



# Functional limitations and health care resource utilization for individuals with cognitive impairment without dementia: Findings from a US population-based survey

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## Abstract

**Introduction:** Little is known about functional limitations and health care resource utilization of people with cognitive impairment with no dementia (CIND).

**Methods:** Respondents with stable or progressive cognitive impairment (CI) after the first (index) indication of CIND in 2000–2010 were identified from the Health and Retirement Study (HRS). Respondents never exhibiting CI were identified as potential controls. Propensity score–based optimal matching was used to adjust for differences in demographics and history of stroke. Differences between cohorts were assessed accounting for HRS survey design.

**Results:** After matching, CIND respondents had more functional limitations (difficulty with  $\geq 1$  activities of daily living: 24% vs. 15%;  $\geq 1$  instrumental activities of daily living: 20% vs. 11%) and hospital stays (37% vs. 27%) than respondents with no CI (all  $P < .001$ ). Seventy five percent of CIND respondents developed dementia in the observable follow-up (median time:  $\sim 6$  years).

**Discussion:** Even before dementia onset, CI is associated with increased likelihood of functional limitations and greater health care resource use.

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## Keywords:

CIND; Functional limitations; Health care resource use; Burden; Dementia

## 1. Introduction

In 2007, the Aging, Demographics, and Memory Study estimated that the prevalence of dementia in the United States among individuals aged 71 years and older was 13.9% [1]. Alzheimer disease (AD) is the most common cause of dementia and accounts for 60%–80% of all dementias in the United States, followed by vascular dementias that account for up to 20% of all dementia patients [2,3].

Several studies have documented the functional and economic burden associated with AD and related dementias. For example, in 2009, more than a third of people with AD

required some assistance with activities of daily living (ADL), such as dressing, bathing, and getting in and out of the bed [2]. The direct costs associated with AD and related dementias in the United States were estimated to be \$226 billion in 2015. In addition, nearly \$18 billion were attributable to costs associated with informal caregiving for people with AD and related dementias in 2014 [2].

However, little is known about the implications of cognitive impairment without dementia—a cognitive status known to develop as many as 18 years before clinical AD diagnosis [4] and affect approximately 10%–20% of Americans aged 65 years and older [5–7]. Recent studies have found that the incidence and prevalence of cognitive impairment without dementia are higher than those for dementia [7,8]. Prior research has also found that cognitive impairment with no dementia (CIND) is associated with

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substantial comorbidities and limitations in ADL and instrumental activities of daily living (IADL). For example, in the Cache County Study, Lyketsos et al. found that participants with CIND had substantially higher rates of comorbid conditions than those with normal cognition [9]. Using data from a nationally representative sample of participants aged 71 years and older, Gure et al. found that 45% of subjects with CIND had difficulty with  $\geq 1$  IADL compared to 13% of subjects with normal cognition [10]. In a similar study, Fisher et al. found that although respondents with CIND generally maintained their functional independence, their caregivers spent approximately 4 hours/day to help them with IADLs [11].

These studies, however, are limited to respondents aged 65 years and older and may not represent the broader population with cognitive impairment, many of whom may be younger [2,6]. In addition, to the best of our knowledge, no study to date has evaluated the health care resource use among respondents with CIND, as compared to similar respondents with normal cognition. Understanding the functional and economic implications of CIND, including in a younger population, is especially important given the refinement of diagnostic criteria for CI and earlier stage Alzheimer disease, and the emergence of new technologies that may facilitate earlier diagnosis of cognitive impairment and its causes [12]. In addition, new treatments in development are likely to target patients at earlier stages of disease. The objective of the present study was to compare differences in patient characteristics, functional limitations, and health care resource use between people with CIND and those with no cognitive impairment (no CI) using a nationally representative sample of the US population enrolled in the Health and Retirement Study (HRS). In addition, the study assessed the rates of progression to dementia among respondents with CIND, the time to progression, and the burden associated with development of dementia in the subgroup of CIND respondents who progressed within 2 years after incident CIND indication.

## 2. Methods

### 2.1. Data

The study used data from the RAND version M of the publicly available HRS survey data sets for respondents enrolled in the study. The survey design and questionnaires have been described previously [13]. Briefly, the HRS is a longitudinal household survey data set facilitating study of retirement and health among the noninstitutionalized population over age 50 years in the United States. The HRS includes rich demographic, clinical, economic, and health-related data. Of particular interest, the survey includes a detailed cognitive assessment, which has been used to study cognitive functioning among older Americans [5]. Certain HRS data elements which are not part of the integrated RAND HRS database (e.g., caregiver assistance) were

accessed directly from the core HRS files and merged at the respondent level. In addition, respondent level weights, strata, and cluster information (provided by HRS) were used in all analyses described in the following to account for the complex survey design.

### 2.2. Measures of cognitive assessment

For each survey wave with valid cognitive assessment data, a respondent's cognitive status was determined following the approach used by Langa et al. [14,15]. Different stages of respondents' cognitive health were defined using the 27-point TICS scale for all self-respondents (this scale includes: 10-word immediate and delayed recall tests of memory, serial 7s subtraction test, and the backwards counting test) and the 11-point composite scale for respondents requiring proxy informants (the composite scale includes: proxy's assessment of respondent's memory and limitations in five IADLs, and interviewer assessment of respondent's cognitive ability). Using the composite scores, respondent's cognitive status was classified as

- No CI
  - Self-respondent—score of 12 or higher
  - Proxy respondent—score of 0 to 2
- CIND
  - Self-respondent—score of 7 to 11
  - Proxy respondent—score of 3 to 5
- Dementia
  - Self-respondent—score 0 to 6
  - Proxy respondent—score of 6 or higher

### 2.3. Study sample and time periods

Following the classification of cognitive functioning, the data were examined to identify respondents with earliest indications of CIND in 2000 or later. The first wave indicating CIND was considered as the index wave. To increase the likelihood of including respondents whose cognitive impairment is consistent with a progressive pattern due to an underlying neurodegenerative process such as AD, those with waves indicating an improvement in cognitive status (i.e., CIND followed by no impairment or dementia followed by CIND/no impairment) were excluded from the analyses. Respondents were required to have complete information regarding demographics and comorbidity profile, cognitive assessment, metrics of physical functioning, and resource use in the index wave as well as the waves immediately preceding and following the index wave.

Respondents with no evidence of cognitive impairment during the observable years of data were considered as potential controls. The index wave for the no CI cohort was selected at random, and respondents were required to have similar information as the CIND cohort in the index wave as well as the waves before and after the index wave.

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