angeles, CA: Muthen & Muthen.

Taylor, M. G. 2005. *Disaggregating Disability Trajectories: Exploring Differences in the Disability Experience of Older Adults in the United States*. Doctoral Thesis.

Table 1: Socioeconomic and Mediating Effects on Disability Onset and Growth

N=2,547	Model 1			Model 2			Model 3			Model 4			Model 5		
	η_u	α_y	β_y	η_u	α_y	β_y	η_u	α_y	β_y	η_u	α_y	β_y	η_u	α_y	β_y
Male	-0.247***	-0.010	-0.029	-0.226***	0.024	-0.003	-0.284***	-0.005	-0.002	-0.205***	0.000	-0.025	-0.226***	-0.12	0.025
White	-0.101	0.007	0.118***	-0.081	0.008	0.124***	-0.014	0.015	0.121***	-0.043	0.009	0.122***	0.055	0.020	0.127***
Age	0.085***	0.004	0.015***	0.083	0.004	0.014***	0.089***	0.004	0.014***	0.090***	0.004	0.015***	0.091***	0.003	0.013***
Educ. 9 to 12	-0.329***	0.061	-0.007	-0.333***	0.062	-0.006	-0.243***	0.078	0.006	-0.254***	0.057	0.007	-0.194***	0.072	0.015
Educ. 13 to 17	-0.610***	0.230***	-0.044	-0.611***	0.233***	-0.049	-0.417***	0.257***	-0.009	-0.493***	0.223***	-0.024	-0.345***	0.247***	-0.002
Inc. 10 to 20	-0.514***	-0.018	-0.106***	-0.481***	-0.023	-0.087	-0.447***	-0.001	-0.093***	-0.387***	-0.031	-0.083	-0.333***	-0.031	-0.061
Inc. 20,000+	-0.532***	0.020	-0.111	-0.481***	0.004	-0.076	-0.421***	0.048	-0.091	-0.408***	-0.003	-0.089	-0.289	-0.004	-0.045
Married	---	---	---	-0.108	0.031	-0.066	---	---	---	---	---	---	-0.091	0.040	-0.055
Perc. Support	---	---	---	-0.108***	-0.010	-0.034***	---	---	---	---	---	---	-0.080	-0.017	-0.024
Obstain	---	---	---	---	---	---	-0.019	-0.001	0.073	---	---	---	0.006	-0.005	0.077
Heavy Drink	---	---	---	---	---	---	-1.120***	-0.065	-0.067	---	---	---	-0.175***	-0.067	-0.043
Pack Years	---	---	---	---	---	---	0.004***	0.000	-0.001	---	---	---	0.004***	0.000	-0.001
Mastery	---	---	---	---	---	---	-0.249***	-0.043***	-0.022***	---	---	---	-0.236***	-0.045***	-0.019***
Underweight	---	---	---	---	---	---	0.469	0.016	0.112	---	---	---	0.401	0.034	0.100
Overweight	---	---	---	---	---	---	0.144	0.040	-0.041	---	---	---	0.141	0.041	-0.036
Obese	---	---	---	---	---	---	0.433***	0.067	0.012	---	---	---	0.415***	0.060	0.023
Own Home	---	---	---	---	---	---	---	---	---	-0.203***	0.005	-0.066***	-0.128	0.007	-0.059***
No Medicare	---	---	---	---	---	---	---	---	---	0.347	0.006	0.110	0.219	-0.009	0.090
Medicare B	---	---	---	---	---	---	---	---	---	-0.005	0.065	-0.034	-0.050	0.078	-0.037
Medicaid	---	---	---	---	---	---	---	---	---	0.274	0.157***	-0.044	0.311	0.141*	-0.051***
Other Ins.	---	---	---	---	---	---	---	---	---	-0.136	0.032	-0.014	-0.106	0.036	-0.005
Phys. Cost	---	---	---	---	---	---	---	---	---	0.430***	-0.015	-0.013	0.252***	-0.048	-0.032
Intercept	---	0.966***	-0.755***	---	0.981***	-0.510***	---	1.120***	-0.663***	---	0.904***	-0.717***	---	1.165***	-0.441***
Var.	---	0.236***	0.116***	---	0.235***	0.113***	---	0.215***	0.109***	---	0.229***	0.098***	---	0.207***	0.088***
Cov. (α, β)	---	-0.022	---	---	-0.020	---	---	-0.017	---	---	-0.015	---	---	-0.010	---
	Onset 89	Onset 92	Onset 96	Onset 89	Onset 92	Onset 96	Onset 89	Onset 92	Onset 96	Onset 89	Onset 92	Onset 96	Onset 89	Onset 92	Onset 96
τ	6.809***	6.520***	6.138***	6.055***	5.762***	5.375***	6.168***	5.769***	5.322***	7.271***	6.958***	6.553***	5.914***	5.501***	5.039***
LL	-6543.097			-6534.505			-6435.540			-6514.920			-6409.707		
BIC	13352.844			13382.716			13302.428			13445.501			13446.829		