How Does Visual Impairment Affect Performance on Tasks of Everyday Life?

The SEE Project

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Objective: To determine the association between performance on selected tasks of everyday life and impairment in visual acuity and contrast sensitivity.

Methods: Visual acuity and contrast sensitivity were obtained on a population-based sample of 2520 older African American and white subjects. Performance was assessed on mobility, daily activities with a strong visual component, and visually intensive tasks. Disability was defined as performance less than 1 SD below the mean. Receiver operating characteristic curve analyses were used to evaluate the sensitivity and specificity of thresholds in acuity and contrast loss for determining disability.

Results: Both visual acuity and contrast sensitivity loss were associated with decrements in function. The relationship of function to the vision measures was mostly linear, therefore, receiver operating characteristic curves were not helpful in identifying cutoff points for predicting disabilities. For mobility tasks, most persons were not disabled until they had significant acuity loss (logMAR visual acuity >1.0 or <20/200) or contrast sensitivity loss (0.9 log units contrast sensitivity). For heavily visually intensive tasks, like reading, visual acuity worse than 0.2 logMAR (20/30) or contrast sensitivity worse than 1.4 log units was disabling.

Conclusions: Both contrast sensitivity and visual acuity loss contribute independently to deficits in performance on everyday tasks. Defining disability as deficits in performance relative to a population, it is possible to identify visual acuity and contrast loss where most are disabled. However, the cutoff points depend on the task, suggesting that defining disability using a single threshold for visual acuity or contrast sensitivity loss is arbitrary.

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THE LINK BETWEEN visual impairment and physical disability, psychosocial distress, and general quality of life has been a growing area of research, and a number of studies including our own have documented the decrements in function associated with loss of various components of visual function.[1-9] In all but a few of these, the measure of visual impairment was confined to either self-report of visual loss, or a measure of visual acuity.

Yet, there are data that suggest other measures of visual function are also important for predicting functional loss. Rubin et al[3] have shown that a 2-fold reduction in contrast sensitivity is associated with 3- to 5-fold odds of self-report of difficulty on everyday tasks, and the effect is independent of the contribution of visual acuity loss. Others have linked loss of contrast sensitivity to mobility and balance decrements.[10,11]

In the Salisbury Eye Evaluation (SEE) Project, our goal is to determine, in a population-based sample of older adults, the relationship of visual impairment with functional disability. Measures of functional disability include both self-report of difficulty and actual performance on a variety of tasks.[12] The tasks chosen are meaningful for comparisons with tasks of everyday life, as we have previously shown that performance on these tasks mirrors the performance on the same tasks conducted in the home.[13] In this article, we show the relationship of decrements in visual acuity and contrast sensitivity to decrements in the performance on a variety of tasks, and try to determine meaningful cutoff points in loss of visual acuity or contrast that are rooted in functional loss.

RESULTS

The population in the SEE Project study was 58% female, and 26% were African American (**Table 1**). The distributions of each of the performance-based outcome measures were close to normal, with the exception of face recognition where the distribution was skewed to high performance. The mean and SD for each of the outcome measures are given in **Table 2**.

As expected, those with very good contrast sensitivity generally also had good visual acuity as well. However, there was a

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PARTICIPANTS AND METHODS

POPULATION

The SEE Project is a population-based, longitudinal study of the effect of visual impairment, and age-related eye diseases, on functional status in older, community-dwelling adults.[12] To achieve the aims of this project, a random sample of residents of Salisbury, Md, aged from 65 to 84 years, was recruited for a home interview and an examination at the SEE clinic. The sample was selected from the Health Care Financing Administration Medicare database. Eligibility criteria excluded those who were institutionalized or completely housebound, and those who scored less than 18 on the Mini-Mental State Examination (MMSE).[14] Written, informed consent was obtained at the home interview in accord with the tenets of the Declaration of Helsinki. Details on the population and recruitment are described elsewhere.[15] In summary, of the original sample, 73% participated in the home interview and 65% participated in both the interview and the clinical examination.

Permission was also sought to administer a 12-question screener questionnaire to both the refusals and the participants, to investigate the comparability between those for whom data were available and those who refused. Of the 1301 refusals to the clinic examination or the home questionnaire, 65% agreed to answer the questions on the screener. There were no differences by age, race, or sex between the refusals who answered the screener and those who did not answer the screener.[15] There was no difference in participation rates by race; participation rates declined with age from 68% in the age group 65 through 69 years to 55% in age group 80 through 84 years. There was no difference in the sex- and age-adjusted proportion rating their vision as 6 or better, on a scale of 1 to10 where 10 was excellent. Among participants, 82.9% were 6 or better compared with 84.0% among refusals. These data provide some assurances that the sample of 2520 participants did not seem to be biased on self-reported vision status.

MEASURES OF HEALTH

The General Health Questionnaire was administered in the clinic; the subscale on depressive symptoms was used as a measure of depression. Cognitive status was assessed at home visit using the MMSE; possible scores for this study range from 18 to 30.

Data on diabetes mellitus were based on self-report, validated by use of insulin or oral hypoglycemics, or by hospital or physician records. For those who did not report having diabetes mellitus, we included as having diabetes mellitus those with a hemoglobin A_{1c} value greater than 7%.[16] Hypertension was based on self-report plus evidence of taking an antihypertension medication. In addition, blood pressure was measured in a sitting position, 3 times, according to a standard protocol.[17] Persons who did not report hypertension but had an average diastolic pressure of 90 mm Hg or higher or a systolic pressure of 160 mm Hg or higher were classified as subjects possibly having hypertension for our study. Other conditions were based on self-report such as stroke, cancer, parkinsonism, arthritis, myocardial infarction, congestive heart failure, and pulmonary problems. We calculated an index of number of comorbid conditions (excluding cataract).

MEASURES OF VISION

Details on vision testing have been described previously.[18] All tests were administered by a trained technician using forced-choice procedures. In essence, distance acuity was measured using Early Treatment Diabetic Retinopathy Study charts, monocularly and binocularly, with habitual

Continued on next page

Table 1. Characteristics of 2520 Participants in the SEE Population*

Characteristic	Proportion
Age, y	
65-69	37
70-74	31
75-79	21
80+	11
Female	58
African American	26
Educational level, mean grade	11
Cognitive score (MMSE), mean, points	27
Comorbid conditions, mean No.	2.4

*Data are given as percentages unless otherwise indicated. MMSE indicates Mini-Mental State Examination; SEE, Salisbury Eye Examination Project. The scores for the MMSE ranged from 18 to 30 as baseline.

Table 2. Mean and SD of Performance-Based Outcome Measures of Function

Domain and Outcome	Mean Value	Value of ± 1 SD Around the Mean
Mobility		
Walk 4 m, m/s	0.84	0.61-1.08
Ascend 7 steps, steps/s	0.90	0.65-1.15
Descend 7 steps, steps/s	0.86	0.58-1.14
Chair ascent/step (time to finish task), s	11.0	8.55-15.38
Daily living tasks*		
Insert plug, s	6.25	4.52-10.10
Insert key, s	11.0	7.81-18.52
Dial telephone No., s	7.04	5.13-11.24
Visually intensive tasks		
Reading speed, words/min	157.6	90.1-225.1
Face recognition, No. of faces	11.5	8.4-14.6

*Data are recorded as the time to finish the assigned task.

substantial spread of visual acuity scores in those with contrast sensitivity below 1.65 log units (36 letters) (**Figure 1**). Overall, the correlation was 0.81 with an R^2 of 0.66. (Data shown for right eye.)

For all the functional outcomes, the relationship with either visual acuity or contrast sensitivity was close to linear, or linear with changes in the slope. There was no evidence for a threshold of either acuity or contrast sensitivity below which a sharp decrement in performance was observed; rather, gradual declines in performance were observed concomitant with modest decrements in visual acu-

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correction followed by best correction after subjective refraction. Visual acuity was scored as the number of letters read correctly, and converted to logMAR scores (logMAR is the logarithm of the minimum angle of resolution). Contrast sensitivity was measured with the Pelli-Robson letter sensitivity test, scored as number of letters read correctly. These data are reported as log contrast sensitivity (with the number of letters read of 48 letters indicated). Our previous article demonstrated that models using vision in the better seeing eye were as good as models using measures of binocular visual acuity in predicting self-reported function.[1] Other analyses also indicated negligible contribution from the worse seeing eye in models of contrast sensitivity loss and function. Therefore, for these analyses, we used presenting acuity and contrast sensitivity in the better seeing eye.

OUTCOME MEASURES: PERFORMANCE ON TASKS

Details on the tasks and scoring procedures are described elsewhere.[12,13] For the purposes of this study, we chose performance-based tests in 3 categories: mobility, tasks of daily living that require a visual component, and visually intensive tasks. Four measures of mobility were included: a timed 4-m walk, a timed stair ascent, stair descent, and a timed get-up-and-go test (the latter requires the participant to get up from a chair with arms, and step away from the chair). The tasks of daily living included 3 timed measures: inserting a key in a lock, inserting a plug in a socket, and dialing a rotary telephone. The times to complete the task for mobility items and items of daily living were converted to speed. All tasks were performed in the clinic under standard conditions, including lighting between 400 and 600 lux. The visually intensive tasks included face recognition and reading speed. Face recognition involved presenting participants with a panel of 4 faces (3 of the same individual) in different poses, and having them select the one that differed from the other 3.[1] The faces subtended 2.5° (horizontal) by 3.2° (vertical). Fifteen sets of panels were presented on a monochrome monitor. Data were recorded as number of faces identified correctly. Reading speed involved reading aloud short passages of text presented on a computer screen for 15 seconds. Four print sizes were tested; data for newsprint-sized text of 0.26° were used in these analyses. Reading speed was calculated as the number of words read correctly per minute.

DATA ANALYSES

The association between contrast sensitivity and visual acuity was examined using a plot of logMAR vs contrast for right eyes, with correlation coefficient and R^2 calculated to determine the degree of independence of the 2 measures. The distributions of the speeds for the functional tests, and the score for face recognition, were examined for normalcy. All speeds of task performance were converted to z scores by subtracting the mean and dividing by the SE to permit meaningful comparisons. Simple smoothed graphs, followed by linear spline regression analyses that adjusted for age, sex, race, education, cognition, and number of comorbid conditions, were done. Linear regression analyses were carried out to determine the joint and unique contribution of visual acuity and contrast sensitivity loss, adjusted for other predictors, to disability. The unit of change was 0.1 logMAR for visual acuity, equivalent to 1 line change, and 0.05 log contrast sensitivity, equivalent to 1 letter for contrast sensitivity.

To characterize disability, we used a cutoff of 1 SD below the population mean for performance on a test. Receiver operating characteristic (ROC) curves were used to evaluate the sensitivity and specificity of acuity and/or contrast sensitivity loss for predicting disability at this level of dichotomization. Graphs were also created of the proportion disabled by level of visual acuity and contrast sensitivity decrement.

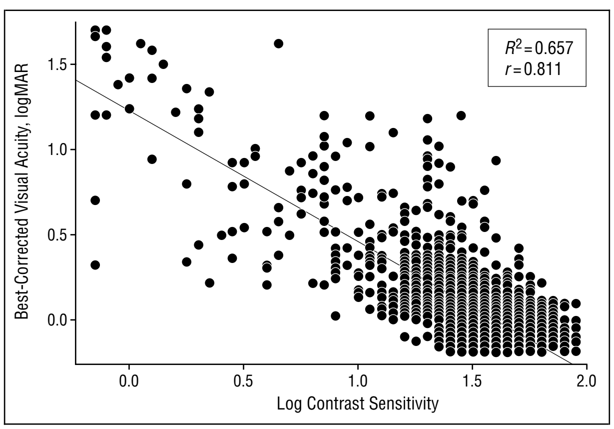

Figure 1. Correlation between logMAR visual acuity and log contrast sensitivity in the right eyes of the participants.

ity or contrast sensitivity. An example of a linear relationship with a change in slope (where a spline regression was appropriate) is shown in **Figure 2**A, where the slope of the relationship with speed of plug insertion changes with loss of contrast sensitivity. A straight linear relationship is typified by Figure 2B, the relationship between logMAR visual acuity and number of faces read correctly.

We created linear regression models, including spline terms where significant, for visual acuity and contrast sensitivity separately for each of the outcome measures (**Table 3**). For all the outcome measures (transformed into z scores so change is per SD unit), significant associations were observed with age, race, sex, cognitive score, and number of comorbid conditions, as well as the vision variables, and these confounders were also included.

To investigate the independent contributions of visual acuity loss and contrast loss, both variables were included in final models for each outcome in the set of mobility items, activities of daily living items, and visually intensive tasks (**Table 4**). All outcomes were significantly related to both measures of vision, except visual acuity was unrelated to decreased speed of stair ascent or descend once contrast sensitivity was included in the model. These data suggest that for daily living tasks and reading speed, the sharpest declines were associated with a contrast sensitivity between 0.85 and 1.60 log units (20-35 of 48 letters). For daily living tasks, decrements were observed until visual acuity was about 0.7 logMAR (20/100); for reading speed, the sharpest declines were observed until visual acuity reached about 0.5 logMAR (20/60), then leveled off.

Except possibly for reading speed, there are no commonly accepted performance standards for "disability" that

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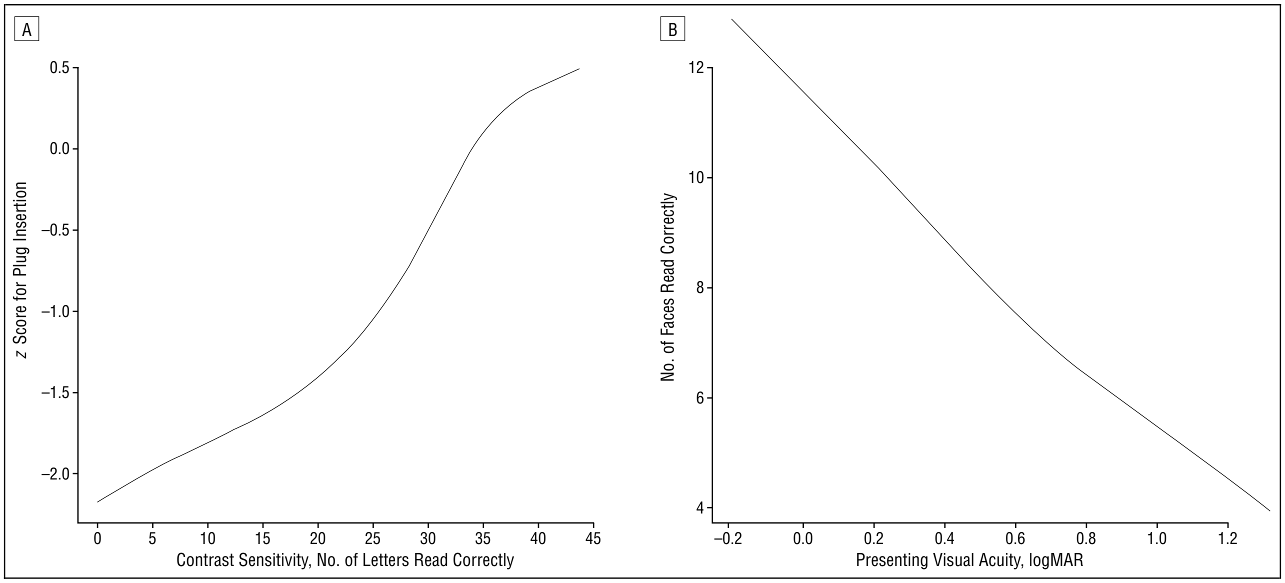

Figure 2. A, Smoothed graph of the relationship between contrast sensitivity in the better eye and the score for speed of inserting a plug. B, Smoothed graph of the relationship between visual acuity in the better eye and the number of faces read correctly on the face recognition test.

Table 3. Regression Models of Associations Between Visual Acuity and Contrast Sensitivity Loss and Performance-Based Tests of Function*

	Visual Acuity per 0.1 Change in logMAR		Contrast Sensitivity per 0.05 log Contrast	
Outcome	(Value of Acuity) β Coefficient	*P* Value	β Coefficient	*P* Value
Mobility				
4-m Walk	(<0.4) −0.074	<.001	0.03	<.001
	(0.4+) −0.019	.34		
Chair stand	(<0.4) −0.074	<.001	0.03	<.001
	(0.4+) −0.014	.49		
Stair ascent	−0.058	<.001	0.04	<.001
Stair descent	−0.063	<.001	0.04	<.001
Daily living tasks				
Plug insertion	−0.123	<.001	(<20) 0.02	.18
			(20-35) 0.94	<.001
			(35+) −0.01	.28
Key insertion	(<0.7) −0.104	<.001	0.04	<.001
	(0.7+) −0.018	.59		
Dial telephone No.	(<0.7) −0.101	<.001	(<20) 0.01	.63
	(0.7+) −0.013	.72	(20-35) 0.06	<.001
			(35+) 0.01	.39
Visually intensive tasks				
Face recognition	−0.44	<.001	0.16	<.001
Reading speed	(<0) −7.3	<.001	(<20)† . . .	.01
	(0–<0.477) −29.6	<.001	(20-35) 9.77	.001
	(<0.477+) 0.3	.79	(35+) 0.6	.34

*Data were adjusted for age, sex, race, educational level, cognitive score, and the number of comorbid conditions. The numbers in parentheses are the locations of significant changes in the regression lines.
†No one with this level of contrast sensitivity read any letters. Ellipsis indicates not applicable.

Table 4. Joint Contribution of Visual Acuity Loss and Contrast Sensitivity Loss to Performance*

	logMAR Visual Acuity		Contrast Sensitivity	
Outcome	(Value of Acuity) β Coefficient	*P* Value	β Coefficient	*P* Value
Mobility				
4-m Walk	(<0.4) −0.053	<.001	0.018	.002
	(0.4+) 0.012	.60		
Chair stand	(<0.4) −0.055	<.001	0.021	.003
	(0.4+) 0.022	.35		
Stair ascent	−0.022	.09	0.031	<.001
Stair descent	−0.021	.08	0.033	<.001
Daily living tasks				
Plug insertion	−0.080	<.001	(<20) −0.015	.33
			(20-35) 0.066	<.001
			(35+) −0.020	.14
Key insertion	(<0.7) −0.086	<.001	.020	.002
	(0.7+) 0.028	.46		
Dial telephone No.	(<0.7) −0.077	<.001	(<20) 0.018	.47
	(0.7+) 0.050	.40	(20-35) 0.033	<.001
			(35+) .004	.68
Visually intensive tasks				
Face recognition	−0.361	<.001	.074	<.001
Reading speed	(<0) −7.04	<.001	(<20)† . . .	<.001
	(0 −<.477) −26.2	<.001	(20-35) 3.47	<.001
	(<0.477+) −0.99	.61	(35+) 0.03	.96

*The numbers in parentheses are the locations of significant changes in the regression lines.
†No one with this level of contrast sensitivity read any letters. Ellipsis indicates not applicable.

could be applied to our data. Therefore, we arbitrarily defined disability for each outcome as the value at 1 SD below the mean value (the values are shown in Table 1). The essentially linear relationship between visual loss and functional loss, and the effect of other comorbid conditions besides visual loss on these functional decrements, suggested that there is no optimal cutoff for either visual acuity or contrast that was both highly sensitive and highly specific for disability in these domains. The ROC curves for each outcome confirm this (**Figure 3**). Except for reading, where for example at logMAR visual acuity value 0.176 there was 50% sensitivity and over 95% specificity, the other outcomes have true- and false-positive rates that are almost equal. Thus, for any arbitrarily defined cutoff for disabling visual acuity loss, there would be persons with less visual

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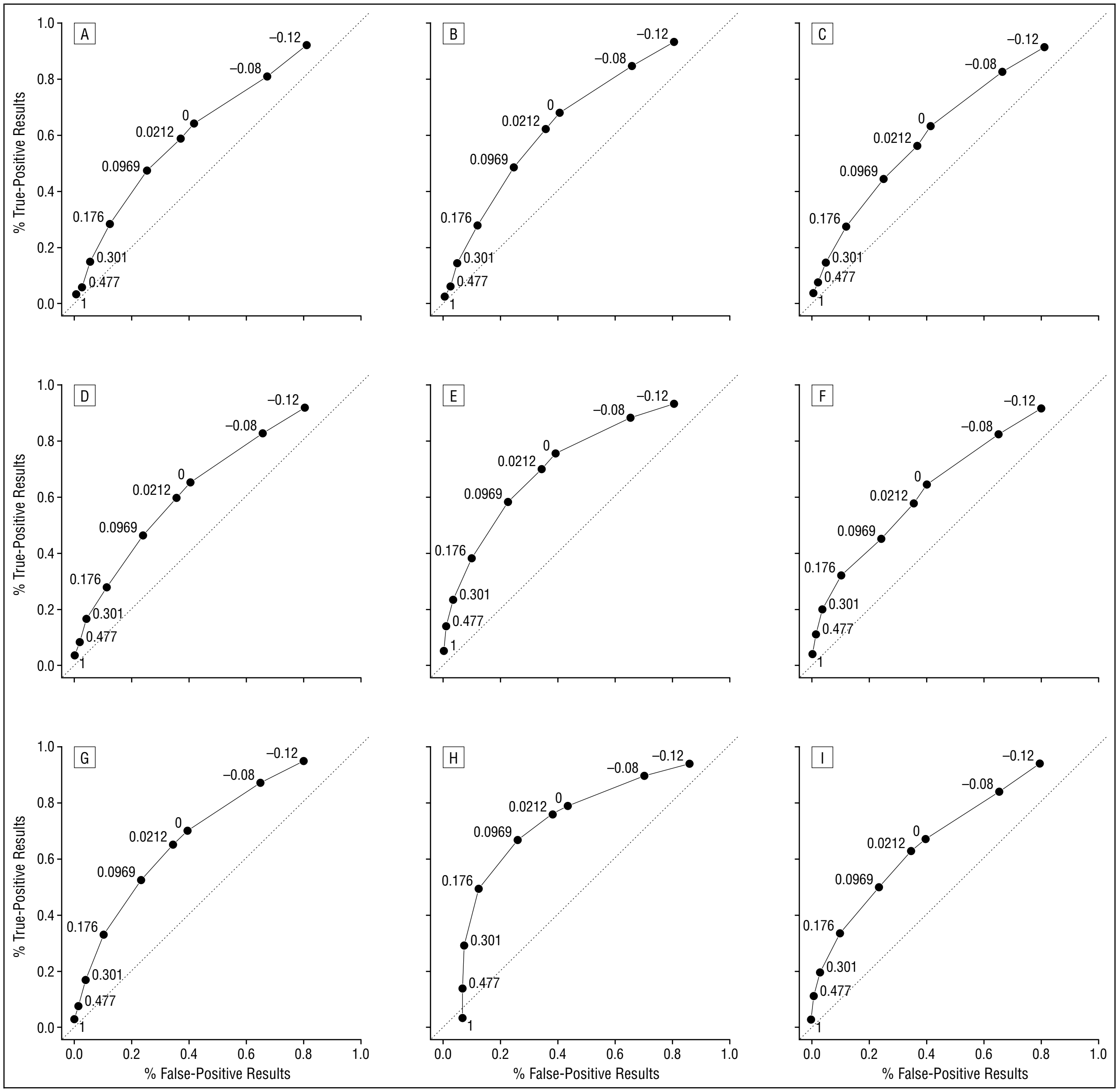

Figure 3. The level of visual acuity and the percentage of subjects labeled "disabled" on the following everyday tasks: walking speed (A), chair stand (B), stair ascent (C), stair descent (D), plug insertion (E), key insertion (F), dialing a telephone (G), reading speed (H), and face recognition (I).

loss with only slightly less risk of disability. Similar ROC curves were observed for contrast sensitivity (data not shown).

In light of these findings, we took another approach to evaluating the effect of visual acuity and contrast sensitivity loss on disability: the determination of the level of visual acuity loss or loss of contrast sensitivity at which more than half of the affected population would be expected to be disabled (ie, performing at levels <1 SD below that of the population mean). For each of the domains, that level was different, as might be expected by the visual demands of the tasks (**Table 5**). Mobility was unaffected by visual acuity loss until levels worse than 1.0 logMAR (20/200) and even then, a sizable number were not disabled. However, for daily living tasks and visually intensive tasks, the cutoff point for 50% disabled occurred at more modest levels of visual acuity and contrast sensitivity loss. Disability in reading, that is, reading fewer than 90 words per minute, was observed in the 50% of the population with visual acuity worse than 0.2 logMAR (20/30) and in 90% of those with acuity worse than 0.3 logMAR (20/40). Disability in reading speed was also sensitive to contrast sensitivity loss, with 50% disabled among those with contrast sensitivity of 1.4 log units or worse (seeing ≤31 letters), and 90% disabled among those with contrast sensitivity of 0.55 log units (14 letters) or fewer.

COMMENT

The loss of vision has been associated with numerous deleterious outcomes, from decrements in self-report of function,[3-7,19,20] use of social services,[21] nursing home admissions,[22] and even mortality.[23-25] However, few population-

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based studies have attempted to determine the effect of vision on actual performance in tasks of everyday life. Performance-based tests of function provide data that is different from self-reported function in several important ways.[26] First, standardized testing provides a continuous measure of performance across the population that is not subject to vagaries of self-report. Self-report of function combines an individual's assessment of his or her ability, his or her expectation of that ability, and his or her understanding of the degree of difficulty involved in carrying out the task in the presence of any limitations. Performance-based testing requires the individual to simply do the task. Second, it has been argued that cognitively impaired persons can perform a task, whereas self-report of difficulty performing the task may be inaccurate. In our study, severe cognitive impairment was not an issue. Finally, performance-based tests usually provide a continuous measure of function that may be more sensitive to change over time compared with categorical data. Performance-based tests as carried out in research settings are criticized as unrepresentative as they are conducted under ideal conditions (lighting among others). However, we have found that performance at the clinic and the performance at home on the same tasks were highly correlated.[13] Moreover, normative data in representative populations enable the determination of performance levels that are distinctly poorer than the average performance. If curves indicating a sharp dropoff in performance were observed, it would enable ROC curve analyses to determine possible cutoff point values for visual loss that had good sensitivity and specificity for poor performance.

In our population-based study of 2520 persons aged from 65 to 84 years, we found reasonably normal distributions of performance on tasks in domains of mobility, activities of daily life, and visually intensive tasks (with the exception of the face recognition test, which was skewed to high performance). Moreover, both visual acuity and contrast sensitivity were significantly related to performance on all the tasks, except stair ascent and descent where contrast sensitivity alone predicted performance. Our data suggest that contrast sensitivity loss and visual acuity loss each contribute independently to decrements in performance. Together with other cofactors, the vision variables predicted anywhere from 21% to 57% of the variance associated with the outcome of interest.

Linear relationships between the functional tasks and visual acuity and contrast, with some spline regressions where the slope changed, were the best characterization of the association. Thus, decrements in visual acuity from 0.0 logMAR (20/20) or better, or in contrast from about 1.85 log units (40 letters), were likely to have a negative effect on performance, and any cutoff point to determine visual disability would be arbitrary. This finding was further supported by the use of ROC curve analyses.

To explore the issue of vision loss associated with functional disability using ROC curve analyses required us to define disability for these tests. We chose to define disability as performance less than 1 SD below the population mean. Our selection allowed us to have reasonable numbers in the disabled group, and yet have disability cutoff points that were marked. For example, the cutoff point of less than 1 SD defined as disabled those who read standard newsprint-size letters at fewer than 90 words per minute, or recognized about half the faces in the test, or required close to 19 seconds to insert a key into a lock. Regardless of the definition of disability, though, no level of vision (either visual acuity or contrast sensitivity) provided reasonable values for sensitivity and specificity in determining disability. This result was not surprising, given the nearly linear relationship of the vision variables with performance on the tasks, and the contribution of other factors to performance.

Table 5. Level of Visual Acuity and Contrast Sensitivity in the Better Eye Associated With at Least 50% of the Population With That Vision Performing in the Disabled Range*

Outcome	Disability Level	logMar Visual Acuity Deficit (Snellen Equivalent)	log Contrast Sensitivity (No. of Letters of 48 Letters)
Mobility			
4-m Walk, m/s	0.61	1.0 (20/200)	<0.6 (<14)
Chair stand, s	15.4	>1.0 (<20/20)	<0.6 (<14)
Stair ascent, steps 15	0.65	1.0 (20/200)	0.9 (21)
Stair descent, steps/s	0.58	0.7 (20/100)	1.2 (27)
Daily living tasks†			
Plug insertion, s	10.1	0.3 (20/40)	1.35 (30)
Key insertion, s	18.5	0.5 (20/60)	1.0 (23)
Dial telephone No., s	11.2	0.7 (20/100)	1.2 (27)
Visually intensive tasks			
Face recognition, No. of faces/total No.	8/15	0.3 (20/40)	1.3 (29)
Reading speed, words/min	90	0.2 (20/30)	1.4 (31)
Reading speed, words/min‡	90	0.3 (20/40)	0.6 (14)

*Values are less than 1 SD below the mean for the population. The outcome data are recorded as the time to finish the assigned task.
†Time is only for daily living tasks.
‡Instead of more than 50% with disability, the proportion is more than 90% with disability.

An alternative approach is proposed: determining at what level of visual acuity or contrast sensitivity loss more than 50% of the population is disabled (in our study, disabled was defined as performance on tasks 1 SD below the population mean, but it could be defined in other ways). Using this approach, the variation in level of visual acuity or contrast sensitivity loss is easily observed, according to the degree of visual demand required to do the task. For mobility tasks, less than 50% of persons are disabled until visual acuity becomes worse than 1.0 logMAR (20/200). We were unable to determine at what point beyond 1.0 logMAR the cutoff point would be reached because of small numbers in our population with vision worse than 1.0 logMAR.

However, for reading speed or face recognition, visual acuity loss as modest as 0.3 logMAR (20/40) and contrast sensitivity loss of 1.35 log units (30 letters) was associated with disability, values of impairment that are otherwise considered rather minor. Leat et al[27] suggest that a log contrast sensitivity score of less than 1.5 log units (33 letters) is impaired, while a score of 1.05 would result in disability. Our data suggest that the level of disability associated with vision loss is highly dependent on the task and the visual demands of the task. Thus, the use of an arbitrary cutoff point of visual impairment to define disability may well ignore disabilities experienced at lesser levels of visual acuity or contrast loss.

There are limitations to our study that must be discussed. First, this is a cross-sectional analysis of associa-

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tions. Because we do not know the time of visual loss or the onset of difficulty in performing tasks, these associations should not be interpreted as causal. Moreover, it is likely that those with visual loss of longer duration have arrived at compensatory strategies for performing tasks that persons with more recent onset have not yet learned. It will be critical to add a longitudinal component to this study.

In addition, the level of visual acuity or contrast sensitivity loss associated with disability will be sensitive to the definition of disability. The question of whether a significant slowing of speed in performing a task is a true problem in everyday life of our participants was not addressed. For a few, a reading speed of fewer than 90 words per minute was reported as not a significant problem, while others reported extreme difficulty or inability to read at such a speed.[28] For this analysis, we chose 1 SD below the mean, and that choice resulted in performances that were clearly abnormal. However, defining disability as 2 SDs below the mean would result in great loss of visual acuity and contrast sensitivity necessary for disability. Regardless of the cutoff point for disability, though, the same linear function will be operative.

Finally, many factors, apart from vision, have an effect on the ability of persons to perform everyday activities. In the SEE Project, we found that age, sex, race, education, and comorbid conditions also affected performance on tasks in several domains. Our study was carried out in an aging population, so it is not surprising that these other factors also are involved in the performance on tasks. We have tried to control for these factors by models that adjust for confounding. However, it is clear that using a visual acuity or contrast sensitivity cutoff point to predict performance on tests of function, even highly visually demanding tests, will never be able to simultaneously achieve reasonable sensitivity and specificity.

CONCLUSIONS

This study has documented the independent contributions of visual acuity and contrast sensitivity loss to decrease in performance in a variety of tasks of daily living. The relationships between visual loss and performance are essentially linear, with no obvious thresholds for sharp declines in performance. Using a population-based approach to defining disability, it is apparent that varying levels of visual acuity or contrast sensitivity loss that are associated with most of the population at that level of loss being disabled can vary, depending on the task. Choosing any cutoff point for disability is arbitrary. A more scientific approach to disability would consider the level of function for a given task that is required, and the likelihood that persons with visual acuity or contrast sensitivity impairments would be able to perform at that level.

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