Cognitive Status and Incident Disability in Older Mexican Americans: Findings from the Hispanic Established Population for the Epidemiological Study of the Elderly

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Objective: To determine the effects of baseline cognitive function on incidence of disability in activities of daily living (ADL) in initially non-disabled Mexican-American elderly over a 7-year period.

Design: A prospective cohort study.

Setting: Southwestern United States: Texas, California, Arizona, New Mexico, and Colorado.

Participants: A population-based sample of Mexican Americans aged 65 and over who completed the Mini-Mental State Examination (MMSE) and other relevant variables at baseline. The sample at baseline consisted of 2731 subjects, of which 2431 were non-ADL disabled.

Measurements: In-home interviews in 1993–94, 1995–96, 1998–99, and 2000–2001 assessed sociodemographic variables, selected medical conditions (stroke, cancer, diabetes, arthritis, and hip fracture), cognitive function, depressive symptomatology, and ADLs.

Results: In a Cox proportional regression analysis, a significant relationship was evident between MMSE score at baseline and risk of incident ADL disability over a 7-year period. Among non-disabled subjects at baseline, the hazard ratio of any new ADL limitation was 1.58 (95% CI, 1.18–2.12) for those with impaired cognition (MMSE score 0–21), 1.38 (95% CI, 1.04–1.82) for low normal cognition (MMSE score 22–24), and 1.30 (95% CI, 1.02–1.66) for normal cognition (MMSE score 25–28) when compared to subjects with high-normal cognition (MMSE score 29–30), adjusting for sociodemographic variables, presence of selected medical conditions and depressive symptoms at baseline. Similar results were also found when MMSE score was used as a continuous variable. Among non-disabled subjects at baseline, each unit increase in MMSE score decreased the risk of onset of any ADL limitation over a 7-year follow-up period, controlling for relevant variables at baseline (HR=0.97; 95% CI, 0.95–0.99).

Conclusion: Low MMSE score was associated with increased risk for incident ADL disability over a 7-year period in older Mexican Americans. Given the social, economic, and health impact of cognitive impairment, these findings suggest a need to develop effective intervention programs that delay or prevent the onset of cognitive and ADL disability in the elderly. (*Ethn Dis*. 2004;14:26–31)

Key Words: MMSE, Activities of Daily Living, Aging, Mexican Americans

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Introduction

Functional disability and loss of independence, irrespective of their causes, have been linked with poor quality of life, nursing home placement, and death.[1–3] Intact cognitive status is crucial for maintaining optimal social and physical functioning. Several studies have examined the relationship between cognitive status and functional decline.[4–7]

Leveille et al[6] found a significant relationship between poor cognition and increasing functional difficulty among older White women, but not among older Black women after controlling for age and education. Similarly, Moritz et al,[4] using data from the New Haven Established Population for the Epidemiological Study of the Elderly (EPESE), showed that the odds of reporting disability in Activities of Daily Living (ADLs) at the 3-year follow-up were about 2.5 times greater in subjects with low cognitive ability at baseline compared with those with normal cognitive ability. Data from the Nun Study[5] also showed that older women with low-normal cognitive function on the Mini Mental State Examination (MMSE) at baseline had twice the risk of ADL disability at follow-up relative to those with high-normal cognition. In a population-based cohort study of community-dwelling New Haven, Connecticut residents, subjects with the least efficient cognitive status were more likely (RR=2.0) to develop functional dependence at 3-year follow-up, after adjustment for relevant confounders.[7]

A few studies have documented a significantly higher prevalence of cognitive impairments among elderly Hispanics compared to non-Hispanic Whites.[8–9] Using data from the Hispanic Established Population for the Epidemiological Study of the Elderly (H-EPESE), Black et al[10] reported a significant cross-sectional association between cognitive status and chronic health conditions among older Mexican Americans. However, little is known about associations between cognitive functioning and incident disability among elderly Mexican Americans, a rapidly growing segment of the United States population.[11]

Given the lack of longitudinal research examining cognitive function in this ethnic group, we conducted a study to determine whether poor cognitive function at baseline, measured by MMSE, in subjects initially free of ADL disability, is associated with any ADL disability over a 7-year period in a large area probability sample of older Mexi-

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can Americans. Our hypothesis is that low scores on cognition measures (MMSE) among non-disabled Mexican Americans aged 65 and older will predict the onset of disability in ADL over a 7-year period, after adjusting for relevant sociodemographic factors, medical conditions, and depressive symptoms.

METHODS

Sample

Data employed are from the H-EPESE. The H-EPESE is an on-going National Institute on Aging (NIA) funded community-based study of 3050 Mexican Americans aged 65 and older. The sample was designed to be generalizable to approximately 85% of older Mexican Americans living in 5 Southwestern states including Texas, California, Colorado, Arizona, and New Mexico.[12] A full description of the rationale, methods, and subject characteristics can be found elsewhere.[13–14] The response rate was 83% at baseline (1993–1994), which was comparable to the other EPESE studies. Of the 3050 subjects, 2873 were interviewed in person and 177 (5.8%) by proxy. The interviews were conducted in Spanish or English, depending on the respondent's preference. The present study used baseline data (1993–94), and data obtained from a 2-year follow-up (1995–96), a 5-year follow-up (1998–99), and a 7-year follow-up assessment (2000–2001). For the analysis, we included subjects who completed the MMSE and other relevant variables at baseline. Thus, the sample at baseline consisted of 2731 subjects of whom 2431 were non-ADL disabled at baseline. Over 7 years of follow-up, 424 subjects refused or were lost to follow-up and 745 were confirmed dead through Epidemiology Resources Incorporated using the Social Security Administration's Death Master Files, and reports from relatives.

Measures

Cognitive Function

The Mini Mental State Examination (MMSE) is a 30-item instrument used to assess cognitive function. Although this instrument is among the most frequently used cognitive screening measures in studies of older adults,[15] it cannot be used to diagnose dementia. The English and Spanish versions of the MMSE were adopted from the Diagnostic Interview Scale (DIS) and have been used in prior community surveys.[16] Similar to previous studies on cognitive aging,[5–7] MMSE scores were divided, based on their distribution in the 2731 subjects at the first assessment, into approximate quartiles: 0–21 (cognitively impaired), 22–24 (low-normal), 25–28 (normal), and 29–30 (high-normal).

Functional Disability

Functional disability was assessed by self-reporting of 7 items from a modified version of the Katz Activities of Daily Living scale (ADLs).[17] The Katz Activities of Daily Living scale (ADLs) included measures, such as walking across a small room, bathing, grooming, dressing, eating, transferring from a bed to a chair, and using the toilet. Respondents were asked to indicate if they could perform these activities without help, if they needed help, or if they were unable to do them. Disability was dichotomized as no help needed vs needing help with or unable to perform one or more of the 7 ADLs activities.

Covariates

Baseline sociodemographic variables included age, gender, marital status, and years of education. The presence of various medical conditions was assessed using a series of questions and by asking the respondents if they ever had a physician diagnosis of a heart attack, stroke, arthritis, diabetes, hip fracture, or cancer. Depressive symptomatology was assessed using the Center for Epidemiological Studies Depression (CES-D) scale, a widely-used measure of emotional health in community studies of older people.[18–20] This scale consists of 20 items that ask how often specific symptoms were experienced by individuals during the past week; responses were scored on a 4-point scale (scored 0 to 3) with potential total scores ranging from 0–60. Alpha reliability with these data was 0.89. Persons scoring 16 or over, as is common in the literature, are considered to experience high depressive symptomatology.[21]

Outcome

Incidence of disability was defined as a new onset of any ADL limitation (needing help with or unable to perform one or more of the 7 ADLs activities) at either the 2, 5, or 7-year follow-up interview.

Statistical Analyses

Cox proportional hazards regressions were used to calculate the hazard ratio of new onset of any ADL limitation at either 2, 5, or 7-year follow-up interview as a function of quartiles of MMSE scores controlling for selected medical conditions and sociodemographic variables at baseline. These analyses were restricted to those who were non-ADL disabled at baseline. We also analyzed the MMSE score as a continuous variable to investigate if there was

Table 1. Descriptive characteristics of the sample at baseline

Variables	*N* = 2,731
Age, (mean ± SD)	72.6 ± 6.4
Gender, *N* (%)	
Male	1131 (41.4)
Female	1600 (58.6)
Marital status, *N* (%)	
Married	1522 (55.7)
Unmarried	1209 (44.3)
Education in years, (mean ± SD)	4.9 ± 3.9
MMSE score, (mean ± SD)	24.9 (4.5)
MMSE score, *N* (%)	
0–21	548 (20.1)
22–24	630 (23.1)
25–28	846 (30.9)
=29	707 (25.9)
Heart attack, *N* (%)	287 (10.5)
Stroke, *N* (%)	154 (5.6)
Cancer, *N* (%)	145 (5.3)
Diabetes, *N* (%)	764 (28.0)
Arthritis, *N* (%)	1104 (40.4)
Hip fracture, *N* (%)	88 (3.2)
Depression (CES-D=16), *N* (%)	644 (23.6)
Any ADL limitation, *N* (%)	300 (11.0)

a gradient of risk associated with onset of disability. All analyses were performed using the SAS System for Windows, Version 8 (SAS Institute, Cary, NC).

RESULTS

Table 1 presents descriptive characteristics of the sample at baseline. The average age of participants was 72.6 years, 58.6% were female and 55.7% were currently married. The average level of education was low at 4.9 years. The average MMSE score was 24.9 ± 4.5. Diabetes (28%), arthritis (40.4%), and high depressive symptoms (23.6%) were the most commonly reported medical conditions. Eleven percent of the subjects reported any ADL limitation at baseline.

Table 2 shows the percentage of non-disabled subjects at baseline reporting any ADL limitation over 7 years of follow-up stratified by quartiles of baseline MMSE scores. Among subjects in the lowest quartile of MMSE score, almost 30% reported any ADL limitation over a period of 7 years compared with 16.5% of subjects in the highest quartile of MMSE score.

Table 3 presents the results of the Cox proportional hazard model predicting the risk of any ADL limitation over a 7-year period of follow-up as a function of quartiles of MMSE score, controlling for demographic variables, selected medical conditions, and depressive symptoms at baseline. In the Cox proportional regression analysis, there was a significant relationship between MMSE score at baseline and risk of incident ADL disability over a 7-year period. Among non-disabled subjects at baseline, the hazard ratio of any new ADL limitation was 1.58 (95% CI, 1.18–2.12) for those with impaired cognition (MMSE score 0–21), 1.38 (95% CI, 1.04–1.82) for low-normal cognition (MMSE score 22–24), and 1.30 (95% CI, 1.02–1.66) for normal cognition (MMSE score 25–28) when compared to subjects with high-normal cognition (MMSE score 29–30), after adjusting for age, gender, marital status, years of education, presence of selected medical conditions, and depressive symptoms at baseline. Similar results were also found when MMSE score was used as a continuous variable. Among non-disabled subjects at baseline, each unit increase in MMSE score decreased the risk of onset of any ADL limitation over a 7-year follow-up period, after controlling for baseline factors listed in Table 3 (HR=0.97; 95% CI, 0.95–0.99).

Table 2. Percentage of subjects reporting any ADL limitation over 7-year follow-up by quartiles of MMSE score among nondisabled subjects at baseline (*N* = 2,431)

Quartiles of MMSE Score	0–21 *N* (%)	22–24 *N* (%)	25–28 *N* (%)	29–30 *N* (%)
Total	413	565	780	673
Any ADL limitation	123 (29.8)	137 (24.3)	174 (22.3)	111 (16.5)
No ADL limitation	290 (70.2)	428 (75.8)	606 (77.7)	562 (83.5)

DISCUSSION

We examined the effects of baseline cognitive performance on subsequent ADL function among community-dwelling Mexican Americans aged 65 and older. Our findings can be summarized as follows. A significant relationship was observed between lower baseline MMSE scores and increased risk of any ADL limitations over a 7-year follow-up period, after adjusting for relevant sociodemographic and selected medical conditions. Older subjects with low cognitive function at baseline (MMSE score 0–21) had a 58% higher chance for ADL disability over 7 years of follow-up, when compared to those with normal cognitive function, after adjusting for relevant confounders. On the other hand, there was a step-wise decrease in the risk of

Table 3. Cox proportional hazard models predicting any ADL limitation over a 7-year follow-up by MMSE score and other covariates among nondisabled subjects at baseline

Independent Variables	HR (95% CI) N = 2431*
Age (one year increase)	1.08 (1.06–1.09)
Gender (female)	1.21 (0.99–1.47)
Marital status (married)	0.89 (0.74–1.08)
Education (yrs)	0.99 (0.97–1.03)
Quartiles of MMSE score (29–30)	
0–21	1.58 (1.18–2.12)
22–24	1.38 (1.04–1.82)
25–28	1.30 (1.02–1.66)
Heart attack	1.27 (0.98–1.65)
Stroke	1.22 (0.83–1.79)
Cancer	0.86 (0.57–1.31)
Diabetes	1.69 (1.41–2.03)
Arthritis	1.28 (1.07–1.52)
Hip fracture	2.03 (1.34–3.08)
Depressive symptoms (CES-D=16)	1.24 (1.01–1.51)

* Include respondents with the values for all independent measures.
Reference category (given in parentheses).
Note: CES-D=Center for Epidemiologic Studies Depression Scale.

Older subjects with low cognitive function at baseline (MMSE score 0–21) have a 58% higher chance for ADL disability over 7 years of follow-up, when compared to those with normal cognitive function . . .

future ADL disability with better cognitive performance at baseline. With each unit increase in MMSE score, older non-disabled Mexican-American subjects had 3% less chance of any ADL limitation over 7 years of followup.

These findings are consistent with the results of previous studies, thus extending these observations to older Mexican Americans.[4–6,22] However, this is the first study that examined the association between baseline cognitive status and incident disability in ADL over a 7-year period in a large community-based sample of Mexican Americans aged 65 and older from 5 Southwestern states. Our study showed a continuum of risk across the entire range of MMSE scores. Scores that were conventionally considered to be within normal (MMSE scores of 25–28) were associated with higher risk of incident ADL disability compared to high-normal MMSE scores. Thus, in a community sample of an elderly Mexican-American population, scores on a brief cognitive test (MMSE) might be used as an indicator of subsequent deficits in functional and physical performance.

Several possible explanations may account for how poor cognitive functioning at baseline may lead to loss of ADL abilities. First, an unrecognized medical condition may plausibly cause both impairment of cognition and ADLs. Thus, cognitive deficits might manifest much earlier as low scores on cognition tests before demonstrable deficits in ADL. Although Ferrucci et al[23] have reported higher risks of incident stroke among subjects with low cognition when compared with those with normal cognition, there is no direct evidence in our study that incident disability in ADL among older Mexican Americans at follow-up is due to stroke or any specific medical condition. Second, poor performance on specific items of MMSE, if persistent, might conceivably lead to impairment of daily living activities. For instance, impairment in memory, task-sequencing ability (apraxia), and poor language ability (aphasia) can directly interfere with ADLs. Subjects with impaired cognition might also have lapses of judgment, become easily confused, show poor object recognition, and may exhibit neurological deficits with potential adverse effects on self reported ADLs.

Furthermore, the subjects with lower MMSE scores may possibly represent those in a predementia state. The concept of predementia, also called mild cognitive impairment (MCI), is characterized by mild, but measurable, memory loss without dementia or significant impairments in general cognitive and ADL functioning.[24] Subjects with MCI have 15% annual conversion rate to Alzheimer's disease compared to 1% of healthy elderly controls.[24] For example, Braekhus at al[25] showed that more than 40% of older community-dwellers with MMSE scores of 24–25 developed clinical dementia at 3-year follow-up compared with those with higher MMSE scores. Though the MMSE is not a diagnostic instrument, a low MMSE score coupled with normal ADL at baseline strongly suggests the possibility of MCI in our subjects with low cognitive scores at baseline. Therefore, some older Mexican Americans with low baseline MMSE scores may have conceivably progressed to clinical dementia over a 7-year period. In this scenario, a progressive loss of independence and ADL abilities occur as cognition declines over time. The present study cannot confirm or refute this explanation because a clinical evaluation for dementia was not made.

A limitation to this study is its exclusive reliance on self-reporting of ADLs by older subjects who might be

cognitively impaired. However, several studies have shown significant agreements between patients and proxy assessments of patients' abilities to perform physical activities of daily living, regardless of patients' cognitive functioning.[26–27] Similarly, Smith and colleagues found that self-reported ADLs have a high test-retest reliability even among cognitively-impaired elders.[28] Despite these limitations, our study has several strengths, including its large community-based sample, its prospective design, and its association of baseline cognitive status with subsequent ADL change over a period of 7 years.

In conclusion, our study found that low MMSE score was associated with increased risk for incident ADL disability over a 7-year period in a population-based sample of older Mexican Americans living in the community. The association between poor baseline cognitive scores and incident disability in ADL over 7 years suggests that older Mexican Americans with poor cognition may be at increased risk for future disability and loss of independence. These Mexican-American elders with low cognitive scores may represent a cohort of individuals that may benefit substantially from targeted rehabilitation interventions and vascular risk modifications, with the expectation of lowering the risk of incident cognitive and physical disability. One approach to reducing functional dependency in this population is a clinical trial of culturally appropriate interventions that promote increased mental, social, and physical activities in the elderly, particularly among the cognitively impaired. The results of this study and others may be a beneficial tool in the development of better forecasting of public health needs of elderly Mexican Americans, a rapidly growing segment of the older population in the United States.[11]

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