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Mild visual impairment and its impact on self-care among older adults

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Abstract

Objective: To determine the prevalence of mild visual impairment (MVI) among urban older adults in primary care settings, and ascertain whether MVI was a risk factor for inadequate performance on self-care health tasks.

Methods: We used data from a cohort of 900 older adults recruited from primary care clinics. Self-management skills were assessed using the Comprehensive Health Activities Scale, and vision with corrective lenses was assessed with the Snellen. We modeled visual acuity predicting health task performance with linear regression.

Results: Normal vision was associated with better overall health task performance (p=0.004). Individuals with normal vision were more likely to recall health information conveyed via multimedia (p=0.02) and during a spoken encounter (p=0.04), and were more accurate in dosing multi-drug regimens (p=0.05).

Discussion: MVI may challenge the performance of self-care behaviors. Healthcare systems and clinicians should consider even subtle detriments in visual acuity when designing health information, materials and devices.

Keywords

vision; mild visual impairment; self-care

Introduction

An increasing number of adult patients live with one or more chronic conditions, and consequently must assume formidable self-care roles (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Holman & Lorig, 2004). Older adults face the greatest burden of chronic

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disease (Gerteis et al., 2014), and as a result have particularly complex self-care regimens. Numerous studies have documented the disproportionate challenges faced by older patients when adhering to medication regimens (Gellad, Grenard, & Marcum, 2011) and self-monitoring conditions (Adams et al., 2003; Federman et al., 2014). Compared with their younger counterparts, older adults have a higher prevalence of cognitive (Park et al., 2002; Salthouse, 2009; Singh-Manoux et al., 2012) and functional impairments (Holmes, Powell-Griner, Lethbridge-Cejku, & Heyman, 2009; Smith et al., 2015). Older adults are also more likely to have low health literacy (Gazmararian et al., 1999; Kobayashi, Wardle, Wolf, & von Wagner, 2014) and less reliable social support (Steptoe, Shankar, Demakakos, & Wardle, 2013). Alone or in combination, these risk factors are associated with poorer self-care performance and chronic disease outcomes among older adults.

A less studied risk factor for poor self-care that may be common among older adults is visual acuity. Population-based studies have found that rates of low vision and blindness increase with age (Congdon et al., 2004; Klein & Klein, 2013). Furthermore, vision impairment is an established risk factor for worse physical function (Christ et al., 2014; Crews & Campbell, 2004; Jacobs, Hammerman-Rozenberg, Maaravi, Cohen, & Stessman, 2005; Salive et al., 1994), poorer mental health (Carrière et al., 2013; Zhang et al., 2013), as well as increased mortality risk (T. Zhang, Jiang, Song, & Zhang, 2016). While the precise causal mechanisms have not yet been specified, these clinical outcomes may be the result of difficulties engaging in self-care behaviors (Stevenson, Hart, Montgomery, McCulloch, & Chakravarthy, 2004), such as safe medication use (McCann et al., 2012), and challenges accessing medical care (Cupples, Hart, Johnston, & Jackson, 2012).

Research investigations to date have predominantly focused on visual impairment using thresholds for 'moderate' and 'severe' impairment. However, it is possible that even a slight limitation in visual acuity or what is considered 'mild' visual impairment (20/30 – 20/70), may subtly – yet meaningfully impact one's ability to assume self-care roles (Crews, Chou, Zhang, Zack, & Saaddine, 2014). Yet unlike individuals with formidable visual impairment, those with mildly impaired vision may not report this as a concern to their physician, resulting in persistent unremediated self-care difficulties. The objective of this investigation was to determine the prevalence of mild visual impairment among older adults in primary care settings in a single urban city, and to ascertain whether it was an independent risk factor for inadequate performance on every-day self-care health tasks.

Methods

Sample and Procedure

We used baseline data from the Health Literacy and Cognitive Function among Older Adults study (also known as 'LitCog'). LitCog is a prospective cohort study of English-speaking adults between the ages of 55–74 that investigates changes in health literacy over time and its relation to cognitive function and performance on healthcare tasks. Participants were recruited from one academic general internal medicine ambulatory care clinic and six federally qualified health centers in Chicago, Illinois. A full description of the systematic recruitment procedures are published elsewhere (Wolf et al., 2012). In brief, 3,851 patients were identified as potentially eligible in clinic records and were notified of the study by mail. Among these individuals, we successfully contacted 2,132 via telephone, of whom 859 refused participation. A total of 1,273 patients were screened for eligibility, of whom 933 were eligible. Of these, 900 provided written informed consent and completed the in-person baseline interview. For this analysis, we excluded individuals with visual acuity of less than 20/50, as this level of vision was required for the health literacy measure we used (see Measures). This resulted in a final sample of 851 participants. The study was approved by the Institutional Review Board at Northwestern University Feinberg School of Medicine (STU00026255).

Measures

Participant characteristics—Measures of age, race (White, Black, Other), and the number of self-reported prescription medicines and chronic conditions were recorded (diabetes, chronic obstructive pulmonary disease, coronary vascular disease, congestive heart failure, asthma, hypertension, hypercholesterolemia, stroke, arthritis, cancer, depression). The number of chronic conditions and prescription medicines were categorized as 0, 1 and 2 or more.

Self-Care Tasks—Ability to perform everyday health tasks was assessed using the Comprehensive Health Activities Scale (CHAS) (Curtis et al., 2015). The CHAS evaluates the capacity and skills needed to navigate healthcare systems. Participants are presented with nine scenarios depicting common health-related tasks for an aging population. The information is presented in a variety of formats which patients may encounter within the healthcare environment including, print documents, prescription medication bottles, spoken health communication and multimedia video. After reviewing the materials, participants are asked a series of questions assessing comprehension. Questions range from retrieval of print information, recall of verbal and multimedia information, demonstration of understanding information from pill bottles and more complicated tasks requiring calculation, multistep commands and reasoning. The CHAS consists of 45 items and includes the following subscales, print (18 items), medication dosing (13 items), spoken counseling (7 items), and multimedia (7 items). Total and subscale scores are standardized to range from 0–100, with higher scores indicating better performance.

Visual Acuity—Vision with current correction was assessed binocularly using the Snellen hand-held chart following standard administration procedures. Participants were instructed to hold the card at arms-length (14 inches from eyes) and read the smallest line of numbers possible. Respondents were prompted to continue reading smaller lines until more than two errors are made. Normal vision was defined as 20/20 or 20/25 and mild visual impairment as 20/30 – 20/50. Operational definitions for visual impairment were based on the World Health Organization International Classification of Diseases and Related Health Problems (ICD-10) (World Health Organization, 2003). Standard definitions of mild visual impairment also include 20/70 (World Health Organization, 2003; Colenbrander, 2002), but we did not include this category due to the health literacy assessment protocol that was also administered (Parker, Baker, Williams, & Nurss, 1995).

Health Literacy—Health literacy was measured using the Test of Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995). The TOFHLA is composed of a numeracy (17 items) and a literacy section (50 items). The numeracy section assesses comprehension of actual health information materials by a series of prompts (prescription bottle, appointment slip, results from a medical test) that a patient may encounter in a healthcare setting. The reading assessment evaluates the patient's ability to read passages of healthcare materials. The assessment uses the cloze procedure whereby every fifth to seventh word of a text is omitted and four multiple choice options are provided. As per TOFHLA administration procedures, the assessment is only administered to individuals with adequate visual acuity, defined as vision ≤ 20/50 (Parker et al., 1995). Scores range from 0 to 100, with higher scores indicating higher health literacy. Scores are classified as limited (inadequate 0–59 and marginal 60–74 combined), or adequate (75–100) Before conducting the analyses, the research team examined the distribution of the TOFHLA scores and determined that few patients scored in the lowest categories. We, therefore, combined the marginal and inadequate literacy groups.

Cognitive Ability—Cognitive ability was assessed with measures of global cognitive function, working and long term memory. Global cognitive ability was assessed using the Mini Mental State Exam, which is a global measure of cognition that is commonly used in medical settings (Folstein, Folstein, & McHugh, 1975). Working memory was measured using the Size Judgement Span task where participants are read lists of differing amounts of randomly ordered, size-constant items and asked to reorder the items from smallest to largest (Cherry, Elliott, & Reese, 2007; Cherry & Park, 1993). Delayed recall was assessed using the New York University Paragraph Recall test, which asks participant to repeat back as much of a story as possible after an approximate twenty minute delay (Kluger, Ferris, Golomb, Mittelman, & Reisberg, 1999).

Analysis plan

Descriptive statistics were calculated for all participant characteristics. T-tests and chi-square statistics were used to examine differences in self-care skills and demographic factors by visual acuity (mild impairment vs. normal), as appropriate. To examine predictors of performance on the CHAS and its subscales, a series of multivariable linear regression models were performed. The multivariable model contained visual acuity, health literacy, cognitive ability, self-reported age, race, number of chronic conditions, and number of prescription medicines. All analyses were performed using STATA 13.1 (College Station, TX).

Results

Overall, the mean age of the sample was 63.1 (±5.5) years. The majority of patients were female (69.3%), nearly half (45.1%) were African American (Table 1). The number of comorbidities reported ranged from 0 to 9, with an average of three chronic conditions (M=2.7, SD=1.8) reported. Nearly a third (29.9%) had limited health literacy skills, while 44.3% had a mild visual impairment (25.0% 20/30, 8.7% 20/40, and 10.6% 20/50), with the remaining 55.7% classified as having normal vision (23.4% 20/20, 32.3% 20/25). Mild visual impairment was more prevalent among African Americans (55.2% compared with 35.4% white), those with limited literacy (55.8% compared with 39.7% adequate), and in those with 2 or more chronic conditions (49.7% vs. 29.9% with <2) (all: p's<0.001).

The mean CHAS total score was 62.0 out of a possible 100 points, with higher scores indicating better performance. Scores ranged from 2.3 to 97.8. There were differences in performance on the CHAS and the subscales by visual acuity. In unadjusted analyses (Table 2), compared with participants with a mild visual impairment, participants with normal vision had greater overall CHAS scores (M=57.1 vs. M=66.0, p<0.001). Differences were also noted for each of the CHAS subscales; print documents (M=61.7 vs. M=70.4, p<0.001), spoken communication (M=64.9 vs. M=73.1, p<0.001), multimedia (M=38.6 vs M=47.5, p<0.001), accurate medication dosing (M=57.8 vs. M=66.8, p<0.001).

In multivariable analyses (Table 3), normal visual acuity was associated with greater CHAS total score (β = 2.41, 95% CI 0.76 – 4.05, p=0.004). Adequate health literacy, white and other race, and all measures of cognitive ability, were also significant predictors of greater CHAS performance in the multivariable model.

With regard to the task specific subscales, normal visual acuity was associated with greater recall of health information presented via multimedia format (β = 3.86; 95% CI 0.70–7.02, p=0.02), more accurate dosing of multi-drug regimens (β = 2.48; 95% CI 0.05–4.92, p=0.05), and recalling more medical information during a spoken encounter (β = 2.82; 95% CI 0.12–5.53, p=0.04). A non-significant trend was found for interpreting medical information on print documents (β = 1.90; 95% CI −0.22–4.01, p=0.08). Greater performance on all cognitive assessments and white race were also associated with better performance on each subscale (all: p's<0.05). Adequate health literacy was associated with better performance on each subscale, except the multimedia task (all: p's<0.05). We tested the interaction between health literacy and visual acuity for each outcome, all of which were non-significant.

Discussion

In this cohort of community-dwelling older American adults, mild visual impairment (20/30 – 20/50) was common (4 in 10) and found to be a risk factor for inadequate performance on everyday self-care tasks. This included proper dosing of a multi-drug regimen, as well as comprehension and recall of health information across a variety of media sources. Importantly, mild visual impairment was independent of other risk factors, such as low health literacy and cognitive ability, which would require a different form of remediation. Older adults categorized as having a mild visual impairment would likely not be identified as in need of intervention as they are still within a normal threshold. Healthcare professionals may overlook these patients' limited visual acuity and not perceive a need to intervene, despite their demonstrated self-care challenges. Our findings highlight several specific concerns with this common problem and the implications to healthcare providers and practices to meet the needs and desires of an aging population.

Our findings suggest individuals designing healthcare artifacts should be mindful of varying levels of eyesight within a normal range. One common example is medication labels. There is limited space on drug labeling, and as a result pharmacies are likely to use small font sizes. One study found prescription drug instructions are conveyed using an average 9.3 font size, and warning stickers attached to the bottle are presented in an average 6.5 font size (Shrank et al., 2007). Small font size may lead individuals to struggle with seeing and acting upon medication labels, as well as increase the risk for errors and adverse events. Patient-centered labels were recently mandated by California legislature, which requires text on drug labeling to appear at a minimum of 12-point font and in sans serif typeface (California State Board of Pharmacy). Revising font size on common healthcare products may improve an individual's ability to more accurately follow recommended self-care behaviors.

A further implication of our work relates to the increasing use of technology to communicate health information (Bailey et al., 2014; Wilson et al., 2012). The National Institute of Aging (NIA) and the American Disabilities Act (ADA) offer recommendations for improving accessibility of websites to older adults and individuals with low vision, respectively. This includes the use of 12 or 14 point font size and high contrast between type and background (Hodes & Lindberg, 2002). Additionally, webpage designers often fix the color and appearance of the webpage; the ADA encourages permitting viewers to manipulate the font size or background contrast. To facilitate this process the NIA recommends the addition of radio buttons at the top of the webpage for the viewer to easily change text size and contrast. However, older adults have less familiarity with these technological features and may be more challenged in making such manipulations (Zickuhr & Smith, 2012). As a result, they may require training in using these technologies. Ensuring information is presented in large font may also facilitate their use.

An unexpected finding was that individuals with a mild visual impairment performed poorly at recalling spoken verbal counseling. It is possible that the inability to visually focus on the speaker may distract the individual from attending to the verbal information. Drawing from research in cognitive psychology, the presence of a constant or unpredictable distractor has been found to decrease the efficiency of working memory in older adults (West, 1999). Mild visual impairment may function as a subtle, constant distraction to patients as they engage with healthcare providers. These patients may miss certain spoken instructions as their attention is in part diverted towards focusing on the healthcare provider. Our present study is limited in fully understanding this association, as it is equally plausible that another unmeasured construct may be related to both mild visual impairment and recall of verbal instructions. Future research could further explore this possible association.

Interestingly, vision did not predict patients' comprehension and subsequent application of written health information. This might seem the most obvious association to expect between a mild visual impairment and self-care task. However, this finding may also reflect why the existing threshold for visual acuity exists; that it was meant to superficially capture those who can at minimum read print documents. Yet this task is arguably the most basic, and other more complex tasks (e.g. using multimedia, following spoken instructions), while less obvious, may still rely on one's vision for optimal performance. Mayer, in describing "multimedia learning", underscores the importance of using both auditory and visual channels in processing not only spoken communication and images, but text as well (Mayer, 2005).

While vision is an intuitive pre-requisite for accurate self-care, there are varying recommendations regarding the frequency that visual acuity should be assessed. In general national guidelines recommend assessing visual acuity every one to two years in primary care settings (Rowe, MacLean, & Shekelle, 2004). Minor changes may not prompt older adults to seek specialty eye care (McGwin, Khoury, Cross, & Owsley, 2010), and therefore primary care physicians may be in a more suitable position to identify small changes in vision. A high proportion of older adults may require corrective lenses or changes in the strength of their lens. In a sample of older adults with vision ≥ 20/40, approximately half had improvements in their visual acuity when their refractive error was updated (Muñoz et al., 2000). The US Preventive Services Task Force recently stated there was insufficient evidence to assess the harms and benefits of screening for impaired visual acuity in older adults; however in their review of the current evidence they did find consistent evidence that screening for visual acuity can identify individuals with refractive error (Siu et al., 2016). While the effectiveness of screening for vision impairment in primary care is still to be determined, dilated eye evaluations have been found to be more cost effective than standard vision tests during an initial preventive physical examination upon enrollment in Medicare (Rein et al., 2012). Future research should examine the both the effectiveness and cost-effectiveness of screening for visual acuity and providing low cost corrective lenses, as well as consider which services will be reimbursed by insurance.

This study has limitations. Our findings are limited to English speaking, predominantly female, older adults in one urban city. Additionally, we are limited in our moderate cooperation rate as well as a lack of demographic characteristics for non-participants and therefore we are unable to determine nonresponse bias. Performance on everyday health tasks was measured using hypothetical scenarios. While these tasks are hypothetical, their appearance is similar to how they would appear if encountered in everyday life. Vision impairment was based solely on visual acuity and did not include an assessment of field of vision or contrast sensitivity, which are also indicators of clinical vision. In addition, we only included individuals with visual acuity of 20/50 or greater. These results are likely to be more pronounced among populations with greater levels of visual impairment. Additionally, concurrent hearing and visual impairment is associated with worse health outcomes (Crews & Campbell, 2004). We did not assess hearing loss in this study and were unable to control for hearing loss in our analyses. Lastly, the cross-sectional nature of these analyses limits inferences regarding causality.

In conclusion, in this cohort of English-speaking, community dwelling older adults we showed that mild visual impairment was a potentially hidden risk factor to inadequate performance on common self-care tasks. To facilitate engagement in self-care behaviors in order to promote independent living among older adults, prescription drug information and health information conveyed via a variety of media sources should follow recommendations for font size and color to promote comprehension across varying levels of visual acuity. Primary care providers should regularly screen for visual acuity and consider even subtle changes in vision as a possible threat to one's self care ability. Healthcare systems, clinicians and researchers should consider even minor detriments to visual acuity when designing health information, materials and medical devices.

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Table 1.

Participant Demographics by Visual Acuity Status

Variable	All Participants (N=851)	Visual Acuity Normal (n=474)	Mild Impairment (n=377)	P Value
Age, mean (SD)	63.1 (5.5)	62.8 (5.3)	63.5 (5.7)	0.07
Female	69.3	70.9	67.4	.28
Race				<0.001
African American	45.1	36.2	56.1	
White	48.3	56.1	38.6	
Other	6.6	7.6	5.3	
Health Literacy				<0.001
Adequate	70.2	76.2	62.6	
Limited	29.9	23.8	37.4	
Number of Chronic Conditions				<0.001
0	8.6	10.8	5.8	
1	18.6	23.4	12.5	
2+	72.8	65.8	81.7	
Number of Prescription Medicines				.04
0	11.5	14.0	8.3	
1	15.3	15.9	14.4	
2+	73.2	70.1	77.3	

Table 2.

Association of Visual Acuity and Self-care Tasks

	Visual Acuity			
Variable	**All Participants (N=851)**	**Normal (n=474)**	**Mild Impairment (n=377)**	**P Value**
CHAS Total Score	62.0 (21.2)	66.0 (20.0)	57.1 (21.5)	<0.001
Print Documents	66.6 (23.9)	70.4 (22.8)	61.7 (24.5)	<0.001
Spoken Communication	69.5 (22.9)	73.1 (22.1)	64.9 (23.0)	<0.001
Multimedia	43.6 (26.8)	47.5 (26.6)	38.6 (26.3)	<0.001
Medication Dosing	62.8 (24.0)	66.8 (22.6)	57.8 (24.8)	<0.001

Note: CHAS Total score and subscale scores range from 0-100.

Table 3.

Multivariable Linear Regression Predicting Self-care Tasks

	CHAS Total Score β (95% CI)	Print Documents β (95% CI)	Spoken Communication β (95% CI)	Multimedia β (95% CI)	Medication Dosing β (95% CI)
Vision					
Near Normal	-	-	-	-	-
Normal	2.41 (0.76-4.05) *	1.90 (−0.22-4.01)	2.82 (0.12-5.53) *	3.86 (0.70-7.02) *	2.48 (0.05 – 4.92) *
Age	−0.09 (−0.24-0.05)	−0.10 (−0.28-0.09)	−0.04 (−0.28-0.20)	−0.34 (−0.62 - −0.06) *	−0.01 (−0.23 – 0.20)
Global Cognitive Ability	2.47 (1.97-2.97) ‡	2.71 (2.07-3.36) ‡	1.60 (0.76 – 2.44) ‡	2.12 (1.16-3.08) ‡	2.84 (2.09-3.58) ‡
Working Memory	4.41 (3.26-5.57) ‡	4.76 (3.28-6.24) ‡	3.32 (1.44-5.21) ‡	5.44 (3.23-7.65) ‡	4.18 (2.47-5.89) ‡
Long Term Memory	1.42 (1.10-1.73) ‡	1.20 (0.79-1.61) ‡	1.32 (0.80-1.84) ‡	2.44 (1.83-3.05) ‡	1.10 (0.64-1.58) ‡
Race					
African American	-	-	-	-	-
White	9.33 (7.29-11.37) ‡	10.60 (7.98-13.22) ‡	9.07 (5.73-12.43) ‡	5.72 (1.81-9.64) †	9.10 (6.08-12.12) ‡
Other	4.62 (1.40-7.84) †	6.87 (2.74-11.00) ‡	−1.38 (−6.66-3.90)	−0.70 (−6.88-5.48)	7.18 (2.42-11.95) *
Chronic conditions					
0	−0.62 (−3.91-2.67)	−0.87 (−5.10-3.35)	0.71 (−4.68-6.10)	−4.35 (−10.67-1.96)	0.95 (−3.91-5.82)
1	0.61 (−1.60-2.82)	1.26 (−1.57-4.11)	−1.35 (−4.97-2.27)	−2.45 (−6.69-1.80)	2.26 (−1.27-5.78)
2+	-	-	-	-	-
# Prescription Meds					
0	0.53 (−2.33-3.38)	0.67 (−2.98-4.34)	−3.61 (−8.28-1.07)	2.96 (−2.51-8.44)	1.03 (−3.19-5.25)
1	1.02 (−1.33-3.38)	0.82 (−2.22-3.87)	−0.59 (−4.48-3.29)	0.45 (−4.07-4.99)	2.25 (−1.57-6.06)
2+	-	-	-	-	-
Health literacy					
Limited	-	-	-	-	-
Adequate	11.77 (9.57-13.97) ‡	15.07 (12.24-17.90) ‡	10.10 (6.48-13.72) ‡	2.46 (−1.76-6.69)	13.46 (10.21 – 16.72) ‡

Notes:

* =p<0.05;

† p<0.01;

‡ p<0.001