The Role of Socioeconomic Status in Disaggregated Disability Trajectories among Older Adults in the United States

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EXTENDED ABSTRACT

INTRODUCTION

The evolution of disablement as a dynamic process has been a focus of disability research since the 1960's. The demography, medical sociology, and gerontology literatures have all contributed to the understanding of what it means to become disabled, recover from disability, and experience disablement as a process. Within recent decades, the interest of researchers has turned to trajectories of disability. Mapping disability experience longitudinally fits accepted theory on the process of disablement and may be couched within the broader framework of the life course, focusing on transitions and trajectories across age or time. Previous research on disability trajectories in late life has shown that disability may be seen as a growth process, increasing with age (Taylor and Lynch 2004). These findings have relied on methods (hierarchical linear models, latent growth models) that fit an aggregate/average trajectory of disability for all individuals, and determine their deviations from the trajectory through the inclusion of covariates and a random normally distributed error term. Although this method is very telling, it assumes that individuals roughly accumulate disability in the same way over time. Previous research using this type of method has also noted the large amount of individual variation in mapping an average trajectory over the disability experience of a population (see Maddox and Clark 1992).

It is possible that subgroups of individuals have fundamentally different, nonlinear trajectories of disability. The identification and parameterization of such disability subgroups would contribute to existing theory on the disablement process, advance knowledge about the shape or shapes of disability trajectories in late life, and add to the methodological toolkit that researchers currently use in this area of study. In addition, including demographic risk factors in the model would increase knowledge of disability risk, having implications for both research and policy. Understanding an individual's risk in experiencing a type of disability trajectory may inform the timing and implementation of health interventions.

Drawing on the life course framework and theory by Glaser and Strauss (1968), I argue that population-level subgroups of experience exist in disability trajectories and that identifying these subgroups greatly enhances they way researchers may understand risk factors in their prediction. Much information on demographic risk factors such as gender, race, and cohort has been forwarded by the medical, gerontological, and demographic literatures. In addition to these factors, I focus on socioeconomic status and the protective role played by income and education in reducing and/or delaying disability.

METHODS

Data

The data source used to test these hypotheses will be the *Established Populations for Epidemiologic Studies of the Elderly (EPESE)* at Duke University. The EPESE project was sponsored by NIA and was conducted at four different sites (Yale, Harvard, Duke, Iowa). This survey was designed to investigate predictors of mortality, chronic disease, and disability, and service utilization including long-term care. Measures in the EPESE data focus on physical, social, mental, and cognitive functioning.

The Duke University sample consists of 4,162 individuals aged 65 and older residing in the community (at baseline) in a five-county area in north-central North Carolina. Over a time period of ten years, respondents participated in 4 in-person and 4 telephone based interviews. Although individuals were community dwelling at baseline, they were followed into institutions at subsequent waves. Proxy responses were also collected for those unable to respond at waves subsequent to baseline. The baseline survey was conducted in 1986-7, with follow-up in-person data collected in years 1989, 1992, and 1996. Only in-person interviews are used in these analyses.

Of the 4,162 persons reporting at baseline, 132 were missing on the disability item. These cases were dropped and the remaining 4,030 were included in analyses. The missing data function computes the likelihood function of each individual given all available information. Therefore, individuals were allowed attrition due to mortality or nonresponse while still contributing to the analyses until they dropped out (see Vermut and Magidson 2004). In analyses not shown, listwise deletion was used to replicate analyses. The substantive results (number and shape of classes and general effects of covariates) were similar except that the individuals were more robust, yielding lower levels of disability in all classes. Due to the biased nature of listwise deletion, I choose to include missing data.

Analytic Strategy

Previous longitudinal research on trajectories of disability has predominantly used growth curves, which allow estimation of individual trajectories and between individual differences in mean intercept and slope. Although this is very telling, it assumes one specification for individual trajectories of disability, therefore masking known heterogeneity in disability over time that has been observed in past research (both in increment-decrement and growth curve type models). More importantly, it is limited in exploring why and how individuals may share similar disability trajectories that may vary in shape and timing.

Latent class analysis may be seen as a complement to other forms of developmental trajectory measurement including hierarchical modeling and latent growth curve modeling. The latter two strategies use continuous multivariate density functions, mapping one average trajectory over the individual trajectories. Latent class analysis uses a multinomial modeling strategy to map group trajectories existing as latent classes in the data (Jones, Nagin, and Roeder 2001). This "prototypal" classification recognizes fuzziness in the data, since all individuals cannot be assumed to exactly fit one and only one group trajectory (Nagin 1999). Initially the latent class model was developed by Lazasfeld and others (Lazarfeld and Henry 1968), based on the assumption that individual attributes differ due to an unobservable (or latent) category to which they belong (Land 2001). The development of latent class models is evident in the work of

Nagin and Land (1993), Roeder, Lynch, and Nagin (1999), and D'Unger, Land, McCall and Nagin (1998). This methodological tool has been used in sociology primarily for the classification of longitudinal delinquent or criminal careers. I argue that this technique is appropriate for the analysis of disability trajectories, which have already been measured using hierarchical and growth curve strategies (see Li et al. 2000 and Taylor and Lynch 2004).

General Equation: For a homogeneous case, a parametric model of f($\mathbf{y}$,λ) may be assumed for the behavior or attribute, where $\mathbf{y} = (y_1, y_2 \ldots . y_T)$ is the longitudinal sequence of observed behaviors or attributes across T periods. If it is assumed that subgroups of attributes exist and differ in parameter values, the model may be rewritten as:

$$f(\mathbf{y}) = \sum_{k=1}^{K} \Pr(C = k) \Pr(\mathbf{Y} = \mathbf{y} | C = k) = \sum_{k=1}^{K} p_k f(\mathbf{y}, \lambda_k) \qquad (1)$$

In Equation (1), p_k is the probability of belonging to class *k* with corresponding parameter(s) λ_k, and λ_k is dependent on time. This basic equation may be further restricted using fixed scores for the categories of **y** (Vermut and Magidson 2004) for the specification of an ordinal dependent variable. Given the nature of the disability index and due to ease of graphic interpretation, I use this specification.

With the inclusion of risk factors (time-stable), it is assumed that these covariates affect the likelihood of class membership, or membership in a particular group trajectory. Covariates, in this technique, both add to knowledge of data **Y** in predicting the number and shape of classes, and also aid in establishing demographic profiles for the group trajectories. Therefore, the risk factors for subject *i*, $\mathbf{Z}_i$-($Z_{i1} \ldots . Z_{iR}$) for the data trajectory for the individual with repeated measures across *T* periods, $\mathbf{Y}_i$=($Y_{i1} \ldots . Y_{iT}$) are dependent given the group, C_i.

In order to test my hypotheses (not listed here in the interest of space), I will estimate models with one to six latent classes for each cohort (given the covariates included in the full model). In order to establish the best fit (and thus the optimum number of classes) I compare the likelihood ratio chi-square statistics (L^2), Bayesian information criteria (BIC), and bivariate residuals. Then, I outline the results of the estimated demographic covariates (gender, race, and age) in predicting class membership in the group disability trajectories for each cohort. Finally, I introduce the full model, including socioeconomic variables, in order to address how income and education work in predicting risk of differential disability experience over time.

DISCUSSION

The support for my hypotheses was mixed given preliminary findings. Generally, five classes of disability experience over the decade arose from the data. The experiences were similar to those hypothesized, but do not include an "increase and recovery" class until the oldest ages. In addition, there was some support for a "delayed" category, especially at the youngest ages. As would be expected, disability levels generally increased across cohorts, with a "mild linear" category among the youngest ages becoming a "moderate linear" category among those 75-84.

Demographic factors generally acted as expected, with men generally more likely to remain nondisabled or to become disabled and recover at the oldest ages. They were also less likely to delay disability than women. Race was generally protective, however, whites were substantially more likely to experience a precipitous increase in disability compared to nonwhites at the latest ages. Age seemed to work most at the poles of disability, keeping individuals in the lowest groups of disability and out of the highest ones.

The effects of education were interesting. It was protective in keeping people free from disability and generally in delaying disability, but at age 75 to 84 those most educated were less likely to be in a delayed category compared to the least educated. Income seemed to work differently at different ages/cohorts. It kept people out of disability in the youngest cohort, kept them nondisabled or delayed disability in age 75 to 84, and strongly increased the likelihood of precipitous increase in the oldest ages.

These preliminary findings suggest that more work is needed to disentangle these effects, although the results presented are an important first step. Of note is the precipitous increase class, which represents between 3 and 10% of the sample given the full model. Almost none of the covariates included predicted this experience, suggesting that other factors, such as health event, may be at work. Generally, socioeconomic status worked to keep people from entering into disability rather than mute the level of disability among the disabled. This gives credence to findings on the compression of morbidity and the role of education in declining disability trends.

The conceptualization and measurement of disability trajectories has been growing in aging research. However, most research still captures transitions or average differences in mean level or slope of disability over time. The approach used here may uncover some of the complexities of the protective nature of risk factors and selection due to mortality. Future analyses will fine-tune these findings to contribute to known theory on the disablement process and add to the methodological toolkit used in studying such a dynamic life course trajectory.