Title: Education, Childhood Conditions, and Dementia Life Expectancy in the Older U.S. Population

Dementia prevalence and incidence have fallen in a number of high-income countries over the past 25 years. Some researchers have speculated that the decline is reflective of populations' rising levels of educational attainment, a critical indicator of cognitive reserve which may account for individuals' reduced susceptibility for Alzheimer's disease-related pathology. Technological and socioeconomic advances have disproportionately allowed well-educated segments of the population to become adept at controlling their environment. Through education, individuals acquire the skills and resources necessary to gain a greater degree of control over their environment and maximize their potential for a longer, healthier life via the adoption of healthier lifestyles, early adoption of health enhancing technologies, and improved control over hypertension and cholesterol – *all factors identified as important contributors to cognitive reserve and Alzheimer's disease (AD) risk*. In addition, the ability of those with advanced education to garner health advantages may be accelerating, potentially leading to widening the educational gradient in AD over time.

Given the critical role of education in influencing AD and education's centrality in the life course, this study evaluates the influence of education on cognitive health in the context of life course development and maintenance of cognitive reserve spanning from childhood into adulthood. The study is based on the Health and Retirement Study (HRS), 1998-2016, and represents the experiences of persons 65 years of age and older in the United States. The HRS offers a unique opportunity to evaluate cognitive health in the older US population based on measures validated on a study in which neuropsychological and clinical assessments were performed on an HRS subsample.

The central question of this study is: **Because early-life conditions set in motion adult achievement processes and exposures to AD risk factors, largely through education, how do early-life conditions and education combine to influence dementia?** When early-life conditions are statistically controlled, what are the net consequences of educational attainment for dementia? Further, to the extent that *both* early-life conditions and education independently influence dementia, how do they *combine* to define life course-related pathways of risk? For example, how might the risk of dementia differ for persons from disadvantaged childhoods who attain a high school credential compared to those who attain a college degree.

To address these issues, we adopt a demographic approach and estimate multivariate, multistate life table models. These models allow us to assess how dementia and mortality intersect to define the period of life spent with dementia. For example, research has identified the average individual disease burden (dementia life expectancy) in the older population, demographic subgroup differences in dementia burden, and recent trends in dementia burden. Less clear, however, is how dementia life expectancy is anchored in major life course experiences shown to be associated individuals' susceptibility for Alzheimer's disease-related pathology, other forms of dementia and mortality. Understanding these associations may be

especially important for thinking about trends and disparities in dementia life expectancy as well as the underlying dynamics driving trends in dementia prevalence. Here, we begin to evaluate how dementia life expectancy is linked to the two major stages of the life course – childhood and adulthood. We approach the problem by assessing the associations between dementia life expectancy, childhood health and socioeconomic context, and educational attainment.

Research Approach

We draw on the Health and Retirement Study, 2000-2016, and use a multivariate, multistate life table (MSLT) approach that incorporates information on childhood health and socioeconomic context as well as educational attainment to estimate subgroup differences in dementia life expectancy. For example, we are able to estimate MSLTs showing dementia and dementia-free life expectancy for adults who are 65 years or older with less than high school or GED, high school, some college, or college completers—with and without controlling for childhood conditions. Comparisons of the expectancies allows us to assess the "net effect" of adult conditions on dementia life expectancy in terms of years of life. Alternative multivariate model specifications allow us to test a variety of hypotheses pertaining to dementia life expectancy, and our main aims are summarized below.

1. What is the effect of education on dementia life expectancy, net of early life conditions? Do early life conditions have a direct association with dementia life expectancy, net of education? Overall, we expect that poor childhood health, childhood social disadvantages and low levels of education both shorten lives and lengthen dementia life expectancy relative to persons from more advantaged backgrounds and higher education.
2. To the extent that both childhood conditions and education have direct associations with dementia life expectancy, how do these factors combine to influence heterogeneity in dementia life expectancy in the population? For example, how does dementia life expectancy differ between people who are consistently advantaged and disadvantaged? What are the consequences for dementia life expectancy for gaining more education among persons from disadvantaged childhoods?

Conclusion

At its core, this study is designed to inform our understanding of how education, a critical indicator of cognitive reserve and risk factor for AD, influences the cognitive health of older Americans. Our assessment is based on an approach that recognizes that education is embedded in the life course and may combine in potentially complex ways with both early

childhood and later adulthood that have important implications for understanding the origins of Alzheimer's disease-related pathology.