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Research Paper

The Dynamic contribution of chronic conditions to temporal trends in disability among U.S. adults

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Abstract

Background: Although evidence has shown that U.S. late-life disability has been declining, studies have also suggested that there has been an increase in chronic diseases between 1984 and 2007.

Objectives: To further illuminate these potentially contradictory trends, we explicate how the contribution of chronic conditions changes across four common types of disability (ADL, IADL, mobility disability, and functional limitations) by age (A), period (P), and birth cohorts (C) among adults aged 20 and above.

Methods: Our data came from seven cross-sectional waves of the National Health and Nutrition Examination Survey (NHANES). We utilize a cross-classified random effect model (CCREM) to simultaneously estimate age, period, and cohort trends for each disability. Each chronic condition was sequentially then simultaneously added to our base models (sociodemographics only). Reductions in predicted probability from the base model were then calculated for each chronic condition by each temporal dimension (A/P/C) to assess the contribution of each chronic condition.

Results: There was increasing age-based contribution of chronic conditions to all disabilities. The period-based contribution remained quite stagnant across years while cohort-based contributions showed a continual decline for recent cohorts. Arthritis showed the greatest contribution to disability of all types which was followed by obesity. Cancer was the least important contributor to disabilities.

Conclusion: Although chronic conditions are becoming less disabling across recent cohorts, other competing risk factors might suggest prevailing causes of disability.

Keywords: Disability; Age-period-cohort; Chronic condition

It is well documented that the prevalence of U.S. late-life disability has been declining in the past few decades[1,2]; in particular, the decline was most pronounced for instrumental activities of daily living (IADL). Similar declines in disability were also found in a previous study which adjusted for sociodemographics and other temporal dimensions (age and cohort effects).[3] Despite the fact that disability is declining, studies have shown that there has been an increase in chronic diseases between 1984 and 2007.[4,5] These two seemingly contradictory trends were not only found in the U.S. but also in European countries such as the Netherlands.[6] Several studies have offered explanations for these trends. First, increased use of assistive devices promotes greater independence among individuals who are afflicted by chronic diseases.[7,8] Second, improved screening and advanced medical treatments might mitigate the severity of chronic conditions and possibly halt the progression from morbidity to disability.[8] Third, environmental changes such as safer and improved sidewalks can help people with mobility issues to better ambulate around their environments.[7] All of the above evidence suggests that the potentially disabling impacts of chronic disease can be reduced over time. Further confirmation comes from previous studies[6,9] that link disability trends with chronic conditions and demonstrate a divergent trend between certain types of disability and some major chronic conditions.

While the aforementioned studies focused on the older population, Martin and colleagues[10] assessed relationships

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between disability trends and chronic conditions among a group of individuals who were between the ages of 50 and 64. Unlike the older population, a significant increase in needing help for activities of daily living (ADL) was uncovered and the proportion of individuals needing help with IADLs and having difficulty with physical functioning remained stable from 1997 to 2007. Martin et al[10] also reported that the contribution of specific chronic condition to disabilities was inconsistent across years—some had a growing role and others had a declining role. As demonstrated above, there are disparate trends in the contribution of chronic conditions to disability that are dependent on age differences. Obviously, the relationship between chronic conditions and disability requires further disentangling. As a result, we aggregated the entire adult population aged 20–80 and attempted to explicate how age relates to the impact of chronic conditions on four different types of disability: ADL disability, IADL disability, mobility disability, and functional limitations. In addition, we explored how the contribution of chronic conditions changes across survey years (period) and birth cohorts. We estimated an age-period-cohort model developed by Yang and Land[11] and we describe below why simultaneously examining these three temporal dimensions (age, period, and cohort) is important.

Three temporal dimensions: age, period, and cohort

Demographically speaking, time can be captured by three temporal dimensions: age, period, and cohort (A-P-C). Age (A) is a proxy of the biological aging process which brings about internal physiological change due to an accumulation of exposure, genetic manifestation of disease, and/or the natural breakdown of the human body.[12] Period effects and cohort effects are external to individuals but still play substantial roles in determining an individual's health. Period effects (P) reflect technological, environmental, economic, and socio-cultural changes over time that affect the entire population simultaneously, but perhaps not equally. For example, as a result of drought, there might be an increase in food price which affects a higher proportion of low income residents than those who are financially well-off. Birth cohort (C) is defined as a group of individuals who were born in similar years and experience formative social events throughout the life-course.[11] Although individuals in the same cohort experience similar historical and social events, successive cohorts experience different historical and social conditions which will result in differential exposures to socioeconomic, behavioral, and environmental risk factors. While each temporal dimension has a unique contribution to population health—including disability—neglect of one of them could produce biased estimates of health trends.[11,13,14] In this study, we were able to consider the effects of age, period, and cohort simultaneously and explicate the contribution of chronic conditions to four common types of disability by age, period, and cohort which is not currently available in the disability literature.

Methods

Target population

This study utilized seven waves of the National Health Nutrition and Examination Survey (NHANES): III (1988–1994), 99–00, 01–02, 03–04, 05–06, 07–08, and 09–10. The NHANES is a successive, cross-sectional, and nationally representative survey which is administered by the National Center for Health Statistics (NCHS). It is designed to assess the health and nutritional status of U.S. adults and children. Due to changes in survey administration, there was a small measurement gap between 1995 and 1999. The exact year (period) of interview/examination is not available in the public release data; consequently, we developed a coding scheme to best estimate the respondent's year of interview. Based on available information of the public dataset, we created a lower estimate (interviewed in the earliest possible interview date) and an upper estimate (interviewed in the latest possible interview date) for each individual (see Online Supplement). The concordance rate was quite high between upper and lower estimates. It is important to note that because the data collection period within NH3 has a larger gap (varying from 2 to 3 years period) than NH4–NH9 (2 year period), the concordance rate for NH3 is substantially lower (K = .54) than NH4–NH9 (K = .90). Although both estimates produced similar results, we selected the lower estimate for both periods and cohorts. We excluded respondents below age 20, women who were pregnant, respondents who belong to the oldest (1900) and youngest (1990) cohort band or were missing birth year (cohort) information. We dropped these respondents because we cannot determine the obesity status for pregnant women prior to the pregnancy and the small sample sizes in the two cohorts precluded reliable estimates. Finally, the amount of missing data for each disability outcome is different; Table 1 depicts the sample sizes for each outcome and set of predictors for disability.

Measurements

Dependent variables

Disability was assessed consistently across the seven survey waves; however, some verbiage changed between NHANES III and NHANES 99–00 onward. In NHANES III, respondents were asked if they have "no difficulty," "some difficulty," "much difficulty," or are "unable" to do a variety of activities by themselves and without the use of aids. From NHANES 99–00 onward, respondent were asked, "By yourself and without using any special