Racial Variations in Causes of Vision Loss in Nursing Homes

The Salisbury Eye Evaluation in Nursing Home Groups (SEEING) Study

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Objective: To determine the prevalence and causes of low vision in a large sample of nursing home residents.

Methods: Twenty-eight nursing homes on the Eastern Shore of Maryland and Delaware were enrolled in a clinical trial to assess the impact of vision restoration/rehabilitation on nursing home residents. Visual acuity was measured using both recognition charts and preferential looking techniques. An ophthalmologist examined all residents with visual acuity worse than 20/40 in the better-seeing eye and determined the primary cause for decreased vision. Results are reported for the better-seeing eye.

Results: Of 2544 eligible residents, 1591 (63%) participated, but 286 residents were unable to respond to visual acuity testing. Of the remaining 1307 residents, 496 (37%) had best-corrected visual acuity worse than 20/40 in the better-seeing eye. Causes were ascribed for 412 subjects. Rates of low vision were similar between African American subjects and white subjects (39% and 38%, respectively; age-adjusted \( P = .18 \)). Cataract was the leading cause of low vision, responsible for 37% of low vision among white subjects and 34% of low vision among African American subjects. Macular degeneration was responsible for 29% of low vision among white subjects but only 7% among African American subjects. Glaucoma caused low vision in 4% of white subjects and 10% of African American subjects. Refractive error was not a frequent cause of low vision in nursing home residents.

Conclusions: Low vision is highly prevalent among nursing home residents, with 37% having visual acuity worse than 20/40 in the better-seeing eye. Differences in causes of low vision between African American subjects and white subjects were noted, with African American subjects more likely to have vision loss on the basis of cataract, a readily treated condition. Appropriate interventions for nursing home residents, who face significant obstacles in accessing eye care services, have the potential to improve the quality of life of this at-risk older population.

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RATES OF BLINDNESS AND VISUAL IMPAIRMENT INCREASE WITH AGE, AS DEMONSTRATED IN SEVERAL POPULATION-BASED STUDIES OF COMMUNITY-DWELLING OLDER PERSONS. \(^1\) \(^4\) Studies of visual impairment among nursing home residents indicate that rates are likely even higher for them, even when matching for age. \(^1\) \(^6\) \(^12\) One possible explanation for this disparity is the negative impact of vision loss on independent function, resulting in more visually impaired individuals being admitted to nursing homes. Findings from 2 studies support this hypothesis (S.K.W., oral communication, May 2003). \(^4\) An alternative explanation is that residents of nursing homes are less likely to obtain vision-restoring services than community-dwelling individuals, resulting in a higher prevalence of untreated eye disease. We recently reported an association between visual impairment and length of stay (LOS) in the nursing home, further supporting this hypothesis. \(^13\)

Given the high prevalence of visual impairment among nursing home residents, we have undertaken a randomized clinical trial of aggressive vision restoration vs usual care to determine whether or not such programs improve the quality of life and function of nursing home residents. \(^13\) We present the causes of vision loss among this study population.

From the Dana Center for Preventive Ophthalmology (Drs Friedman and West and Mss Munoz, Broman, McGill, and Gilbert), Lions Vision Research and Rehabilitation Center (Dr Massof and Mr Deremeik), Wilmer Eye Institute, and Johns Hopkins Bloomberg School of Public Health (Drs Frick and German), Johns Hopkins Medical Institutions, Baltimore, Md.

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METHODS

STUDY POPULATION

A detailed description of the study has been published. \(^13\) In brief, 28 nursing homes on the...
Eastern Shore of Maryland and Delaware, representing all but 2 of the nursing homes on the Eastern Shore within a 2-hour drive of Salisbury, Md, at the time of study design, were enrolled in the study. Two additional nursing homes refused.

**INCLUSION AND EXCLUSION CRITERIA**

To be enrolled in this clinical trial, residents had to be 65 years or older and had to reside in the nursing home on a permanent basis (patients to be discharged within 30 days were therefore excluded). Because we were monitoring change during the course of 1 year, we also excluded those who were known to be at risk for imminent death. Those patients who were extremely mentally compromised were also excluded at the outset because vision testing was not possible. These residents had to be unresponsive to all stimuli, including verbal and motion, on 2 separate occasions to be excluded on this basis. We also excluded those who could not provide informed consent and for whom no legal guardian could be found and 2 patients with whom language barriers were large enough to preclude accurate assessment of the resident.

**VISUAL ACUITY SCREENING**

Habitual and best-corrected acuity was attempted on all eligible residents; we used standard letter/symbol charts and grating acuity charts, as described below. The habitual, distance, refractive correction was measured with a lensometer (Nikon model OL33; Nikon Instruments, Torrence, Calif) on the participant’s usual distance glasses (reading-only glasses were not used). A portable handheld auto refractor (Retinomax model 30965; Nikon Instruments) was used to obtain a starting correction if the patient’s usual glasses were not available.

Initial visual acuity, using the patient’s usual glasses, was tested first, using Early Treatment Diabetic Retinopathy Study (ETDRS) charts or Lea symbols to determine if refraction was necessary. Each eye was tested separately. The maximum number of letters read correctly was scored, and acuity in logMAR units was reported. If the visual acuity was 20/40 or better in either eye, no further testing using a different correction was done.

If habitual visual acuity was worse than 20/40 in the better-seeing eye, a subjective refraction was attempted with a trial lens set. The starting prescription was based on the lensometer results or, if the participant did not have glasses, on results from the autorefractor. If necessary, a streak retinoscopic evaluation of the likely refraction was also obtained. All subjects with visual acuity worse than 20/40 in the better-seeing eye underwent an examination by an ophthalmologist. Vision was also tested using a grating acuity chart (Teller acuity full system; Visitech Consultants, Dayton, Ohio), following the procedures outlined by Marx et al, for noncommunicative older persons. Procedures are outlined in detail in a previous publication and summarized here. Lighting on the screen was standardized within 400 to 500 lux, and the distance from the eye to the screen was set at 84 cm. Residents were requested to look at a large rectangular card, which had 2 halves; one side was blank and the other had stripes, or line gratings, of decreasing size. The residents were asked to look at the stripes on the card. When the technician was satisfied that the patient saw the correct side, a card with a set of smaller gratings was presented. The subject had to correctly identify the side with the gratings on 2 of 3 presentations to have “seen” the card. The technician started with 2.3 cycles/cm until the last card with which the subject saw 2 of 3 presentations.

Different technicians assessed the visual acuity using the standard ETDRS chart and the Teller Acuity cards, and they were unaware of the visual acuity obtained with the other test. Both initial and (if visual acuity was worse than 20/40 in both eyes) best-corrected grating acuity were obtained. The refraction used was the same as that obtained for standard letter testing. The study protocol stated that at least 2 hours should separate the acuity ascertainment using the 2 tests to avoid tiring the patients, unless the technician felt the patient could proceed in a shorter period of time.

For the purposes of this study, visual impairment was defined as visual acuity in the better eye worse than 20/40 on ETDRS and grating acuity. In the event that only 1 test could be performed, the results of that test were used to assign patients. If there was disagreement of more than 1 line on the ETDRS between the 2 tests, or if 1 test indicated the patient saw 20/40 or better and the other indicated visual acuity worse than 20/40, a retest was done and the results were used to assign patients. We have shown that agreement between the 2 measures of visual acuity is good with evidence that acuity tested with Teller cards is better when cognition is poor. When a discrepancy persisted, we relied on the examining physician to determine if the clinical findings were consistent with visual acuity worse than 20/40 in both eyes.

Blindness was defined using both the United States legal definition of visual acuity less than or equal to 20/200 in the better-seeing eye and the World Health Organization definition of visual acuity less than 20/400 in the better-seeing eye. A board-certified ophthalmologist (D.S.F.) determined the primary cause of blindness at the time of the definitive examination. When more than 1 cause of vision loss was present, causes of permanent vision loss (glaucoma, age-related macular degeneration [AMD], and so on) were assigned as the primary cause if other causes (refraction and cataract) were also present.

**OTHER DATA**

Residents were given the Mini-Mental State Examination to determine the level of cognitive impairment. For this test, scores range from 0 to 30, with higher scores indicating higher cognitive function. Scores from 18 to 24 are consistent with moderate cognitive impairment, and scores below 10 indicate severe cognitive loss. These data were collected at the time of visual acuity determination. If a resident could not complete parts of the Mini-Mental State Examination for physical reasons, the questions were not included in the calculation of the score, which was calculated on the basis of the remaining questions and rescaled to the reference total of 30 (for example, those items were skipped for residents who could not hold a pencil and write or draw).

Age, sex, race, educational status, and length of time in the nursing home were ascertained from the medical record.

**STATISTICS**

For this article, we present the cause-specific rate of visual impairment stratified by age, group, and race. We compare the causes of visual impairment by age, race, sex, and LOS. Logistic models accounting for correlation within nursing homes were used to compare cause-specific rates. All procedures and protocols for this study were reviewed and approved by the Johns Hopkins institutional review board, Baltimore, Md, in accordance with the Declaration of Helsinki.

A total of 3201 patients were identified in the census of the 28 nursing homes. Of these patients, 657 were not eligible, primarily because they were too young (37%)
or were short-stay residents (35%). However, 19% were too severely cognitively impaired to be in the study; this was determined at the outset. Of the 1307 participants whose visual acuity could be tested, 496 (38%) were initially found to have best-corrected visual acuity worse than 20/40 in the better-seeing eye (Figure 1). Rates were similar comparing African American subjects with white subjects (39% and 38%, respectively; age-adjusted \( P = .18 \)).

Fifty-three subjects did not receive an eye examination (40 refused, and 13 had died or were hospitalized at the time of examination), and an additional 31 were found to have no ocular cause of decreased vision (vision loss was most probably due to poor cognition and inability to fully cooperate with testing, although central causes of decreased vision could not be ruled out). Assuming that these individuals in fact had normal vision and that a similar proportion of those not receiving an eye examination also had normal vision decreases the overall prevalence of low vision to 36%.

**Table 1** presents the cause-specific prevalence of visual impairment and blindness by race. Cataract was the leading cause of low vision for both races but was a more common cause of vision loss among African American subjects (24.2% of African American subjects vs 11.8% of white subjects; age-adjusted \( P = .001 \)). Macular degeneration was uncommon among African American subjects (2.3%), whereas it was the second leading cause of low vision among white subjects (10.3%; age-adjusted \( P = .001 \)). Glaucoma was a more common cause of low vision among African American subjects than among white subjects (3.3% and 1.5%, respectively; age- and cluster-adjusted \( P = .08 \)). We did not attempt to confirm glaucoma with visual fields, but glaucoma was assigned as a primary cause of low vision only in cases of severe optic nerve head excavation. The prevalence of refractive error resulting in low vision was 3% among African American subjects and 3.5% among white subjects.

**Table 2** presents the cause-specific prevalence of visual impairment by age groups (<85 vs ≥85 years). Cataract was the leading cause of low vision in all age ranges and increased with age, whereas AMD was less common in the youngest ages but explained the majority of cases of low vision among the oldest white residents (3.2% vs 14.1%, with 22% of all white subjects in this age category having AMD as a cause of low vision). Similarly, glaucoma prevalence as a cause of low vision increased dramatically with age (1% vs 2.9%). No association was seen between sex and specific causes of low vision or the prevalence of low vision (age-adjusted \( P = .8 \)).

Length of stay in the nursing home was associated with the presence of low vision. On average, individuals with low vision were resident for 37.3 months, whereas those without visual impairment were resident for 24.4 months. The association with LOS remained positive after adjusting for age, sex, race, and correlation within homes (\( P < .001 \)). However, no specific cause of low vision was associated with LOS. Furthermore, no significant difference in LOS was seen when comparing conditions for which vision can be restored (cataract and refractive error) with those for which no vision-restorative treatment is available (AMD, glaucoma, and others).

Bilateral blindness using a cutoff of visual acuity (20/200 in the better-seeing eye) occurred in 7.4% of those 85 years or older vs 3.1% in the younger subjects (\( P = .002 \)). African American subjects were more likely to be bilaterally blind than white subjects (6.5% vs 4.8%; age-adjusted \( P = .19 \)), but this was not statistically significant. Age-related macular degeneration accounted for 23 of 67 cases of bilateral blindness, only 1 of which occurred in an African American individual. Glioma accounted for 11 cases, and cataract accounted for an additional 10.

Habitual visual acuity less than 20/40 is common in nursing homes, with almost 40% of those studied in 28 nursing homes on the Eastern Shore of Maryland and Delaware meeting this standard of visual impairment. Contrary to findings in community-based studies, refractive error among this population is responsible for a small proportion (<10%) of visual impairment. More than 5% of nursing home residents with testable vision were bilaterally blind. Our results are similar to those of previous research documenting higher rates of visual impairment and blindness among nursing home residents than among community-dwelling persons of similar age.\(^6,9,10\)

African American subjects in the present study had a slightly higher prevalence of blindness, but this was not statistically significant. This finding differs from a previous study on racial differences in visual impairment among nursing home residents in which African American persons were found to have substantially more blindness (21% vs 14% prevalence among white persons; \( P < .01 \)).\(^5\) Explanations for the difference in findings include secular trends (the previous study was conducted more than a decade ago), differences in the populations studied, and bias introduced by study methodology. It is possible that access to or use of cataract surgery services for African American persons has increased during the past decade, which would have resulted in a reduction in cataract blindness among African American persons as compared with past studies. An alternative explanation is that by excluding those in whom vision could not be tested, the present study underestimated the prevalence of blindness among African American subjects. It is possible that some with testable vision who were blind may have been misclassified, which could have resulted...
in lower estimates of blindness prevalence in white subjects, African American subjects, or both. If we assume that all untestable individuals (who were excluded from the present study) actually had low vision, then the overall prevalence would have been 48.9% for white subjects and 49.5% for African American subjects (P < .001).

We therefore believe it is highly unlikely that our exclusion criteria caused the rates to be artificially similar between African American and white subjects. A final possibility is that in the rural setting of the Eastern Shore, admission to nursing homes for vision loss may be less likely among African American persons than among white persons, leading to a lower overall prevalence of blindness among African American nursing home residents than was seen in an inner-city population. Whereas our experience observing community-dwelling individuals on

Table 1. Cause-Specific Rate of Visual Impairment and Blindness by Race*

<table>
<thead>
<tr>
<th>Primary Cause</th>
<th>African American Subjects (n = 304)</th>
<th>White Subjects (n = 997)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visually Impaired, No. (%)</td>
<td>Blind US†, No. (%)</td>
</tr>
<tr>
<td>Refraction</td>
<td>9 (3.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cataract</td>
<td>50 (16.4)</td>
<td>4 (1.3)</td>
</tr>
<tr>
<td>Cataract/refraction§</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Posterior chamber opacification</td>
<td>2 (0.7)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Age-related macular degeneration</td>
<td>6 (2.0)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>4 (1.3)</td>
<td>6 (2.0)</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Retinal vein occlusion/macular pathology</td>
<td>3 (1.0)</td>
<td>2 (0.7)</td>
</tr>
<tr>
<td>Optic neuropathy</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Corneal opacity</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Amblyopia</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Complication after surgery</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other¶</td>
<td>13 (4.3)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>No access or refused examination</td>
<td>7 (2.3)</td>
<td>5 (1.6)</td>
</tr>
<tr>
<td>Total</td>
<td>98 (32.2)</td>
<td>19 (6.5)</td>
</tr>
</tbody>
</table>

*Six participants of other races were excluded from this table; 2 were visually impaired, and none were blind.
†United States legal definition is visual acuity < 20/200.
‡World Health Organization definition is visual acuity < 20/400.
§It was unclear which was the major contributor to vision loss.
¶This includes branch retinal vein occlusion, macular holes, retinal dystrophy, and retinitis pigmentosa.
||This includes unknown causes and dementia.

Table 2. Cause-Specific Rate of Visual Impairment and Blindness by Age

<table>
<thead>
<tr>
<th>Primary Cause</th>
<th>65-84 y of Age (n = 682)</th>
<th>85 y of Age or Older (n = 625)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visually Impaired, No. (%)</td>
<td>Blind US†, No. (%)</td>
</tr>
<tr>
<td>Refraction</td>
<td>28 (4.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cataract</td>
<td>68 (10.0)</td>
<td>2 (0.3)</td>
</tr>
<tr>
<td>Cataract/refraction§</td>
<td>3 (0.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Posterior chamber opacification</td>
<td>3 (0.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Age-related macular degeneration</td>
<td>18 (2.6)</td>
<td>4 (0.6)</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>2 (0.3)</td>
<td>5 (0.7)</td>
</tr>
<tr>
<td>Diabetic retinopathy</td>
<td>9 (1.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Retinal vein occlusion/macular pathology§</td>
<td>5 (0.7)</td>
<td>2 (0.3)</td>
</tr>
<tr>
<td>Optic neuropathy</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Corneal opacity</td>
<td>1 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Amblyopia</td>
<td>1 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Complication after surgery</td>
<td>1 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other¶</td>
<td>21 (3.1)</td>
<td>2 (0.3)</td>
</tr>
<tr>
<td>No access or refused examination</td>
<td>15 (2.2)</td>
<td>6 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>175 (25.7)</td>
<td>21 (3.1)</td>
</tr>
</tbody>
</table>

*United States legal definition is visual acuity < 20/200.
†World Health Organization definition is visual acuity < 20/400.
‡It was unclear which was the major contributor to vision loss.
§This includes branch retinal vein occlusion, macular holes, retinal dystrophy, and retinitis pigmentosa.
||This includes unknown causes and dementia.
the Eastern Shore found vision to be a predictor of nursing home admission, we did not find differential admissions to nursing homes among the visually impaired by race.

The higher prevalence of cataract among African American persons can be attributed to any of several factors. Previous research, including our report on residents of the Eastern Shore, indicates that African American persons are less likely to visit an ophthalmologist, and they obtain cataract surgery at lower rates than white persons. Therefore, African American persons with visual impairment from cataract may be more likely to enter a nursing home than white persons. Alternatively, African American persons may be less likely to obtain cataract surgery services once residing in the nursing home. This is highly unlikely to lead to the disparity we observed because we found that even when residents were screened for cataract and referred for surgery, fewer than 5% underwent cataract surgery during a 1-year period (S.K.W., oral communication, May 2003).

Macular degeneration was the leading cause of blindness among white subjects and the second leading cause of visual impairment, whereas it explained only 1 case of bilateral blindness among African American subjects and 6 cases of visual impairment. This is expected, with previous research indicating that AMD is less common among African American persons than white persons. Glaucoma was a relatively uncommon cause of low vision, but this is not surprising given that glaucoma rarely leads to reduced central visual acuity until late in the disease. Glaucoma blindness was about 4 times as common in African American subjects as in white subjects, a finding that is consistent with previous publications.

Length of stay was associated with low vision but not with specific conditions. This increasing visual impairment with increasing LOS remained when we adjusted for age, race, sex, and Mini-Mental State Examination score. This finding raises the concern that nursing home residents are not screened for vision loss at admission and are not adequately observed for progression of ocular disease during their residence in the home. Incident visual impairment and worsening of preexisting conditions are likely not being treated, resulting in higher rates of visual impairment with greater LOS. We did not find a significant association between treatable causes of visual impairment and LOS, however, this may be owing to the relatively small sample available for this comparison.

Our findings of high rates of visual impairment and increased prevalence of visual impairment with greater LOS point to the need for greater emphasis on vision in nursing homes. Vision screening on admission and periodic examinations could be implemented to help identify individuals with eye diseases requiring treatment as well as those with uncorrected refractive errors.

A substantial proportion of the residents whom we were planning to screen refused to participate (32%). Some of these individuals would have been untestable and therefore ineligible for this study. The nursing staff estimated that 12% would have been ineligible because of severe cognitive loss (as defined by no response to external stimuli on 2 or more occasions). Had we excluded them as ineligible at the outset, our response rate would have been 71%. There were no age or sex differences in participation for the study; however, African American persons were more likely to participate than white persons. Our finding of no difference in race-specific causes of visual impairment and blindness between African American subjects and white subjects could have been influenced by nonparticipation. If African American persons with vision loss were less likely to participate than white persons with vision loss, our estimates of visual impairment rates may have been lower for African American subjects than white subjects on this basis, thereby making rates appear equal. We do not believe that this is the case, however. In a previous publication, we documented that community-dwelling nonparticipants reported similar rates of vision impairment to those of participants in the Salisbury Eye Evaluation project. Furthermore, family members made the vast majority of refusals. We doubt that refusals by family members were made on the basis of visual function.

Although the study enrolled nearly all nursing homes on the Eastern Shore of Maryland and Delaware and therefore is likely representative of visual impairment in this region, other parts of the United States may have different nursing home populations. Another limitation is that we were unable to test vision in a substantial proportion of nursing home residents. This contrasts with the Baltimore Nursing Home Study, in which higher testability was noted. This difference can be attributed to differences in methodology between the studies or possibly to an increased prevalence of severe cognitive impairment among nursing home residents during the last decade. It is possible that knowledge of the race of the participant influenced the ophthalmologist in selecting diseases as causes of blindness. Given the nursing home setting and the limitations of our ability to formally document AMD and glaucoma with photographs, all diagnoses were based on the clinical examination and therefore could not be independently validated. Nevertheless, the findings are similar to population-based studies that have used more objective means, masked to racial characteristics, to determine disease presence. Finally, we may have incorrectly attributed vision loss to cognitive difficulties in 31 subjects because no clearly identifiable cause of vision loss was present, and the subjects were unable to describe the quality of their vision. Subtle macular lesions or occipital causes of vision loss cannot be ruled out completely in these cases.

In summary, low vision and blindness are highly prevalent among residents of nursing homes, with more than one third affected. African American subjects have a greater burden of unoperated cataract and glaucoma, while white subjects have much higher prevalence rates of AMD. Cataract remains the most common cause of low vision for both racial groups, pointing to a potential benefit of intervention programs aimed at providing surgical services to this population.

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REFERENCES