Published in final edited form as:

J Am Geriatr Soc. 2009 February ; 57(2): 202–208. doi:10.1111/j.1532-5415.2008.02099.x.

Vision-Enhancing Interventions in Nursing Home Residents and Their Short-Term Impact on Physical and Cognitive Function

Amanda F. Elliott, PhD, MSN^{*}, Gerald McGwin Jr., MS, PhD^{‡,*,†}, and Cynthia Owsley, PhD, MSPH^{*}

^{*} Department of Ophthalmology, University of Alabama at Birmingham, Birmingham, AL, USA

[†] Department of Epidemiology, University of Alabama at Birmingham, Birmingham, AL, USA

[‡] Department of Surgery, University of Alabama at Birmingham, Birmingham, AL, USA

Abstract

OBJECTIVE—To evaluate the effect of vision-enhancing interventions (i.e., cataract surgery or refractive error correction) on physical function and cognitive status in nursing home residents.

Corresponding Author: Amanda F. Elliott, Address: Department of Ophthalmology, School of Medicine, University of Alabama at Birmingham, 700 S. 18th Street, Suite 609, Birmingham, AL 35294-0009, USA, Phone: (205) 325-8631 Fax (205) 325-8692, E-mail: elliotta@uab.edu. Alternate Corresponding Author: Cynthia Owsley, E-mail: owsley@uab.edu.

Conflict of Interest Checklist: Below is a table for all authors to complete and attach to their papers during submission.

Elements of Financial/Personal Conflicts	* Author 1 Amanda F. Elliott		Author 2 Gerald McGwin		Author 3 Cynthia Owsley		Etc.	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		
Grants/Funds		X		X		X		
Honoraria		X		X		X		
Speaker Forum		X		X		X		
Consultant		X		X		X		
Stocks		X		X		X		
Royalties		X		X		X		
Expert Testimony		X		X		X		
Board Member		X		X		X		
Patents		X		X		X		
Personal Relationship		X		X		X		

* Authors can be listed by abbreviations of their names;

Financial Disclosure(s):

Amanda F. Elliott: None _____

Cynthia Owsley: None _____

Gerald McGwin Jr.: None _____

Author Contributions: Indicate authors' role in study concept and design, acquisition of subjects and/or data, analysis and interpretation of data, and preparation of manuscript.

Amanda F. Elliott: __ study concept and design; interpretation of data, preparation of manuscript __

Cynthia Owsley: __ study concept and design; interpretation of data, preparation of manuscript __

Gerald McGwin Jr.: __ study concept and design, data analysis and interpretation, preparation of manuscript _____

DESIGN—Longitudinal cohort study.

SETTING—Seventeen nursing homes in Birmingham, AL.

PARTICIPANTS—A total of 187 English-speaking older adults (>55 years of age).

INTERVENTION—Participants took part in one of two vision-enhancing interventions: cataract surgery or refractive error correction. Each group was compared against a control group (persons eligible for but who declined cataract surgery, or who received delayed correction of refractive error).

MEASUREMENTS—Physical function (i.e., ability to perform activities of daily living and mobility) was assessed with a series of self-report and certified nursing assistant ratings at baseline and at 2 months for the refractive error correction group, and at 4 months for the cataract surgery group. The Mini Mental State Exam was also administered.

RESULTS—No significant differences existed within or between groups from baseline to follow-up on any of the measures of physical function. Mental status scores significantly declined from baseline to follow-up for both the immediate ($p=0.05$) and delayed ($p<0.02$) refractive error correction groups and for the cataract surgery control group ($p=0.05$).

CONCLUSION—Vision-enhancing interventions did not lead to short-term improvements in physical functioning or cognitive status in this sample of elderly nursing home residents.

Keywords

Vision Intervention; Physical Functioning; Cognitive Impairment; Nursing Homes

INTRODUCTION

Limitations in physical function and mobility are greater among older adults with visual and/or cognitive impairment,^{1–5} and difficulty with the performance of basic physical tasks is a strong predictor of nursing home placement.⁶ Nursing home residents are more likely than community-dwelling older adults to have visual impairments, cognitive impairments, and physical function limitations.^{7–10} Nursing home residents with these impairments are more dependent upon nursing home staff for care, and subsequently require greater amounts of staff time for their care than residents without these impairments.^{11–13}

High rates of visual impairment in the nursing home have been attributed to inadequate access to eye care, a higher risk of nursing home placement for those who are visually impaired, individuals with cognitive impairment not complaining about visual dysfunction leading to under-diagnosis, and the belief by family and health care professionals that persons with cognitive impairment will not benefit from improved vision.^{7, 14} Visual and cognitive impairments increase the risk of impaired physical function and mobility, falls, hip fracture, impairments in mood and social relationships, decreased social engagement and time spent in leisure activities, health disparities, mortality, disruptive behaviors, and increased admission to and length of stay in the nursing home.^{2, 5, 6, 15–21}

Longitudinal studies have shown that persons with vision or cognitive impairment have higher rates of incident ADL/IADL impairment and/or accelerated decline in these abilities at follow-up.^{16, 22–26} Improvements in physical function may be achieved by alleviating these impairments. Currently, however, no proven treatments are available for reversing cognitive impairment. There is some evidence that cognitive status may improve with improvements in vision.^{27, 28} However, few studies have explored the effects on physical function, mobility, and cognition after an intervention to improve vision. Existing studies on community-dwelling older adults undergoing cataract surgery have found that reduction in visual impairment is significantly related to improved physical function, mobility, and cognition.^{28–31}

We are aware of only one other study to date that has explored the longitudinal effects of an intervention to enhance visual acuity on the physical function and mobility of older nursing home residents. By providing corrective lenses and Croakies to residents and providing staff training to recognize vision problems, Teresi and colleagues³² significantly decreased declines in observed tasks of physical function and mobility at follow-up (6–8 months later). This study did not investigate changes in cognition over the course of the study. The aim of the present study is to evaluate the impact of vision enhancing interventions (i.e., cataract surgery or refractive error correction) in nursing home residents on their physical function, mobility, and cognitive status two to four months after the intervention.

METHODS

Participants

This study was approved by the Institutional Review Board at the University of Alabama at Birmingham and follows the tenets of the Declaration of Helsinki. A total of 17 area nursing homes participated in this study. Written informed consent was obtained from all participants and also the resident's sponsor (a family member or state-appointed guardian) after explaining the nature and possible consequences of the study. There were two mutually exclusive arms to this study: participants receiving refractive error correction vs. those receiving delayed refractive error correction and participants receiving cataract surgery vs. controls. Eligible persons were: 1) identified by the unit charge nurse being able to answer simple questions about vision and daily activities; 2) ≥ 55 years old; 3) able to speak English; 4) able to obtain a Mini-Mental State Exam (MMSE)³³ score ≥ 13 , since comprehension of simple requests and questionnaire items was critical to valid outcomes measurement. Additionally, for the refractive error correction arm, immediate treatment and delayed treatment group participants had to have uncorrected refractive error in one or both eyes for near or far test distances (that would be correctable to at least one line on a distance acuity chart for at least one eye) as determined in an eye examination within the past month performed by an optometrist. To be eligible for the cataract surgery treatment and control groups, participants had to have a cataract in one or both eyes that caused functional problems and have the optometrist who worked in the nursing home and the referral ophthalmologist judge that cataract surgery was an appropriate treatment option for one or both eyes given the person's ocular and overall health status.

Detailed descriptions of protocols for both refractive error correction participants (immediate and delayed correction groups)³⁴ and cataract surgery participants (treatment and control groups)³⁵ can be found elsewhere. Briefly, refractive error measurement and refraction for best distance and near correction were carried out by an optometrist using subjective refraction with trial lenses and frames, portable autorefractor, and/or retinoscopy, with most enrollees receiving a combination of approaches. For participants in both arms of the study, distance acuity was assessed with the ETDRS chart using its standard protocol and expressed as logMAR.³⁶ Near visual acuity was assessed with the Lighthouse Near Visual Acuity Test (Modified ETDRS) administered at 40 cm.

The study provided participants in the refractive error correction immediate treatment group ($N=78$) with new bifocal spectacles with their best refractive correction about one week after enrollment. Follow-up assessment was completed at two months after enrollment. Trained research personnel emphasized the importance of the resident's wearing the spectacles and how to care for them, to both the resident and the resident's certified nursing assistant, and compliance was monitored. Visual acuity for distance in these participants improved on average from approximately 20/66 to 20/58 in the right eye and 20/63 to 20/55 in the left eye ($P=0.02$ and 0.01 respectively). Near vision improved on average from approximately 20/96 to 20/80 in the right eye and 20/89 to 20/76 in the left eye ($P=0.01$ and 0.02 respectively).³⁴

Those residents assigned to the delayed treatment group (N= 64) received spectacles after the two-month follow-up.

With respect to the cataract surgery intervention, those residents with clinically significant cataract who were deemed candidates for cataract surgery were offered cataract surgery and intraocular lens insertion as an option for reversing vision impairment. Of these residents (and sponsors) some elected to have surgery on one or both eyes, and some declined, thus forming an intervention (N= 30) and a no-intervention control group (N=15). Surgery was covered by the participants' health insurance, as were new spectacle corrections following surgery, occurring typically 4–6 weeks following cataract surgery. For this reason, follow-up in the cataract surgery treatment and control groups occurred 4 months following surgery when the treatment group participants had been wearing his/her new spectacles for 2–3 months. If both eyes were undergoing surgery, follow-up assessment was not performed until both surgeries were completed. Distance acuity improved on average from approximately 20/100 to 20/35 and near acuity improved approximately 20/150 to 20/50.³⁵

Measures

All of the following assessments were carried out at baseline and follow-up. The ability to perform basic activities of daily living was assessed by the Functional Independence Measure (FIM). The FIM measured participants' disability in 13 common daily activities related to eating, bathing, grooming, toileting, and mobility. Scores ranged from 1 = Total assistance to 7 = Complete independence. This measure was completed independently by both the participant as well as the Certified Nursing Assistant (CNA) primarily in charge of the resident's daily care. The FIM has high internal consistency ($\alpha = 0.93$).³⁷ Activity performance and fear of falling was assessed by the Survey of Activities and Fear of Falling (SAFE) measure. The SAFE assessed 1) whether the participant performed specific activities (e.g., Take a tub bath or shower, No/Yes); 2) their fear of falling while performing each activity (e.g., 0 = Very worried to 3 = Not at all worried); and 3) their general activity restriction (e.g., Compared to 5 years ago would you say that you take a tub bath or shower: 0 = More than you used to 2) Less than you used to). This measure has been found to have high internal consistency ($\alpha = 0.91$).³⁸ The extent of mobility was examined with the Nursing Home-Life Space Diameter (NHLSD). The NHLSD assessed participants' extent of mobility in their room, on the nursing unit, around the facility, and outside the facility within the last two weeks. Responses were scored from 0 = Never to 5 => 3 times per day. This measure has been found to have good inter-rater ($r = 0.95$) and intra-rater ($r = 0.92$) reliability.³⁹ Both the participants and CNAs completed the NHLSD separately. Additionally, the Mini Mental State Exam (MMSE)³³ was administered at baseline and follow-up to assess for change in cognitive status. On average, visual impairments in the present sample were not so severe as to require any modifications to the presentation or scoring of this measure.

Statistical Analysis

Pre- and post-intervention measures of physical function, mobility, and cognitive status were compared within the treatment groups using paired t-tests. With respect to between group differences, baseline measures were compared using t-tests and for follow-up measures, analysis of variance (ANOVA) was used. The dependent variable for the ANOVA models was the follow-up measurement that was adjusted for the associated baseline measurement. P-values of ≤ 0.05 (two-sided) were considered statistically significant.

RESULTS

Demographic data has been published previously for participants in the refractive error immediate and delayed correction groups³⁴ as well as for participants receiving cataract surgery

and controls.³⁵ No significant differences existed at baseline between each treatment group and their respective control group in regard to sex, education, number of medical conditions, eye conditions, or length of stay in the nursing home (Tables 1 and 2). Significant group differences did exist at baseline for age between cataract surgery patients and controls, in that controls were significantly older than persons electing to have cataract surgery (Table 2).

The refractive error correction groups did not differ significantly at baseline on any of the measures of physical function (i.e., FIM, SAFE, NHLSD) (p range = 0.08 to 0.66), nor did they differ in MMSE score ($p = 0.06$). There were no significant within-group differences from baseline to follow-up for any measure of physical function for either the refractive error immediate or delayed correction groups (Table 3). The MMSE score showed significant declines from baseline to follow-up in both the immediate ($p = 0.05$) and delayed ($p < 0.02$) refractive error correction groups. There were no between-group differences from baseline to follow-up for these groups on any of the measures of physical function or MMSE score (Table 3).

For the cataract surgery and control participants, no significant baseline differences between groups were found for any measure of physical function (p range = 0.08 to 0.82), or MMSE score ($p = 0.32$). No significant within-group differences existed from baseline to follow-up for either the cataract surgery or control groups on the measures of physical function. The MMSE showed significant cognitive declines in the control group ($p = 0.05$) but not in the cataract surgery group ($p = 0.08$), although it trended in that direction. There were no baseline to follow-up between-group differences for the measures of physical function or MMSE score (Table 4).

DISCUSSION

Previous research has confirmed the benefits of vision enhancement interventions such as refractive error correction and cataract surgery for improving vision and quality of life in older adults,^{15, 29, 30} and recent work demonstrates that these benefits extend to the nursing home population.^{32, 34, 35} For our sample of older nursing home residents, we have previously shown that refractive error correction and cataract surgery not only improved vision but improved vision-targeted health-related quality of life (e.g., general vision, reading, social interaction).^{34, 35} The present study sought to examine whether these interventions would also have positive impacts on physical and cognitive function for nursing home residents, at least in terms of short-term benefits within two to four months.

Results were that participants receiving refractive error correction did not improve significantly in terms of their physical function ability at the two-month follow-up compared to their baseline performance levels. They also showed no significant differences with the delayed treatment group at follow-up indicating that the intervention also did not decrease the rate of decline in physical function as has been found in a previous study whose follow-up was later in time (6–8 months following intervention) as compared to the present study.³² Likewise, participants undergoing cataract surgery did not experience significant functional changes at follow-up as compared with their baseline scores or with the no-surgery control group. It is interesting that even though cataract surgery brought dramatic improvements in vision in our sample, these improvements did not translate into improved physical function or even slowed declines in physical function four months following intervention. These results are similar to those of Scott and colleagues⁴⁰ who found no change in physical functioning of community-dwelling older adults 3 months after receiving low vision rehabilitation services. Additionally, others have found transient significant improvements in physical functioning in a community-dwelling sample at 3 and 4 months after cataract surgery. However, in each of these studies, improvements were not maintained 1-year post surgery.^{29, 31}

The lack of change in physical function in this study despite the effectiveness of the interventions to improve vision may be due to several factors. First, it is possible that the relatively short follow-up period (i.e., 2 months for the refractive error correction group and 4 months for the cataract surgery group), while sufficient to observe significant changes in visual function ability and improvements in vision-targeted health-related quality of life in this sample,^{34, 35} is not long enough for improved vision to affect physical function. However, in community-dwelling older adults, short-term benefits in physical function have been observed within 3 to 6 months after intervention.^{28–31, 40} It is important to note that these studies used measures of physical functioning that were either vision-specific or incorporated IADLs in addition to basic ADLs. IADL performance has been shown to be more related to vision than have basic ADLs.^{16, 41} In the present study we primarily examined basic ADLs, which may also explain why we saw no effect on our physical function measures from the intervention, even at the level of analyzing individual ADL items versus the total measure score. Additionally, a longer follow-up period in the present study may have still missed a positive impact on physical function, given the strong evidence that physical function decreases over time in nursing home residents.^{11, 42, 43}

It is also possible that the magnitude of visual improvement obtained in this study was not dramatic enough to produce change in physical function in this population because their physical functional problems were already quite serious and difficult to reverse. For example, the mean baseline score on the FIM (rated by CNAs) ranged from 47.7 to 53.5 (maximum score = 91, with higher scores representing greater independence), showing that this group was on average at least minimally to moderately dependent, meaning they needed aid to complete 25–50% of a functional task.⁴⁴ Because those with any degree of physical dependency require greater staff time and resources for their care, we compared the proportion of our sample with any dependency to those who were completely independent. This was accomplished by transforming FIM scores into Katz's categorical dependent versus independent ADL scale.⁴⁵ Using this method, we found that at baseline over 55% of the residents were rated by CNAs as having dependency in at least one ADL, and 63% of this group (or 34% of the total sample) had reported dependency in more than one ADL. For example, with bathing, the most frequently rated area of dependency (>90% of each group), the CNA must at a minimum supervise this activity and at a maximum perform the entire activity for the resident, which would prevent the CNA from caring for other residents during this time.

Over the course of the study, cognitive status significantly decreased in both control groups and also in the refractive error correction group. The significant decline in cognitive status over the relatively short follow-up period in this study is likely related to the fact that in our sample each group had mean MMSE scores below the cutoff indicating dementia and thus, it is not surprising that cognitive status would continue to decline, as this is characteristic of dementia. In order to establish that visual impairments were not falsely suppressing MMSE scores because of participants' problems seeing the materials presented to them, we analyzed the correlation between participants' baseline near and distance visual acuity and performance on the eight MMSE questions requiring image processing.⁴⁶ There was no significant relationship between visual acuity and ability to complete any of these eight questions.

Because of the highly correlated relationship between cognitive status and physical function,^{3, 21, 26, 47, 48} it is possible that our interventions to improve vision were not substantial enough to overcome this relationship. The results of this study do not support the effectiveness of vision improvement interventions for improving cognitive status, although previous research has demonstrated gains in cognitive function at a mean follow-up time of 3.65 weeks after cataract surgery in cognitively impaired older adults.²⁷ Given that significant declines were seen in each of the other 3 groups over this relatively short follow-up period, perhaps the lack of a

significant decrease in cognitive status in our sample undergoing cataract surgery represents the superior ability of dramatic visual improvements in maintaining cognitive function.

This study is the first study to our knowledge to specifically examine the effects of two proven vision improvement interventions on the outcomes of physical function and cognition in older adult nursing home residents. Interventions to improve vision in older adult nursing home residents are successful in increasing visual acuity, visual function (e.g., ability to perform visual ADLs), and vision-targeted quality of life, and in decreasing depressive symptoms.^{34, 35} Here our purpose is to address a secondary outcome -- the extent to which the beneficial effects of these interventions extend to basic physical functioning and cognitive functioning. Our sample size was sufficiently large to address the primary outcomes of interest, namely quality of life and depression; however a larger sample, may be needed to reveal positive effects on physical and cognitive function.

Typically, studies use measures of visual function performance created specifically for use in persons with impaired vision, such as the VF-14, ADVS, NEI-VFQ, or the Melbourne Low Vision ADL Index, which are highly responsive to improvements in vision.^{41, 49} However, the results of this study indicate that general measures of physical functioning (not vision specific measures) and cognitive status did not improve in response to refractive error correction or cataract surgery in this sample of nursing home residents. This is likely due to the multi-factorial process affecting a person's ability to maintain basic ADLs, of which vision is a part, but not all of, the total picture. Recent research indicates that ability to perform IADLs (e.g., preparing meals or self-administering medications) is more related to vision than are ADLs.^{16, 41} Additionally, there is evidence to suggest that measures of visual acuity are poor predictors of overall physical disability, and that visual field characteristics may be more closely related to physical function in nursing home residents, especially for mobility,^{20, 23, 41} an issue for further study. The findings of this study support that comprehensive interventions to improve physical function, mobility, and cognition should be explored. Designs for future interventions should include components to address the rehabilitative and medical issues of participants, as well as targeting general health⁵⁰ and cognitive training programs⁵¹ in combination with vision improvement interventions. Together, these components may produce changes along the continuum of physical function decline, which in turn may produce meaningful changes in nursing home residents' physical function. Because as many as 83% of nursing home residents require assistance with 3 or more basic ADLs and 2/3 require mobility assistance from nursing home staff,⁵² finding successful methods to decrease dependency would have large implications for nursing home staff and resources.

Acknowledgments

This research was supported by the Retirement Research Foundation, the EyeSight Foundation of Alabama, NIH grant R21-EY14071, Research to Prevent Blindness Inc., and the Alfreda J. Schueler Trust.

Sponsor's Role: None

References

1. Salive M, Guralnik J, Glynn R, Christen W, Wallace R, Ostfeld A. Association of visual impairment with mobility and physical function. *Journal of the American Geriatrics Society* 1994;42(3):287–292. [PubMed: 8120313]
2. Crews J, Campbell V. Vision impairment and hearing loss among community-dwelling older americans: Implications for health and functioning. *American Journal of Public Health* 2004;94(5): 823–829. [PubMed: 15117707]

3. Dodge H, Kadowaki T, Hayakawa T, Yamakawa M, Sekikawa A, Ueshima H. Cognitive impairment as a strong predictor of incident disability in specific ADL-IADL tasks among community-dwelling elders: The Azuchi study. *The Gerontologist* 2005;45(2):222–230. [PubMed: 15799987]
4. Gill T, Williams C, Richardson E, Tinetti M. Impairments in physical performance and cognitive status as predisposing factors for functional dependence among nondisabled older persons. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences* 1996;51A(6):M283–M288.
5. Whitson H, Cousins S, Burchett B, Hybels C, Pieper C, Cohen H. The combined effect of visual impairment and cognitive impairment on disability in older people. *Journal of the American Geriatrics Society* 2007;55:885–891. [PubMed: 17537089]
6. Wang J, Mitchell P, Cumming R, Smith W. Visual impairment and nursing home placement in older Australians: the Blue Mountains Eye Study. *Ophthalmic Epidemiology* 2003;10(1):3–13. [PubMed: 12607154]
7. Owsley C, McGwin G, Scilley K, Meek G, Dyer A, Seker D. The visual status of older persons residing in nursing homes. *Archives of Ophthalmology* 2007;125(7):925–930. [PubMed: 17620572]
8. Hamman R, Mulgrew C, Baxter J, Shetterly S, Swenson C, Morgenstern N. Methods and prevalence of ADL limitations in Hispanic and non-Hispanic White subjects in rural Colorado: The San Luis Valley Health and Aging Study. *Annals of Epidemiology* 1999;9:225–235. [PubMed: 10332928]
9. Ferrell B. The management of pain in long-term care. *The Clinical Journal of Pain* 2004;20(4):240–243. [PubMed: 15218408]
10. Falconer M, O'Neill D. Profiling disability within nursing homes: A census-based approach. *Age and Ageing* 2007;36:209–213. [PubMed: 17296601]
11. Horowitz A. Vision impairment and functional disability among nursing home residents. *The Gerontologist* 1994;34(3):316–323. [PubMed: 8076872]
12. Marx M, Werner P, Cohen-Mansfield J, Feldman R. The relationship between low vision and performance of activities of daily living in nursing home residents. *Journal of the American Geriatrics Society* 1992;40(10):1018–1020. [PubMed: 1401674]
13. Paquay L, De Lepeleire J, Milisen K, Ylief M, Fontaine O, Buntinx F. Tasks performance by registered nurses and care assistants in nursing homes: A quantitative comparison of survey data. *International Journal of Nursing Studies* 2007;44:1459–1467. [PubMed: 17397849]
14. Mitchell P, Hayes P, Wang J. Visual impairment in nursing home residents: The Blue Mountains Eye Study. *The Medical Journal of Australia* 1997;166:73–76. [PubMed: 9033561]
15. Appollonio I, Carabellese C, Frattola L, Trabucchi M. Effects of sensory aids on the quality of life and mortality of elderly people: A multivariate analysis. *Age and Ageing* 1996;25:89–96. [PubMed: 8670534]
16. Brennan M, Horowitz A, Su Y. Dual sensory loss and its impact on everyday competence. *The Gerontologist* 2005;45(3):337–346. [PubMed: 15933274]
17. Cormack FK, Tovee M, Ballard C. Contrast sensitivity and visual acuity in patients with Alzheimer's disease. *International Journal of Geriatric Psychiatry* 2000;15:614–20. [PubMed: 10918342]
18. Friedman DS, West SK, Munoz B, Park W, Deremeik J, Massof R, et al. Racial variations in causing vision loss in nursing homes. *Archives of Ophthalmology* 2004;122:1019–1024. [PubMed: 15249367]
19. Resnick H, Fries B, Verbrugge L. Windows to their world: The effect of sensory impairments on social engagement and activity time in nursing home residents. *The Journals of Gerontology Series B, Psychological Sciences and Social Sciences* 1997;52B(3):S135–S144.
20. West C, Gildengorin G, Haegerstrom-Portnoy G, Schneck M, Lott L, Brabyn J. Is vision function related to physical functional ability in older adults? *Journal of the American Geriatrics Society* 2002;50:136–145. [PubMed: 12028258]
21. Black SA, Rush RD. Cognitive and Functional Decline in Adults Aged 75 and Older. *Journal of the American Geriatrics Society* 2002;50:1978–1986. [PubMed: 12473009]
22. Rudberg M, Furner S, Dunn J, Cassel C. The relationship of visual and hearing impairments to disability: An analysis using the Longitudinal Study of Aging. *Journal of Gerontology, Medical Sciences* 1993;48(6):M261–M265.

23. West SK, Munoz B, Rubin G, Bandeen-Roche K, Broman A, Turano K. Compensatory strategy use identifies risk of incident disability for the visually impaired. *Archives of Ophthalmology* 2005;123:1242–1247. [PubMed: 16157806]
24. Lin M, Gutierrez P, Stone K, Yaffe K, Ensrud K, Fink H, et al. Vision impairment and combined vision and hearing impairment predict cognitive and functional decline in older women. *Journal of the American Geriatrics Society* 2004;52:1996–2002. [PubMed: 15571533]
25. Anstey KJ, Luszcz MA, Sanchez L. Two-Year Decline in Vision but Not Hearing Is Associated with Memory Decline in Very Old Adults in a Population-Based Sample. *Gerontology* 2001;47:289–293. [PubMed: 11490149]
26. Sauvaget C, Yamada M, Fujiwara S, Sasaki H, Mimori Y. Dementia as a predictor of functional disability: A four-year follow-up study. *Gerontology* 2002;48:226–233. [PubMed: 12053112]
27. Tamura H, Tsukamoto H, Mukai S, Kato T, Minamoto H, Ohno Y, et al. Improvement in cognitive impairment after cataract surgery in elderly patients. *Journal of Cataract and Refractive Surgery* 2004;30:598–602.
28. Elam J, Graney M, Applegate W, Miller S, Freeman J, Wood T, et al. Functional outcome one year following cataract surgery in elderly persons. *Journal of Gerontology, Medical Sciences* 1988;43(5):M122–M126.
29. Mangione C, Phillips R, Lawrence M, Seddon J, Orav E, Goldman L. Improved visual function and attenuation of declines in health-related quality of life after cataract extraction. *Archives of Ophthalmology* 1994;112(11):1419–1425. [PubMed: 7980131]
30. Lamoureux E, Hopper C, Lim L, Pallant J, Hunt N, Keeffe J, et al. Impact of Cataract Surgery on Quality of Life in Patients with Early Age-Related Macular Degeneration. *Optometry and Vision Science* 2007;84(8):683–688. [PubMed: 17700333]
31. Applegate W, Miller S, Elam J, Freeman J, Wood T, Gettlefinger T. Impact of cataract surgery with lens implantation on vision and physical function in elderly persons. *Journal of the American Medical Association* 1987;257(3):1064–1066. [PubMed: 3806895]
32. Teresi J, Morse AR, Holmes D, Yatzkan ES, Ramirez M, Rosenthal B, et al. Impact of a vision intervention on the functional status of nursing home residents. *Journal of Vision Impairment and Blindness* 2005;99:96–108.
33. Folstein M, Folstein S, McHugh P. “Mini-mental state”: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 1975;12:189–198. [PubMed: 1202204]
34. Owsley C, McGwin G, Scilley K, Meek G, Seker D, Dyer A. Effect of refractive error correction on health-related quality of life and depression in older nursing home residents. *Archives of Ophthalmology* 2007;125(11):1471–1477. [PubMed: 17998508]
35. Owsley C, McGwin G, Scilley K, Meek G, Seker D, Dyer A. Impact of cataract surgery on health-related quality of life in nursing home residents. *British Journal of Ophthalmology* 2007;91:1359–1363. [PubMed: 17522143]
36. Ferris F, Kassoff A, Bresnick G, Bailey I. New visual acuity charts for clinical research. *American Journal of Ophthalmology* 1982;94:91–96. [PubMed: 7091289]
37. Dodds T, Martin D, Stolov W, Deyo R. A validation of the functional independence measurement and its performance among rehabilitation inpatients. *Archives of Physical Medicine and Rehabilitation* 1993;74(5):531–536. [PubMed: 8489365]
38. Lachman M, Howland J, Tennstedt S, Jette A, Assmann S, Peterson E. Fear of falling and activity restriction: The Survey of Activities and Fear of Falling in the Elderly (SAFE). *Journal of Gerontology, Psychological Sciences* 1998;53B(1):P43–P50.
39. Tinetti M, Ginter S. The Nursing Home Life-Space Diameter: A measure of extent and frequency of mobility among nursing home residents. *Journal of the American Geriatrics Society* 1990;38:1311–1315. [PubMed: 2254569]
40. Scott I, Smiddy W, Schiffman J, Feuer W, Pappas C. Quality of life of low-vision patients and the impact of low-vision services. *American Journal of Ophthalmology* 1999;128:54–62. [PubMed: 10482094]
41. Haymes S, Johnston A, Heyes A. Relationship between vision impairment and ability to perform activities of daily living. *Ophthalmic and Physiological Optics* 2002;22:79–91. [PubMed: 12014491]

42. Carpenter G, Hastie C, Morris J, Fries B, Ankri J. Measuring change in activities of daily living in nursing home residents with moderate to severe cognitive impairment. *BMC Geriatrics* 2006;6:7. [PubMed: 16584565]
43. Keller B, Morton J, Thomas V, Potter J. The effect of visual and hearing impairments on functional status. *Journal of the American Geriatrics Society* 1999;47(11):1319–1325. [PubMed: 10573440]
44. Cohen M, Marino R. The tools of disability outcomes research functional status measures. *Archives of Physical Medicine and Rehabilitation* 2000;81(S2):S21–S29. [PubMed: 11128901]
45. Katz S, Down T, Cash H, Grotz R. Progress in the development of the index of ADL. *The Gerontologist* 1970;10(1):20–30. [PubMed: 5420677]
46. Reischies F, Geiselmann B. Age-related cognitive decline and vision impairment affecting the detection of dementia syndrome in old age. *The British Journal of Psychiatry* 1997;171:449–451. [PubMed: 9463604]
47. Logsdon R, Gibbons L, McCurry S, Teri L. Assessing quality of life in older adults with cognitive impairment. *Psychosomatic Medicine* 2002;64:510–519. [PubMed: 12021425]
48. Reyes-Ortiz C, Kuo Y, DiNuzzo A, Ray L, Raji M, Markides K. Near vision impairment predicts cognitive decline: Data from the hispanic established populations for epidemiologic studies of the elderly. *Journal of the American Geriatrics Society* 2005;53:681–686. [PubMed: 15817017]
49. Margolis M, Coyne K, Kennedy-Martin T, Baker T, Schein O, Revicki D. Vision-specific instruments for the assessment of health-related quality of life and visual functioning. *Pharmacoeconomics* 2002;20(12):791–812. [PubMed: 12236802]
50. Eklund K, Sjostrand J, Dahlin-Ivanoff S. A randomized controlled trial of a health-promotion programme and its effect on ADL dependence and self-reported health problems for the elderly visually impaired. *Scandinavian Journal of Occupational Therapy* 2007:1–7.
51. Hausdorff J, Yogev G, Springer S, Simon E, Giladi N. Walking is more like catching than tapping: Gait in the elderly as a complex cognitive task. *Experimental Brain Research* 2005;164:541–548.
52. Krauss, N.; Altman, B. MEPS Research Findings No. 5. Rockville (MD): Agency for Health Care Policy and Research; 1998. Characteristics of nursing home residents-1996.

Table 1

Baseline Demographic and Medical Characteristics for the Refractive Error and Delayed Refractive Error Correction Groups.

Variable	Refractive Error Correction Group (N=78)	Delayed Refractive Error Correction Group (N= 64)	p-value
Age, mean ($\pm$ SD)	79.2 (8.4)	78.0 (8.2)	.4610
Race/Ethnicity, n (%)			
African American	29 (37.2)	16 (25.0)	.1819
White, non-Hispanic	48 (61.5)	48 (75.0)	
Hispanic	1 (1.3)	0 (0)	
Gender, n (%)			.7893
Female	60 (76.9)	48 (75.0)	
Male	18 (23.1)	16 (25.0)	
Education, n (%)			.5291
Attended school but not a high school graduate	44 (56.4)	29 (45.3)	
High school graduate	21 (26.9)	23 (35.9)	
At least some college	11 (14.1)	9 (14.1)	
No information available	2 (2.6)	3 (4.7)	
MMSE Score, mean ($\pm$ SD) *	20.2 (4.4)	21.7 (4.5)	.0549
Number of medical conditions, mean ($\pm$ SD)	5.2 (3.0)	5.7 (3.0)	.3015
Eye conditions, n (%)			
Glaucoma	1 (1.3)	4 (6.5)	.1016
Age-related macular degeneration	13 (16.7)	9 (14.5)	.7284
Cataract	53 (68.0)	38 (60.3)	.3463
Diabetic retinopathy	3 (3.9)	6 (9.7)	.1623
Length of nursing home stay, years, mean ($\pm$ SD)	1.6 (1.5)	2.2 (2.5)	.1191

* Mini Mental State Exam (MMSE) score <24 indicates cognitive impairment

Table 2

Baseline Demographic and Medical Characteristics for the Cataract Surgery and Comparison Groups.

Variable	Cataract Surgery Group (N= 30)	No Cataract Surgery Group (N= 15)	p-value
Age, years, mean ($\pm$ SD)	81 (8)	87 (6)	.021
Race/Ethnicity, n (%)			
African American	7 (23.3)	3 (20)	.800
White, non-Hispanic	23 (77.7)	12 (80)	
Gender, n (%)			
Female	22 (73.3)	13 (86.7)	.311
Male	8 (26.7)	2 (13.3)	
Education, n (%)			
Attended school but not a high school graduate	19 (63.3)	8 (53.3)	.264
High school graduate	4 (13.3)	5 (33.3)	
At least some college	7 (23.3)	2 (13.3)	
MMSE Score, mean ($\pm$ SD) *	21.1 (5.3)	19.7 (5.3)	.386
Number of medical conditions, mean ($\pm$ SD)	6.5 (4.0)	4.9 (3.8)	.197
Cataract, type, n (%)			
Nuclear sclerotic	30 (100)	13 (92.9)	.139
Cortical	22 (73.3)	10 (71.4)	.895
Posterior subcapsular	16 (53.3)	6 (42.9)	.517
Cataract Symptom Score	3.1 (3.6)	2.3 (4.1)	.512
Co-morbid eye conditions, n (%)			
Glaucoma	0 (0)	1 (6.7)	.153
Age-related macular degeneration	3 (10)	3 (20)	.352
Diabetic retinopathy	0 (0)	0 (0)	
Length of nursing home stay, years, mean ($\pm$ SD)	1.5 (1.7)	1.6 (1.9)	.962

* Mini Mental State Exam (MMSE) score <24 indicates cognitive impairment

Table 3
Within and Between Group Comparisons for Immediate and Delayed Refractive Error Correction Groups on Physical Function and Cognitive Status

Variable	Intervention Group		Control Group		p-value	p-value*	p-value [†]
	Baseline Mean (±SD)	Follow-up Mean (±SD)	Baseline Mean (±SD)	Follow-up Mean (±SD)			
FIM [‡]							
-Certified Nursing Assistant	47.9 (24.2)	47.5 (22.9)	53.5 (22.5)	51.8 (22.5)	0.19	0.16	0.37
-Resident	50.8 (23.5)	49.1 (23.5)	57.4 (20.4)	55.2 (21.9)	0.09	0.08	0.75
SAFE [§]							
-Fear	0.6 (0.8)	0.6 (0.8)	0.5 (0.6)	0.5 (0.6)	0.27	0.66	0.15
-Activity	8.6 (3.2)	8.6 (3.4)	9.1 (2.8)	8.9 (2.9)	0.24	0.30	0.34
-Restriction	8.1 (3.4)	8.4 (3.2)	7.5 (3.3)	7.5 (3.4)	0.76	0.29	0.32
NHLSD [¶]							
-Certified Nursing Assistant	23.1 (10.1)	23.5 (8.9)	24.9 (7.3)	25.2 (8.8)	0.60	0.26	0.68
-Resident	22.5 (10.0)	24.1 (9.3)	24.7 (7.2)	25.1 (8.5)	0.56	0.15	0.68
MMSE [#]	20.2 (4.4)	19.4 (4.8)	21.7 (4.5)	20.5 (5.5)	0.015	0.06	0.72

* baseline between group differences

[†] follow-up between group differences

[‡] Functional Independence Measure (FIM) scores range from 0–91 with higher scores indicating greater independence

[§] Survey of Activities and Fear of Falling (SAFE) fear subscale represents average fear of falling per activities performed, range is 0 to 3 with higher scores representing less fear; SAFE activity subscale range is 0–14 for the number of activities participants engaged in; SAFE restriction subscale range 0–14 for the number of activities participants perform less often than they did 5 years ago.

[¶] Nursing Home Life-Space Diameter (NHLSD) scores range from 0–45 with higher scores indicating greater mobility

[#] Mini Mental State Exam (MMSE) score <24 indicates cognitive impairment

Table 4
Within and Between Group Comparisons for Cataract Surgery and Control Groups on Physical Function and Cognitive Status

Variable	Intervention Group		Control Group		p-value	p-value*	p-value [†]
	Baseline Mean (±SD)	Follow-up Mean (±SD)	Baseline Mean (±SD)	Follow-up Mean (±SD)			
FIM [‡]							
-Certified Nursing Assistant	49.9 (23.5)	50.9 (24.2)	47.7 (26.3)	41.5 (23.4)	0.88	0.78	0.07
-Resident	48.5 (22.1)	50.5 (25.3)	51.5 (24.0)	51.9 (22.2)	0.93	0.67	0.39
SAFE [§]							
-Fear	0.5 (0.6)	0.6 (0.7)	0.2 (0.5)	0.3 (0.5)	0.62	0.36	0.88
-Geriatric activity	8.4 (3.0)	8.2 (3.6)	8.7 (3.0)	9.0 (3.0)	0.45	0.50	0.31
-Restriction	7.8 (3.8)	6.5 (3.9)	7.0 (4.3)	6.4 (3.4)	0.09	0.61	0.79
NHLSD [¶]							
-Certified Nursing Assistant	23.5 (7.9)	23.0 (9.4)	24.1 (6.4)	21.6 (7.0)	0.87	0.25	0.45
-Resident	22.7 (8.1)	23.4 (9.2)	25.9 (7.6)	22.1 (6.2)	0.92	0.26	0.52
MMSE [#]	21.3 (5.3)	20.4 (6.3)	19.7 (5.3)	17.0 (6.9)	0.08	0.32	0.27

* baseline between group differences

[†] follow-up between group differences

[‡] Functional Independence Measure (FIM) scores range from 0–91 with higher scores indicating greater independence

[§] Survey of Activities and Fear of Falling (SAFE) fear subscale represents average fear of falling per activities performed, range is 0 to 3 with higher scores representing less fear SAFE activity subscale range is 0–14 for the number of activities participants engaged in SAFE restriction subscale range 0–14 for the number of activities participants perform less often than they did 5 years ago.

[¶] Nursing Home Life-Space Diameter (NHLSD) scores range from 0–45 with higher scores indicating greater mobility

[#] Mini Mental State Exam (MMSE) score <24 indicates cognitive impairment