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Visual Functioning and Quality of Life among the Elderly in Hong Kong

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Abstract

OBJECTIVES—To examine the association of visual functioning and health related quality of life (HRQOL) among the elderly community in Hong Kong

DESIGN—Baseline examination of a cohort study MrOs and MsOs (a large study for osteoporosis in men and women)

SETTING—Hong Kong community

PARTICIPANTS—Four thousand ambulatory community-dwelling Chinese men and women aged 65 years or above

MEASUREMENTS—HRQOL was assessed by Medical Outcomes Study Short Form-12 (SF-12), with physical component score (PCS) and mental component score (MCS). Demographics, medical history, mental status and quality of life were obtained from face to face interviews, using standard structured questionnaire. Visual functions: binocular visual acuity, contrast sensitivity and stereopsis were assessed by different visual tests after refraction corrections. Different visual functions were tested simultaneously in multiple ordinal logistic regression models.

RESULTS—Better binocular visual acuity, contrast sensitivity and stereopsis were associated with higher PCS. Visual acuity and contrast sensitivity was associated with PCS after adjustment of different visual functions and sex, age, education level, cognitive status and history of diabetes in multivariate analysis, (OR=0.73, 95% CI=0.54–0.98) for low vision (6/24) compared with 6/9 in visual acuity and (OR=1.34, 95% CI=1.09–1.64) for contrast sensitivity row b 5–8 (best) compared with 0–1 (worst). MCS was only associated with visual acuity and contrast sensitivity. But no association was found after adjustment.

CONCLUSION—Apparent association was found between visual functions and HRQOL among elderly community in Hong Kong. In addition to visual acuity, contrast sensitivity is also important so eye care should also cover.

Keywords

contrast sensitivity; elderly; quality of life; vision; visual acuity

INTRODUCTION

From World Health Organization (WHO) result in 2002, there were 161 million people visually impaired in the world, in which 124 million were low vision and 37 million were blind. More than 82% of them were 50 years old or above. Visual impairment in elderly was a serious problem globally. For Hong Kong elderly, only half for age 70–79 had normal vision and more seriously, only one-fourth for age 80 or above (Michon et al. 2002). Main causes of visual impairment were cataract, macular degeneration and glaucoma. Visual functions decline when age increases with presence of eye diseases, so activities of daily life are influenced, which results in decline of quality of life (QOL).

It is clear that reduced vision status is associated with lower QOL. QOL including self care, mobility, social and mental functions showed significantly correlation with visual acuity among cataract patients in Hong Kong. Similar result also appeared for the unoperated cataract patients (Lau et al. 2002). However, study for glaucoma patients, visual acuity did not show association with quality of life (GQL-15), while contrast sensitivity and stereopsis showed the association ($r=-0.3$, $p=0.016$ and $r=0.26$, $p=0.044$ respectively) (Nelson et al. 2003).

To investigate the relationship of vision and QOL, visual acuity, being primary indicator of vision assessment is not good enough. Findings showed that many people with good acuity are effectively visually impaired in performing everyday tasks involving low and changing light levels, stereopsis, glare, and low contrast. Vision under non-ideal conditions cannot be predicted from standard acuity on an individual basis (Brabyn et al. 2001). To improve quality of life of elderly, solely concerning visual acuity is not enough, other visual functions like contrast sensitivity and stereopsis should also be included.

Association of different visual functions and health related quality of life (HRQOL) among elderly community were studied in other countries but not in Hong Kong. Such association only investigated among patients with eye diseases or low vision, so the objective of the current research is to find the association of visual functioning and HRQOL among the elderly community in Hong Kong

This study used the baseline data of a cohort bone health study MrOs & MsOs (a large study for osteoporosis in men and women), done by The Chinese University of Hong Kong Jockey Club Centre for Osteoporosis Care and Control.

SUBJECTS AND METHODS

Four thousand ambulatory community-dwelling Hong Kong Chinese men and women who were 65 years and older, were recruited. Stratified samples for age 65–69, 70–74 and 75 or above were recruited in equal proportions through advertisements and health talks. The study was approved by the Clinical Research Ethics Committee of the Chinese University of Hong Kong and informed consent was obtained prior to data collection.

General Characteristics

Demographics such as age, education and medical history especially eye diseases were obtained. Depression was diagnosed by using a validated Chinese version of the Geriatric

Depression Scale (GDS), with depression being defined as a score of 8 or more (Lee et al. 1993).

Quality of Life

Quality of life (QOL) measure can be broadly divided into two classes: generic and disease- (e.g., vision-) specific. Though vision-specific QOL is more sensitive to detect subtle changes in vision and vision impairment, generic HRQOL permits comparison among different diseases (National Research Council 2005). Medical Outcomes Study Short Form-36 (SF-36) was well recognized and was used as the measure of general health-related quality of life (HRQOL) in National Institutes of Health-funded Ocular Hypertension Treatment Study and the Collaborative Longitudinal Evaluation of Kerataconus study (CLEK).

In this study HRQOL were evaluated by the short form 12 (SF-12), which derives summary scores from specific items from the eight domains of the SF-36, with physical component summary score (PCS) (summary of physical functioning, role-physical, bodily pain and general health) and mental component summary score (MCS) (summary of vitality, social functioning, role-emotional and mental health) (Ware et al. 2002) highly correlated with that of SF-36 (0.951 and 0.969 respectively). Such difference is not as important for large group study (e.g., n=500) (Ware et al. 1996). SF-12 is of equally reliable and sensitive as SF-36 in a study for post-infarction population (Melville et al. 2003).

Visual Functions

Visual tests were measured at constant illumination for both eyes and the participants were wearing their own suitable eyeglasses for refraction corrections.

Visual Acuity—Binocular visual acuity was measured by Snellen tumbling E chart (Clement Clarke, London, UK). Subjects were tested 6 meters apart from the chart. If they could not read even the largest, they would move to 3 meters apart. Subjects were asked to recognize the E direction from the biggest to the smallest line they could correctly recognize.

Contrast Sensitivity—Contrast sensitivity was measured by Vectorvision CSV-1000E chart (Vectorvision, Ohio, USA). Subjects seated 8 feet far from the chart and if they could not see, they would move forward to 4 feet apart. This measures contrast sensitivity at four spatial frequency (3, 6, 12 and 18 cycles per degree (cpd)) and grades it from 1 (highest contrast) to 8 (lowest contrast).

Stereopsis—Stereopsis was measured by the Frisby Stereo test (Clement Clarke International, London, United Kingdom). Subjects were tested 40cm far from the plate, if they failed to recognize, they viewed them at 30cm. This test consists of three transparent plates (1.5mm, 3 mm, and 6 mm thick) marked with four different pattern squares.

Cognitive Status

Cognitive status was measured by Mini-Mental Status Examination (MMSE), which was modified and validated for Hong Kong Chinese (Chiu 1994). MMSE <24 is defined as cognitive impaired (Iddon et al. 1999).

Data Collection Method

Information of general characteristics, quality of life and mental status were obtained by a standard structured questionnaire administered to the subject. Visual data were measured by trained staffs. All data were collected in one visit.

STATISTICAL METHODS

Descriptive statistics were presented in different genders; t-tests were used for continuous variables and chi-square tests for categorical variables to test difference between genders. Visual acuity and stereopsis data were skewed and so they were categorized for analyses. Visual acuity was classified into 3 groups: (1) 6/9, (2) 6/12–6/18, (3) 6/24 (which is defined as low vision by WHO). Stereopsis was also classified into 3 groups: (1) 85 (best), (2) 151–340 (moderate), (3) >604 sec of arc (worst).

For univariate analyses, risk factors were analyzed among quartiles of PCS or MCS. ANOVA were used for continuous risk factors while chi-square tests for trend for categorical risk factors.

Multicollinearity tests were performed and found three visual functions though correlated, but showed no evidence of multicollinearity and hence suitable for multivariate analysis. Three visual functions: visual acuity, contrast sensitivity and stereopsis and other risk factors including demographics, cognitive status and medical history (except eye diseases) were put into multiple ordinal logistic regressions. History of eye diseases was not put into multivariate analysis though associated, but as being path of association between QOL and visual functions. For contrast sensitivity, only row b (6 cpd) was used in multivariate analyses as similar results were found among four spatial frequencies but row b was most predictive and significant. Moreover, row b (6 cpd) is defined as functional acuity (Vectorvision CSV-1000 product manual). It was classified into 3 groups: (1) 0–1 (worst), (2) 2–4 (moderate), (3) 5–8 (best).

All statistical analyses were performed using the statistical package SAS, version 9.1 (SAS Institute, Inc., Cary, North Carolina). Alpha level of 5% was used as the level of significance.

RESULTS

The characteristics of male and female subjects are shown in table 1. The mean age of the study subjects was 72.5 (range: 65 to 98). Female subjects were significantly more living alone (20.2% vs. 7.2%), single, divorced, separated or widowed (46.6% vs. 12%); cognitive impaired (39.3% vs. 11.4%), having history of cataract (48.2% vs. 31.7%); but lower educated (secondary or above: 17.3% vs. 39.1%), PCS (mean=46.6 vs. 50.5) and MCS (mean=55.0 vs. 55.8) of HRQOL, self-rated overall health (good or excellent: 36.5% vs. 58%) and three visual functions (visual acuity 6/9: 67.7% vs. 77%; contrast sensitivity: 1.7–3.3 vs. 2.2–4.1; stereopsis 85 sec of arc: 71.8% vs. 76%).

Associations of PCS or MCS and risk factors are shown in table 2 and 3. Better binocular visual acuity, contrast sensitivity and stereopsis were significantly associated with higher PCS ($p<0.001$, $p<0.001$ and $p=0.043$ respectively). Male, younger age, higher education level, married or living in a married-like relationship, better cognitive status, no history of diabetes, glaucoma or cataracts were also associated with higher PCS. For MCS, only better binocular visual acuity and contrast sensitivity was found associated with higher MCS ($p=0.009$ and 0.005 – 0.158 respectively). Moreover, male, older age, higher education level,

living with others, better cognitive status and no history of glaucoma were significantly associated with higher MCS.

In multivariate analysis shown in table 4 and 5, better binocular visual acuity and better contrast sensitivity was associated with higher PCS after adjusting for confounders, adjusted OR=0.73 (95% CI=0.54, 0.98) for low vision compared with 6/9 in visual acuity and adjusted OR=1.34 (95% CI=1.09, 1.64) for 5–8 (best) compared with 0–1 (worst) in contrast sensitivity row b (6 cpd) (p-value for trend = 0.0007). No association was found between MCS and visual functions.

DISCUSSION

This is the first study to demonstrate the association of HRQOL and visual functions among the elderly community in Hong Kong. In the Blue Mountains Eye Study, better visual acuity was found associated with both higher PCS and MCS among the elderly living in the Blue Mountains region, west of Sydney, Australia (Chia et al. 2004). Lau et al. (2002) found the similar result among elderly undergone cataract surgery in Hong Kong. Our study found better visual acuity associated with higher PCS and MCS, which is consistent with the previous findings.

Nelson et al. (2003) found QOL was not associated with Snellen visual acuity ($r=-0.16$, $p=0.201$) but associated with contrast sensitivity ($r=-0.3$, $p=0.016$) among glaucoma patients. In our study, among the general older population, higher contrast sensitivity was associated with higher PCS even adjusted for the other confounders and two visual functions: visual acuity and stereopsis. Such finding had important implication that on top of visual acuity, contrast sensitivity was significant risk factor for PCS. Most of the previous studies investigated associations of different visual functions with QOL separately, but it is more informative by using multivariate analysis, showing different contributions from different visual functions on QOL.

Visual acuity was the strongest visual predictor of recreational activities, reading and fine handiwork domains while contrast sensitivity was the strongest visual predictor of the activities of daily living and driving domains (Walker et al. 2006). Such vision impairment leads to disability in activities of daily living, including both personal care tasks (e.g. bathing, dressing, eating) and instrumental tasks (e.g. shopping meal preparation, house-keeping) (Horowitz 2004). Moreover, vision is one of four sensory mechanisms to detect worries of balance and elderly people are more dependent on vision. Visual acuity and contrast sensitivity were associated with sway, which is strong predictor of falls (Rowan 2001). Functional disabilities caused by poor vision severely damage their physical health.

Many people even health care workers are only concerned about visual acuity, using high contrast letters to evaluate vision status, but such high contrast is almost never been seen in the world (AgingEye Time 2006). In daily life, non-optimal viewing conditions are encountered quite often; standard visual acuity actually underestimates the degree of visual function loss suffered by elderly (Brabyn et al. 2001, Haegerstrom-Portnoy et al. 1999, Margolis et al. 2002). On the contrary, contrast sensitivity can pick up losses that are not evident from measuring visual acuity, and it is sensitive to visual loss caused by cataracts, glaucoma and multiple sclerosis in subjects with little or no loss in visual acuity (Regan 1991). Moreover, low contrast spatial vision is strong predictor of future visual acuity loss. (Lord and Dayhew 2001, Schneek et al. 2004) So, visual acuity, as well as contrast sensitivity should be regarded as two primary measures (Garza-Reyes 2000).

Nelson et al. (2003) also found QOL was associated with stereopsis ($r=0.26$, $p=0.044$) among glaucoma patients. Another study found many older individuals had greatly reduced

stereopsis although visual acuity was reasonably well maintained on average (Haegerstrom-Portnoy et al. 1999). Our study also found better stereopsis associated with higher PCS, but not with MCS.

Previous studies found better visual functions associated with higher MCS. In Blue Mountains Eye Study, visual impairment was found having greater impact on mental than physical domains (Chia et al. 2004). In contrast, our study showed association of visual status was larger with PCS than with MCS. In our study, better visual acuity and contrast sensitivity were associated with higher MCS, while stereopsis was not. However, the magnitude of association was small and no significant association was found in any visual functions after adjustment in multivariate analysis. Such result may attribute to the healthy subjects. Subjects were good in mental health, so it could hardly show significant associations with visual functions. In a previous study among Hong Kong elderly, there were 71.7%, 52% and 26.9% for age 60–69, 70–79 and 80+ people having normal vision (6/18) (Michon et al. 2002). In our study, subjects' visual functions were very good in visual acuity (normal vision: 96.1% for male and 93.6% for female) and stereopsis (76% for male and 71.8% for female getting the highest score of the test) but rather poor in contrast sensitivity, below average in each of four rows. So the eye care especially for contrast sensitivity should be concerned, not only due to the significantly importance over visual acuity, but also because it was abnormally poor even in these healthy subjects.

The healthy subjects are the limitation of the study. As subjects were recruited through advertisements and health talks, they were more health conscious. Moreover, it was originally a cohort bone health study and the inclusion criteria was walking without aids, so subjects recruited were of no major visual problems and hence underestimated the associations. Furthermore, the cross-sectional design of this study can just show the association but not causal relationship between QOL and visual functions. In our study, HRQOL outcomes were limited to PCS and MCS as SF-12 was adopted. It is more informative if SF-36 is used, with 8 domains included.

HRQOL among elderly is needed to draw the public attention in Hong Kong since psychological issue has long been a serious public health problem, which severely affects elderly mentally, as well as their daily living. When age increases, visual functions decrease (Rumsey 1993) and hence decreases one's QOL (Goldberg 2004, Stelmack 2001, Tsai et al. 2004). This is a foreseeable trend that when the Hong Kong population is aging, the problem will be much more serious in the future, being not only an individual health problem, but also a public economic burden. To cope with this, suitable eye services are essential and many have been proven effective to improve QOL for people with visual impairment (Brenner et al. 1993, Mangione et al. 1994, Tsai et al. 2004). Visual acuity, contrast sensitivity and stereopsis were used to access risk of falls in many studies (Ivers et al. 1998, Lord and Dayhew 2001, Rowan 2001). In the QOL point of view, a set of comprehensive eye care services is also needed.

In conclusion, visual functions were associated with HRQOL among elderly in Hong Kong. Other than visual acuity, contrast sensitivity is also important that a comprehensive eye care should cover in order to improve QOL, which is hot issue worldwide.

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Table 1

Characteristics of Study Subjects

Variable	Mean(SD)/ Percentage (%)		p-value*
	Male (N=2000)	Female (N=2000)	
Demographics			
Age			
65–69	33.2%	33.5%	0.254
70–74	35.4%	33.3%	
75+	31.4%	33.3%	
Mean (SD)	72.4 (5.0)	72.6 (5.4)	
Education level			<0.001
Primary or below	60.4%	82.8%	
Secondary / Matriculation	26.1%	11.3%	
University or above	13.6%	6.0%	
Marital status			<0.001
Married or living in a married-like relationship	88.0%	53.5%	
Single, divorced, separated or widowed	12.0%	46.6%	
Living status			<0.001
Live alone	7.2%	20.2%	
Live with spouse, family members, or a roommate	92.9%	79.9%	
Cognitive status			
MMSE (Mini-Mental State Examination)			
<24 (cognitive impaired)	11.4%	39.3%	<0.001
24 (normal)	88.7%	60.8%	
Mean (SD)	27.0 (2.8)	24.3 (4.0)	
Medical history			
Diabetes	14.7%	14.3%	0.753
Glaucoma	3.8%	4.6%	0.179
Cataracts	31.7%	48.2%	<0.001
Depression	8.5%	10.2%	0.064
Arthritis	24.3%	21.9%	0.072
Hypertension	41.8%	43.6%	0.263
Cardiovascular disease	18.3%	16.5%	0.133
Quality of life			
SF12-PCS (Physical Component Summary)	50.5 (7.6)	46.6 (8.8)	<0.001
SF12-MCS (Mental Component Summary)	55.8 (6.8)	55.0 (7.8)	0.001
Overall health			<0.001
Excellent for my age	14.7%	4.4%	
Good for my age	43.3%	32.1%	
Fair for my age	37.5%	53.3%	
Poor for my age	4.1%	9.3%	
Very poor for my age	0.5%	1.1%	

Variable	Mean(SD)/ Percentage (%)		p-value*
	Male (N=2000)	Female (N=2000)	
Visual function			
Binocular visual acuity			<0.001
6/9	77.0%	67.7%	
6/12–6/18	19.2%	26.0%	
6/24 (low vision)	3.9%	6.4%	
Contrast sensitivity			
Row a (3 cpd)	4.1 (2.4)	3.3 (2.2)	<0.001
Row b (6 cpd)	2.9 (2.0)	2.4 (1.8)	<0.001
Row c (12 cpd)	2.2 (2.1)	1.7 (1.8)	<0.001
Row d (18 cpd)	2.2 (1.9)	1.7 (1.8)	<0.001
Stereopsis (sec of arc)			0.003
85 (best)	76.0%	71.8%	
151–340 (moderate)	15.7%	19.8%	
> 604 (worst)	8.4%	8.5%	

* p-value of t-test for continuous variables or Chi-square for categorical variables where appropriate

Table 2

Characteristics among Quartiles of Physical Component Summary

Variable	Mean(SD)/ Percentage (%)				p-value*
	Q1 (N= 1000)	Q2 (N= 1067)	Q3 (N= 1227)	Q4 (N= 706)	
Demographics					
Female	65.8%	53.2%	43.3%	34.4%	<0.001
Age	73.0 (5.3)	72.0 (5.0)	72.6 (5.3)	72.3 (5.2)	<0.001
Education level					<0.001
Primary or below	78.0%	74.4%	66.2%	67.6%	
Secondary / Matriculation	15.5%	17.2%	21.4%	20.8%	
University or above	6.5%	8.4%	12.5%	11.6%	
Married or living in a married-like relationship	66.0%	70.6%	72.5%	74.5%	<0.001
Live alone	14.6%	13.1%	14.7%	11.3%	0.214
Cognitive status					
Cognitive impaired (MMSE<24)	33.7%	26.9%	21.6%	17.4%	<0.001
Medical history					
Diabetes	17.1%	14.7%	14.1%	11.1%	0.002
Glaucoma	6.3%	3.7%	4.0%	2.3%	<0.001
Cataracts	48.1%	39.6%	37.1%	33.7%	<0.001
Depression	17.4%	8.2%	6.3%	4.8%	<0.001
Arthritis	32.1%	22.8%	18.9%	17.9%	<0.001
Hypertension	44.6%	45.7%	39.7%	40.5%	0.060
Cardiovascular disease	23.7%	16.5%	15.2%	13.7%	<0.001
Visual function					
Binocular visual acuity					<0.001
6/9	66.1%	71.3%	76.5%	75.6%	
6/12–6/18	26.3%	23.8%	19.6%	20.5%	
6/24 (low vision)	7.6%	4.9%	4.0%	3.8%	
Contrast sensitivity					
Row a (3 cpd)	3.3 (2.3)	3.6 (2.3)	3.9 (2.3)	4.1 (2.4)	<0.001

Variable	Mean(SD)/ Percentage (%)				p-value *
	Q1 (<i><44.5</i>) (N= 1000)	Q2 (44.6–49.1) (N= 1067)	Q3 (49.2–56.6) (N= 1227)	Q4 (<i>>56.6</i>) (N= 706)	
Row b (6 cpd)	2.3 (1.8)	2.6 (1.9)	2.8 (2.0)	3.0 (2.0)	<0.001
Row c (12 cpd)	1.6 (1.8)	2.0 (2.0)	2.1 (2.0)	2.2 (2.1)	<0.001
Row d (18 cpd)	1.6 (1.8)	2.0 (1.8)	2.1 (1.9)	2.2 (1.9)	<0.001
Stereopsis (sec of arc)					0.043
85 (best)	71.6%	74.0%	75.3%	74.5%	
151–340 (moderate)	18.9%	17.3%	16.9%	18.0%	
> 604 (worst)	9.5%	8.7%	7.8%	7.5%	

* p-value of ANOVA for continuous variables or Chi-square test for trend for categorical variables where appropriate

Table 3

Characteristics among Quartiles of Mental Component Summary

Variable	Mean(SD)/ Percentage (%)				p-value*
	Q1 (<small><53.7</small>) (N= 1000)	Q2 (<small>53.7–57.8</small>) (N= 1328)	Q3 (<small>57.9–59.8</small>) (N= 672)	Q4 (<small>>59.8</small>) (N= 1000)	
Demographics					
Female	54.4%	46.2%	50.6%	50.2%	0.004
Age	72.5 (5.1)	72.1 (5.1)	72.7 (5.3)	72.8 (5.2)	0.004
Education level					0.002
Primary or below	75.6%	69.8%	70.5%	70.6%	
Secondary / Matriculation	16.0%	20.9%	17.3%	19.4%	
University or above	8.4%	9.3%	12.2%	10.0%	
Married or living in a married-like relationship	68.5%	73.3%	70.4%	69.7%	0.131
Live alone	16.5%	11.5%	14.1%	13.4%	0.005
Cognitive status					
Cognitive impaired (MMSE<24)	31.3%	21.2%	25.9%	24.4%	<0.001
Medical history					
Diabetes	15.7%	13.5%	12.5%	15.9%	0.274
Glaucoma	5.5%	2.9%	5.1%	3.9%	0.028
Cataracts	42.1%	38.1%	39.4%	40.4%	0.139
Depression	24.2%	5.4%	3.7%	3.4%	<0.001
Arthritis	25.2%	21.6%	21.3%	24.0%	0.089
Hypertension	43.3%	42.4%	43.3%	42.0%	0.641
Cardiovascular disease	21.4%	15.6%	15.5%	17.1%	0.0002
Visual function					
Binocular visual acuity					0.009
6/9	69.2%	74.1%	72.2%	73.3%	
6/12–6/18	24.6%	21.2%	22.3%	22.4%	
6/24 (low vision)	6.2%	4.7%	5.5%	4.3%	
Contrast sensitivity					
Row a (3 cpd)	3.5 (2.4)	3.9 (2.3)	3.6 (2.4)	3.7 (2.3)	0.005

Variable	Mean(SD)/ Percentage (%)				p-value *
	Q1 (<53.7 (N= 1000)	Q2 (53.7–57.8) (N= 1328)	Q3 (57.9–59.8) (N= 672)	Q4 (>59.8 (N= 1000)	
Row b (6 cpd)	2.5 (1.9)	2.8 (1.9)	2.6 (1.9)	2.7 (1.9)	0.016
Row c (12 cpd)	1.8 (1.9)	2.1 (2.0)	1.9 (2.0)	1.9 (1.9)	0.021
Row d (18 cpd)	1.9 (1.9)	2.1 (1.9)	1.9 (1.9)	1.9 (1.8)	0.158
Stereopsis (sec of arc)					0.359
85 (best)	72.9%	74.0%	71.1%	76.6%	
151–340 (moderate)	18.3%	17.3%	20.1%	16.0%	
> 604 (worst)	8.8%	8.7%	8.8%	7.4%	

* p-value of ANOVA for continuous variables or Chi-square test for trend for categorical variables where appropriate

Table 4

Multiple Ordinal Logistic Regression of Physical Component Summary

Variable	Percentage (%)				Adj. OR (95%CI)	p-value
	Q1 (<u><44.5</u>) (N= 1000)	Q2 (44.6-49.1) (N= 1067)	Q3 (49.2-56.6) (N= 1227)	Q4 (<u>>56.6</u>) (N= 706)		
Visual function						
Binocular visual acuity						
6/9	66.1%	71.3%	76.5%	75.6%	1	
6/12-6/18	26.3%	23.8%	19.6%	20.5%	0.92 (0.79, 1.08)	0.304
6/24 (low vision)	7.6%	4.9%	4.0%	3.8%	0.73 (0.54, 0.98)	0.039
p-value for trend = 0.240						
Contrast sensitivity row b (6 cpd)						
0-1 (worst)	34.5%	27.9%	26.9%	23.1%	1	
2-4 (moderate)	53.4%	56.4%	54.0%	55.5%	1.05 (0.90, 1.23)	0.565
5-8 (best)	12.1%	15.7%	19.2%	21.4%	1.34 (1.09, 1.64)	0.005
p-value for trend = 0.0007						
Stereopsis (sec of arc)						
85 (best)	71.6%	74.0%	75.3%	74.5%	1	
151-340 (moderate)	18.9%	17.3%	16.9%	18.0%	1.08 (0.93, 1.26)	0.324
> 604 (worst)	9.5%	8.7%	7.8%	7.5%	0.98 (0.78, 1.22)	0.822
p-value for trend = 0.728						

Result of multiple ordinal logistic regression are presented as the odds ratio (OR) of being in one higher quartile. Model also adjusts for sex, age, education level, cognitive status and history of diabetes, depression, arthritis, hypertension and cardiovascular disease.

Table 5

Multiple Ordinal Logistic Regression of Mental Component Summary

Variable	Percentage (%)				Adj. OR (95%CI)	p-value
	Q1 (<53.7) (N= 1000)	Q2 (53.7–57.8) (N= 1328)	Q3 (57.9–59.8) (N= 672)	Q4 (>59.8) (N= 1000)		
Visual function						
Binocular visual acuity						
6/9	69.2%	74.1%	72.2%	73.3%	1	
6/12–6/18	24.6%	21.2%	22.3%	22.4%	0.93 (0.80, 1.09)	0.390
6/24 (low vision)	6.2%	4.7%	5.5%	4.3%	0.85 (0.63, 1.14)	0.281
p-value for trend = 0.103						
Contrast sensitivity row b (6 cpd)						
0–1 (worst)	31.7%	24.5%	30.4%	29.0%	1	
2–4 (moderate)	53.3%	58.5%	51.5%	53.4%	0.91 (0.78, 1.07)	0.263
5–8 (best)	15.0%	17.0%	18.2%	17.6%	1.04 (0.84, 1.27)	0.739
p-value for trend = 0.607						
Stereopsis (sec of arc)						
85 (best)	72.9%	74.0%	71.1%	76.6%	1	
151–340 (moderate)	18.3%	17.3%	20.1%	16.0%	0.93 (0.79, 1.08)	0.332
> 604 (worst)	8.8%	8.7%	8.8%	7.4%	0.91 (0.73, 1.13)	0.386
p-value for trend = 0.355						

Result of multiple ordinal logistic regression are presented as the Odds ratio (OR) of being in one higher quartile. Model also adjusts for sex, age, education level, cognitive status and history of diabetes, depression, arthritis, hypertension and cardiovascular disease.