# Screening for Cognitive Impairment in Older Adults Attending an Eye Clinic

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Preliminary results of the study were presented as a poster at the 2004 9th International Conference on Alzheimer's Disease and Related Disorders Meeting at Philadelphia, PA.

*Purpose:* We conducted a cross-sectional study examining potentially modifiable factors associated with cognitive impairments (mild or severe) in older whites, African Americans and Hispanics attending an outpatient eye clinic.

*Methods:* In-clinic interviews and physical examinations assessed social, demographic and health information from 100 consecutive Hispanic, African-American and white adults aged ≥55. Our primary outcome was presence of any cognitive impairment (mild or severe) using the St. Louis University Mental Status Examination (SLUMS) scale.

*Results:* Of the 100 subjects, 65 screened positive for cognitive impairments on the SLUMS cognitive instrument: 46 with mild cognitive impairment and 19 with severe impairment (possible dementia). African-American and Hispanic adults (nonwhites) were significantly more likely to have cognitive impairment compared to white adults (OR 2.80; 95% CI=1.05–7.44), independent of age, years of education and systolic blood pressure. Subjects with diabetes also had increased odds of cognitive impairments (OR 3.28, 95% CI=1.21–8.90) even after adjusting for relevant confounders. There was a nonsignificant trend between visual acuity impairment and cognitive impairment (p=0.059).

*Conclusions:* Sixty-five percent of adults aged ≥55 attending the eye clinic screened positive for cognitive impairments, with higher rates among nonwhites and adults living with diabetes.

**Key words:** cognitive impairment ■ visual impairments ■ older adults

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## INTRODUCTION

A major cause of disability and death in older adults, Alzheimer's disease (AD) typically affects memory, linguistic, executive and visuospatial functions, but little is known about the earliest manifestations of AD—the predementia state. The concept of predementia, also called mild cognitive impairment (MCI), is characterized by mild but measurable memory loss with no impairment in general cognitive and ADL functioning.[1] Adults with MCI progress to AD at a 15% annual conversion rate compared to 1% of those without MCI.[1] A plausible step towards reducing incidence of AD and other dementias is an early identification (and treatment) of potentially modifiable factors associated with cognitive impairment.

These potentially modifiable factors include: obesity, diabetes, hypertension and metabolic syndrome.[2-7] In addition, studies have shown associations between visual impairments and increased risk of cognitive impairments and subsequent dementia, independent of other health indicators, such as disability and falls, among others.[8-12] Indeed, preliminary evidence in mostly white populations suggests that visual impairment may precede memory or neurocognitive signs and symptoms of AD.[10-18] For example, postmortem analysis—based on longitudinal evidence of visual symptoms progression in white adults—showed cortical atrophy with abundant neurofibrillary tangles present in the occipitoparietal areas.[10]

Specifically, from these past studies and given the ethnic differences in prevalence and risk factors

for visual impairment,[19,20] it is not clear whether visual complaints are associated with early cognitive change in nonwhites and whether deteriorating vision predicts the onset of dementia in older African-American and Hispanic adults—populations with particularly greater ocular morbidity, visual and cognitive impairments compared with older whites. Previous studies have raised a number of questions. Can common complaints (such as difficulty writing, trouble staying on the correct line of text and difficulty recognizing familiar objects, among others) constitute early warnings of AD or even MCI? If so, which complaints are more specific to cognitive loss as opposed to common causes of visual impairments, such as glaucoma?

In an attempt to answer these questions, we conducted a cross-sectional study examining the prevalence and predictors of cognitive impairments (mild or severe) in older whites, African Americans and Hispanics attending an outpatient eye clinic. Because ethnicity, age and visual complaints comprised some of the potential predictors of cognitive impairments in our study, we chose the eye clinics for recruiting our subjects to increase our access to older adults with various eye disorders and also to take advantage of the multiethnicity of our patient population.

## METHODS

### Sample

Following approval from the University of Texas Medical Branch (UTMB) institutional review board, we collected social, demographic and health information from 100 consecutive Hispanic, African-American and white adults, aged ≥55, who came to receive ophthalmologic care at the UTMB Eye Center. Patients included in the study had no history of dementia, were able to give informed consent for the interviews and physical examination, and were able to communicate in English or Spanish. The eye examination was done by a board-certified ophthalmologist. Patients with significant cognitive, physical and emotional disorders were referred to appropriate professionals for further management.

The data collection was performed over a period of eight months (November 2003 to June 2004). In addition to sociodemographic and medical information and using standardized questionnaires, we collected information on physical activity level and cognition. All participants also had a comprehensive eye examination as well as blood pressure measurements. The assessments lasted approximately one hour. Interviews were done in English or Spanish, depending on the preferences of participants. The bilingual interviewers were thoroughly trained in the administration and scoring of the questionnaires.

## MEASURES

### Cognitive Impairment

Saint Louis University Mental Status Examination (SLUMS)[21-22] is a new and easy to use 11-item scale with good reliability and validity for screening for mild and severe cognitive impairments. SLUMS was developed to detect mild cognitive impairment and to distinguish it from dementia.[21] SLUMS scores range from 0 to 30, with lower scores indicating increasing severity of cognitive impairments in the cognitive domains of orientation, memory, attention and executive functions.

Our primary outcome was the presence of any cognitive impairment (mild or severe) using the SLUMS scale. Mild cognitive impairment was defined as a SLUMS score of 20–27 for subjects with high-school education and above, and as a score of 15–19 for those with less than high-school education. Scores of 1–19 (for those with high-school education) and 1–14 (for those with less than high-school education) depicted severe cognitive impairment (dementia) on the SLUMS scale.

### Vision Impairment

The Visual Data Battery (VDB) was used to assess vision and screen for ocular pathologies with the use of the following instruments:

1. Snellen letter chart for 20-foot distance vision (with correction, if any). Best corrected vision was obtained using established techniques for refraction.
2. Rosenbaum pocket vision screener at 14 inches for near (reading) vision
3. Refractor
4. Ishihara plates for color vision testing using handheld pictorial book
5. Amsler grid, a simple grid for assessing central field and for other visual field examination using confrontation method
6. Haag Streit 900 or equivalent slit lamp to view the anterior part of the eye, including eyelid, conjunctiva, cornea, anterior chamber, iris, pupil and the lens
7. Goldman tonometer attached to a slit lamp to measure intraocular pressure
8. Indirect and direct ophthalmoscope with dilated fundus examination to look at the retina and optic nerve using slit lamp and handheld +78 & +90 D lens and 20 D lens for indirect ophthalmoscopy.

### Other Measures

Demographic and health measures included age, gender, ethnicity, years of education, marital status, and systolic blood pressures. For selected medical

**Table 1. Characteristics of Cognitive Impairment Using Saint Louis Mental Status Examination Scale**

| Characteristics | Number of Subjects | Percent with Any Cognitive Impairment | Chi-Square | P Value |
|---|---|---|---|---|
| Total | 100 | 65.0% | | |
| *Age* | | | | |
| 55–69 | 56 | 62.5% | 0.35 | 0.554 |
| ≥70 | 44 | 68.2% | | |
| *Gender* | | | | |
| Female | 58 | 63.8% | 0.09 | 0.766 |
| Male | 42 | 66.7% | | |
| *Ethnicity* | | | | |
| White | 61 | 57.4% | 4.00 | 0.046 |
| Nonwhite | 39 | 76.9% | | |
| *Year of Education* | | | | |
| <12 | 27 | 55.6% | 1.45 | 0.229 |
| ≥12 | 73 | 68.5% | | |
| *Marital Status* | | | | |
| Married | 48 | 60.4% | 0.85 | 0.356 |
| Not currently married | 52 | 69.2% | | |
| *Systolic BP* | | | | |
| <135 mmHg | 22 | 50.0% | 2.52 | 0.112 |
| ≥135 mmHg | 76 | 68.4% | | |
| *PASE* | | | | |
| <22 | 43 | 62.8% | 0.02 | 0.891 |
| ≥22 | 53 | 64.2% | | |
| *Diabetes* | | | | |
| Yes | 38 | 81.6% | 7.41 | 0.007 |
| No | 62 | 54.8% | | |
| *Cardiovascular Disease* | | | | |
| Yes | 37 | 62.2% | 0.21 | 0.648 |
| No | 63 | 66.7% | | |
| *Stroke* | | | | |
| Yes | 10 | 50.0% | 1.10 | 0.313 |
| No | 90 | 66.7% | | |
| *History of Smoke Addiction* | | | | |
| Yes | 16 | 75.0% | 0.84 | 0.360 |
| No | 84 | 63.1% | | |
| *Vision—Both Eyes Normal** | | | | |
| Yes | 68 | 58.8% | 3.56 | 0.059 |
| No | 32 | 78.1% | | |
| *Retina Examination* | | | | |
| Normal | 71 | 59.2% | 2.74 | 0.098 |
| Abnormal | 16 | 81.3% | | |
| *Intraocular Pressure* | | | | |
| Normal | 92 | 65.2% | 0.83 | 0.660 |
| Abnormal | 6 | 83.3% | | |

* Either visual acuity or corrected acuity are normal in both eyes. Patients with abnormal visual acuity didn't test for corrected acuity in either eye was counted as "No".

condition, subjects were asked if they have ever had a physician diagnosis of stroke, diabetes and hypertension. Physical Activity Scale for the Elderly (PASE),[23] a 10-item instrument, was used to measure level of self-reported occupational, household and leisure activities during a one-week period.

## Statistical Analysis

For screening covariates, we examined social, demographic, health and lifestyle factors associated with cognitive impairment with descriptive contingency tables (Chi-squared and Fisher's exact test). Multivariate logistic regression models were then used to identify factors associated with cognitive impairment as a function of ethnicity (white vs. nonwhite) by comparing cognitively impaired subjects to those with normal cognition. The factors adjusted for in the regression models included age (prevalence of cognitive impairment increases with age) and all variables that had a p value ≤0.3 in the univariate analyses. The unadjusted model included white and nonwhite ethnicity. Because of small numbers of nonwhites, African-American and Hispanic adults were grouped in the same category of nonwhite ethnicity. Adjusted model 1 included age, years of education and systolic blood pressure. Diabetes was added to adjusted model 2, while vision (normal visual acuity in both eyes, yes versus no) was added to the fully adjusted model 3. All analyses were performed using the SAS System for Windows®, Version 8.12 (SAS Institute, Cary, NC).

## RESULTS

Figure 1 shows the frequency of subjects by performance on the SLUMS measure. Thirty-five subjects had normal scores. Sixty-five subjects had scores in the cognitive impairment range: 46 with mild cognitive impairment and 19 with severe impairment (possible dementia).

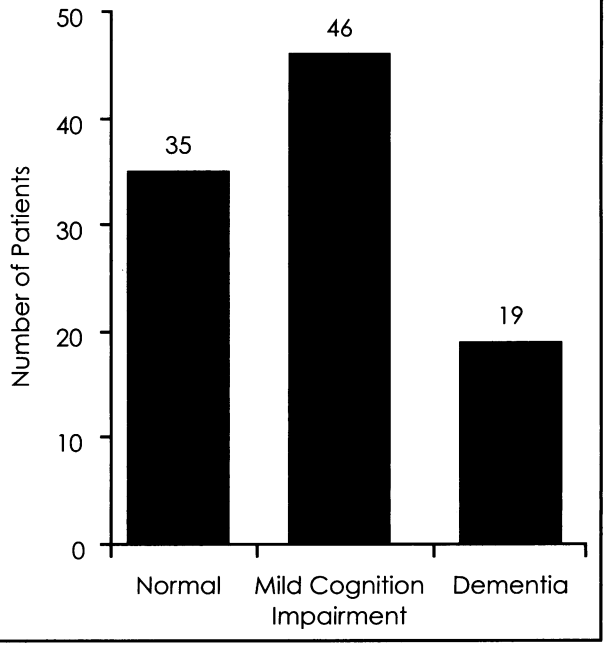
Table 1 presents the characteristics associated with cognitive impairments (mild or severe) in subjects aged ≥55 attending the eye clinic. African-American and Hispanic adults (nonwhites) were significantly more likely to have cognitive impairment (76.9% in nonwhites vs. 57.4% in whites, p=0.046). Subjects with diabetes were also significantly more likely to have cognitive impairment (81.6% in diabetics vs. 54.8% in nondiabetics, p=0.007. There was a nonsignificant trend between visual acuity impairment and cognitive impairment (p=0.059).

Table 2 presents the logistic regression models for factors predicting cognitive impairments on the SLUMS instrument. In the unadjusted model with white ethnicity as reference category, the odds ratio (OR) of cognitive impairment for nonwhites was 2.48 (95% CI=1.01–6.10). Even after controlling for age, years of education and systolic blood pressure in the adjusted model 1, the odds of cognitive impairment in nonwhites was still significantly higher than for whites. However, after adjusting for diabetes, ethnicity was no longer predictive of cognitive impairment, indicating a possible mediating role for diabetes in the ethnic differences in risk of cognitive impairment. Presence of diabetes was also significantly predictive of cognitive impairment, even after controlling for all variables in Table 2 (OR 3.28, 95% CI=1.21–8.90); with the wide confidence interval reflecting the small number of 38 subjects with diabetes.

## DISCUSSION

Our findings can be summarized as follows. In our study sample of 100 community-dwelling subjects aged ≥55 years attending a university-based eye clinic, 65 subjects screened positive for cognitive impairments on the SLUMS. African-American and Hispanic adults (nonwhites) were significantly more likely to have cognitive impairment compared to white adults, independent of age, years of education and systolic blood pressure. Subjects with diabetes also had increased odds of cognitive impairment even after adjusting for relevant confounders, including ethnicity and visual acuity. After adjustments were made for presence of diabetes, ethnicity was no longer significantly predictive of cognitive impairment, indicating a possible mediating effect of diabetes on the association between nonwhite eth-

**Figure 1.** Frequency of cognitive impairment using St Louis University Mental Status Examination Scale (SLUMS), n=100



nicity and increased likelihood of cognitive impairments. There was a nonsignificant trend between visual acuity impairment and cognitive impairment (p=0.059).

Our findings are different from some prior studies and consistent with others. Overall prevalence rate (65%) of cognitive impairment in our study is much higher than rates of 8.5–43% reported in past studies.[24-26] The wide range of prevalence rates of cognitive impairment in the literature might, in part, be due to differences in sources of subjects (clinics versus community) or in cognitive assessment tools, which may overestimate cognitive impairments in minority ethnic groups.[24-27]

Consistent with past studies is the higher prevalence of cognitive impairment in nonwhite adults compared to white adults, and among subjects with diabetes.[24-29] For example, a study of 2,759 adults aged ≥65 found that 17% of African-American men, 9.4% of Hispanic-Cuban men and 9% of white non-Hispanic men screened positive for cognitive impairments on the Short Portable Mental Status Questionnaire.[24] Data from the San Luis Valley Health and Aging Study also showed that Hispanic ethnicity was significantly associated with executive cognitive impairment, but after adjusting for education and acculturation, ethnicity was no longer predictive of cognitive impairment.[25] In our study, ethnicity was still predictive of cognitive impairment even after adjusting for education.

Possible explanations for the differences in rates and predictors of cognitive impairments in previous studies and ours include our small sample size and our sample composition (eye clinic patients with 39% being nonwhite). For example, our grouping African Americans and Hispanics as the nonwhite category, unlike other studies, could have contributed to the differences in our study and others, given the known differences in determinants of health and disease between the two ethnic groups. It is also theoretically possible that poor vision might lead to underestimation of our subjects' cognitive ability, given the 32% prevalence of abnormal visual acuity in our sample.

Our finding that diabetes is associated with increased risk of cognitive impairments is consistent with some studies in older adults; although other investigators reported no such association.[28-30] Several reasons have been postulated for diabetes-associated cognitive impairment: brain hypoperfusion from diabetic vasculopathy, neuronal damage from hyperinsulinemia and recurrent hypoglycemia, and existence of genetic predisposition to both impaired cognition and impaired glucose tolerance.[28-29,31-32] Because we did not have brain imaging and measures of blood insulin, we could not test the hypotheses that brain ischemia and hyperinsulinemia are potential mediators of diabetes-related cognitive impairment. Regardless, given the high prevalence of diabetes in older black and Hispanic adults, an important step in reducing cognitive disability in this population is a better identification (and potential modification) of factors linking diabetes to poor cognition. One way to lower diabetes-related cognitive disablement is better control of diabetes-associated disorders, such as depression, hypertension,

**Table 2. Logistic Regression Models for Factors Predicting of Cognitive Impairment on SLUMS Examination**

| Characteristic | Unadjusted Model OR | 95% CI of OR | Adjusted Model 1 OR | 95% CI of OR | Adjusted Model 2 OR | 95% CI of OR | Adjusted Model 3 OR | 95% CI of OR |
|---|---|---|---|---|---|---|---|---|
| *Ethnicity* | | | | | | | | |
| White | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Nonwhite | 2.48 | (1.01, 6.10) | 2.80 | (1.05, 7.44) | 2.40 | (0.87, 6.61) | 2.26 | (0.81, 6.32) |
| Age | | | 1.03 | (0.97, 1.10) | 1.03 | (0.96, 1.09) | 1.02 | (0.96, 1.09) |
| Years of Education | | | 1.07 | (0.95, 1.21) | 1.07 | (0.95, 1.20) | 1.08 | (0.95, 1.22) |
| Systolic Blood Pressure | | | 1.01 | (0.99, 1.03) | 1.01 | (0.99, 1.03) | 1.01 | (0.99, 1.03) |
| *Diabetes* | | | | | | | | |
| No | | | | | 1.00 | | 1.00 | |
| Yes | | | | | 3.43 | (1.27, 9.23) | 3.28 | (1.21, 8.90) |
| *Vision—Both eyes normal** | | | | | | | | |
| Yes | | | | | | | 1.00 | |
| No | | | | | | | 2.11 | (0.73, 6.09) |

SLUMS: The Saint Louis University Mental Status (SLUMS) Examination; CI: confidence intervals; OR: odds ratio

retinopathy and hyperlipidemia—disorders that potentially modify cognitive impairment.

This study has several limitations. First, because of its cross-sectional design, we cannot make any causal inference about the connections among ethnicity, diabetes and cognitive impairment. Second, the small number of subjects did not allow us to investigate differences between African Americans and Hispanics with regards to our outcomes. The small sample size may also account for our not finding differences in rate of cognitive impairments by vision status, given the findings in past studies linking low vision to poor cognition. Another limitation is the potential bias inherent in recruiting subjects from one university-based eye clinic. This limitation has two implications: our findings may not be directly generalizable to other populations, and the higher rate of cognitive impairments in our study could represent an overestimation. One way to address this limitation is by extending our preliminary study to a greater number of older subjects in other clinics and then to compare those subjects to additional subjects recruited from the community. Despite these limitations, strengths of our study included its triethnic sample, in-depth visual examinations by consultant ophthalmologist and the benefits to the study participants in terms of early referral of identified medical problems to appropriate professionals.

In conclusion, the present findings showed that 65% of subjects aged ≥55 years attending the eye clinic screened positive for cognitive impairments on the SLUMS measure. African-American and Hispanic adults (nonwhites) and patients living with diabetes were significantly more likely to have cognitive impairment compared to white adults and nondiabetics, independent of age, years of education and systolic blood pressure. These findings suggest that studies on reduction of cognitive disablement in older adults need to consider the interethnic variations in prevalence of cognitive impairments and the potential role of diabetes and visual disorders in this disablement process. These findings also suggest that screening for cognitive impairment among older adults in outpatient clinics may be key towards early identification and treatment of acute and chronic diseases (including visual disorders) contributing to poor cognition, in addition to potential to improve overall patient care and adherence to needed therapy. An important area for future investigation is the relationship between use of cognition-enhancing therapy among those with mild cognitive impairments and health outcomes in different ethnic groups.

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