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# Associations of Eye Diseases and Symptoms with Self-Reported Physical and Mental Health

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## Abstract

**Purpose—**To study the associations of eye diseases and visual symptoms with the most widely used health-related quality of life (HRQOL) generic profile measure.

**Design—**HRQOL was assessed using the SF-36® version 1 survey administered to a sample of patients receiving care provided by a physician group practice association.

**Methods—**Eye dieases, ocular symptoms, and general health was assessed in a sample of patients from 48 physician groups. A total of 18,480 surveys were mailed out and 7,093 returned; 5,021of these had complete data. Multiple linear regression models were used to examine the decrements in self-reported physical and mental health associated with eye diseases and symptoms, including trouble seeing and blurred vision.

**Results—**Nine percent of the respondents had cataracts, 2% had age-related macular degeneration, 2% glaucoma, 8% blurred vision, and 13% trouble seeing. Trouble seeing and blurred vision both had statistically unique associations with worse scores on the SF-36 mental health summary score. Only trouble seeing had a significant association with the SF-36 physical health summary score. While these ocular symptoms were significantly associated with SF-36® scores, having an eye disease (cataracts, glaucoma, macular degeneration) was not, after adjusting for other variables in the model.

**Conclusions—**Our results suggest an important link between visual symptoms and general HRQOL. The study extends the findings of prior research to show that both trouble seeing and blurred vision have independent, measurable associations with HRQOL, while the presence of specific eye diseases may not.

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**D. Statement about Conformity with Author Information.** The study was approved by the RAND Institutional Review Board.

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The presence of eye diseases has had inconsistent associations with health-related quality of life (HRQOL). Several studies have shown strong associations between glaucoma and decreased HRQOL, but most other studies have failed to show similar results.[1–5] In contrast, HRQOL decrements have been shown to be independently and strongly associated with the presence of visual symptoms.[6] For example, trouble seeing and blurred vision have been found to be significantly related to functional limitations among older Americans, even after controlling for income, wealth, and co-morbid medical conditions.[7,8]

This study examines the associations of trouble seeing and blurred vision (as independent factors) with HRQOL among a sample of adults that includes youngeras well as older patients, controlling for multiple chronic conditions and the presence of specific eye diseases. The study includes 3 of the 4 eye diseases that are the leading causes of adult blindness and visual impairment in the United States: cataract, glaucoma, and macular degeneration.

## METHODS

### Study Design

Survey data was obtained from randomly selected patients receiving medical care from an independent association of physician groups located primarily in the western United States.[9] Of the 48 medical groups in the association participating in the study, 32 groups were located in Southern California, 10 groups were located in Northern California, and 21 groups were located in other states (Washington, Oregon, Texas, Arizona, and New Jersey). Patients at least 18 years of age and with a minimum of one provider visit during the 365 days prior to the study were considered eligible for the survey.

Each selected patient was mailed both Spanish and English language versions of a 12-page questionnaire and cover letter along with a $2 cash payment and a return envelope. One week later, each individual was mailed a reminder/thank you postcard. Two weeks later, non-respondents were mailed a second packet of materials and a reminder telephone call was attempted. Each non-respondent was called back a maximum of six times. A total of 18,480 surveys were mailed out and 7,093 returned. An overall response rate of 59% was achieved after adjusting for individuals who had moved (undeliverable surveys), had died, or were otherwise not eligible. Response rates across medical groups ranged from 46% to 73% and were not significantly associated with the participant's rating of health care received. The field period began in October 1994 and ended in June 1995.

Forty seven percent of respondents had visited a medical provider in the preceding 4 weeks, while 25% reported having had at least one prior referral for mental health care.

### Survey Instrument

A detailed description of the survey, including its psychometric properties, is reported elsewhere.[9] The questionnaire included 153 items assessing chronic medical conditions including eye diseases, symptoms, general health, and patient satisfaction with care. In addition, the survey contained items assessing age, gender, race/ethnicity, education, income, and insurance status. The survey took approximately 27 minutes on average to complete. A total of 5,021 individuals completed all aspects of the questionnaire and form the basis for the results reported here.

### Chronic Medical Conditions and Symptoms Measures

To evaluate the presence of chronic medical conditions, the survey provided a check-list that included heart disease, hypertension, diabetes, cancer (except skin cancer), chronic lung disease, and kidney disease. In addition, patients were asked about the presence of eye diseases

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and symptoms (see Table 1). For example, respondents were asked, “Do you now have any of the following conditions?” One of the items following the item stem was “Trouble seeing (even with glasses or contact lenses)” and another was “Blurred vision (even with glasses or contact lenses).”

### Health-related quality of life

Health-related quality of life was measured using the SF-36® version 1, which includes multi-item scales (35 items) that evaluate physical and mental health: physical functioning (10 items), role limitations caused by physical health problems (4 items), role limitations caused by emotional health problems (3 items), social functioning (2 items), emotional well-being (5 items), pain (2 items), energy/fatigue (4 items), and general health perceptions (5 items). An additional single item assesses change in the respondent’s health over the past year. The SF-36® can be summarized in terms of physical and mental health component summary scores (PCS and MCS).[10] The PCS and MCS were derived using scoring weights from an exploratory factor analysis by the developers of the SF-36®.[10]

### Analysis Plan

Multiple linear regression models were used to examine the decrements in SF-36 PCS and MCS associated with the eye conditions and symptoms, controlling for age, gender, race, education, income, and insurance status. The decrement in health associated with each ocular condition and symptom was estimated using the T-score metric of the SF-36 summary scores by examining unstandardized regression coefficients. We also evaluated whether there were significant interactions among the eye diseases, interactions between the eye symptoms and the number of eye diseases, and interactions between age and eye symptoms.

## RESULTS

Characteristics of the sample are given in Table 1. About a third (30%) of the patients had some form of arthritis or rheumatism, 28% had chronic allergies or sinus trouble, 25% had hypertension, 6% diabetes mellitus, and 3% kidney disease. Nine percent of the respondents had cataracts, 2% had age-related macular degeneration (ARMD), and 2% glaucoma. Less than 1% (0.4%) of the sample reported having all 3 of the eye diseases. The correlation between reporting trouble seeing and blurred vision was r = 0.62. Table 2 provides data on those who had different combinations of eye symptoms and number of eye diseases.

The results of the multivariate analyses of SF-36® PCS and MCS are reported in Table 3. The model presented included main effects because interaction terms (among eye diseases and between eye symptoms and age) were found to be not significant after adjusting for multiple comparisons. Table 3 contains only those independent variables found to be significant (*P* 0.05). Blanks indicate that the association was not statistically significant for that dependent variable. The numeric value for each of the individual variables in the table indicates the deviation from a standardized T-score. The SF-36 PCS and MCS are normed to have a mean of 50 and a SD of 10 in the U.S. general population. These deviations are relative to the reference group in the sample: age 30–39, female, white, private health insurance, college graduate, $70,000 or more income in the year, and without medical conditions or symptoms.

The regression models in Table 3 account for 45% of the adjusted variance in the SF-36 PCS and 14% of the adjusted variance in the SF-36 MCS. Of note, trouble seeing had statistically significant independent associations with both physical and mental health. Blurred vision was significantly associated with mental health but not physical health. Of equal import, there were no significantly associations of having an eye disease and HRQOL. In other words, while ocular

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symptoms were significantly associated with SF-36® scores, having glaucoma, macular degeneration, or cataract did not, after adjusting for other variables in the model.

Chronic lung disease, sciatica or chronic back problems, limitations in the use of an arm or a leg, arthritis or rheumatism, and liver trouble had the strongest associations with worse physical health. In contrast, trouble seeing and blurred vision along with stomach trouble and abnormal vaginal bleeding, had noteworthy associations with mental health.

## DISCUSSION

The results of this study are based on cross-sectional data collected over 10 years ago. Hence, strong inferences about the directionality of associations are not possible. Nonetheless, the findings confirm and extend prior studies that demonstrate the important linage of eye symptoms with general HRQOL. While not a comprehensive list of all possible eye symptoms, blurred vision and trouble seeing are commonly used descriptors by patients and investigators. As such, the import of this investigation lies in several areas. First, prior studies examined only trouble seeing or blurred vision separately.[6–8] This study provides data supporting both trouble seeing and blurred vision as having unique associations with worse mental health. Blurred vision was less common than trouble seeing and is most likely related to a specific form of visual symptom, suggestive of refractive error or a defined loss of vision. In contrast, trouble seeing was reported more frequently and may be likely to include difficulties other than just reduced vision or loss of vision. Additional work addressing the bases of reporting these ocular symptoms is needed to clarify these points.

This current study also simultaneously examined the role played by the presence of having an eye disease—cataract, glaucoma, and macular degeneration—apart from eye symptoms. In so doing, the results tend to support prior reports that note that the mere presence of an eye disease does not generally impact on HRQOL, after adjusting for other important variables.[1–3] However, eye symptoms do have an impact over and above the presence of these conditions.

The sample included both younger and older adults with a large mix of comorbid medical conditions and systemic symptoms. Prior studies were limited to older Americans or to patients enrolled in an ongoing study.[6–8] The results of this study are quite similar to those of the earlier studies and thus buttress our understanding of the critical role that visual symptoms play in general HRQOL.

This is in contrast to studies using clinic-based populations with a defined disease (glaucoma) and case control methods in which an independent relationship with SF-20 or SF-36® scale scores were found.[4,5] Not only were the study populations different, but also controls for comorbid medical conditions and other demographic variables may have been more problematic in those studies. In this study thorough case-mix adjustment was possible due to the large sample size and extensive collection of measures and data. Further, many more potentially confounding variables were included in this study.

This study also has the advantage, shared with some of the earlier research,[7,8] of including income and more detailed socioeconomic data in the models. As might be expected, where there is an effect, lower income is associated with lower levels of HRQOL even after adjustment for the other medical conditions and symptoms.

The results of the study suggest that merely having a condition may not be as important to HRQOL as having a noticeable physical difficulty or symptom. Diseases are related to underlying disturbances in biological and physiological systems that sometimes, though not always, are related to the presence or severity of symptoms.[11] These symptoms then impact functional status, well-being, and general health perceptions. Along the way, intervening

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variables such as psychological supports, personality and motivation factors, and social and economic supports arising from both the person and the environment can modulate the transition. Empirical support can be found for this approach in not only our earlier work on symptoms but also in other fields of medicine, such as HIV and AIDS.[6–8,12] It is also important to note that our measure of HRQOL may not be precise enough to detect the impact of milder forms of eye disease. A diease-targeted measure may be needed to capture more subtle impacts.

Most importantly, the study results further reinforce the importance in daily clinical care of paying attention to patient symptoms and complaints. Patients have problems for which they seek care from a physician, generally manifested as a symptom or specific complaint. They may have a disease, but the disease has meaning only relative to the manifestations and problems posed by the disease, including possibly issues related to concern and anxiety. As proposed by Wilson and Cleary, knowing the patient's social and personality contexts in light of the presence of symptoms will enable physicians to maximize functioning and well-being.

Intuitively, symptoms rather than diseases are the focal points of patients' daily concerns in terms of their physical functioning. Whether they have difficulty with some aspect of their body will result in limitations to activities that are reflected in physical health items in the SF-36®. In contrast, mental stress and difficulties may stem more from possible adaptations and fear of the future than from the actual physical ailments or symptoms. We can see this phenomenon in the amount of variance explained by the models presented here—the physical health model adjusted $R^2$ was 0.45 (indicating that 45% of the variance was explained by the significant factors), while that of the mental health model was 0.14. The large differences in variance explained in mental health compared to physical health suggest that factors important to the mental health of patients were not as well captured by the variables present in this study. Issues such as worry about the future and concern are different concepts than the presence of symptoms in the current time frame.

At the same time, we can see that the effect of eye symptoms is more prominent upon the mental health composite scores than on the physical health composite scores. This may reflect the greater importance of vision for cognitive tasks but may also engender concerns about the future, the ability to work, and the ability to live independently. Indeed, the content of a vision-targeted questionnaire, the NEI-VFQ,[13] includes items that capture concerns about the future, fear, and anxiety.

The results of this study demonstrate the importance of eye symptoms to general HRQOL. It extends the findings of prior studies to show that both "trouble seeing" and "blurred vision" have independent, measurable associations with HRQOL, while the presence of eye diseases, such as glaucoma, cataract, and macular degeneration, do not. It demonstrates this even after adjustment for household income, medical comorbidities, hearing deficits, and interactions among these variables. As such, we can now more confidently conclude that visual symptoms, for the adult population, have independent associations with decrements in generic HRQOL.

Finally, for policy-makers, the results of the study reveal the importance of ameliorating difficulties in receiving care for visual problems in our health care system. Having a disease, in this study an eye disease, is not sufficient in and of itself to decrease general HRQOL, but having a symptom or a problem does places one at risk for significant HRQOL decrements.

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## TABLE 1

Characteristics of the Sample (n = 5021)

| Subgroup | Percent (n) |
|---|---|
| Age 18–29 | 13 (628) |
| Age 30–39 | 24 (1224) |
| Age 40–49 | 21 (1044) |
| Age 50–59 | 14 (707) |
| Age 60–69[+] | 14 (694) |
| Age 70 and older[+] | 14 (724) |
| Male | 36 (1792) |
| Female | 64 (3229) |
| White | 81 (4077) |
| Black | 3 (129) |
| Hispanic | 9 (475) |
| Asian | 4 (218) |
| Other race/ethnicity | 2 (122) |
| High school or less | 28 (1390) |
| Some college/vocational school | 61 (3067) |
| College graduate | 14 (682) |
| Income < $10,000 | 6 (307) |
| Income $10,000–19,999 | 13 (633) |
| Income $20,000–39,999 | 31 (1536) |
| Income $40,000–74,999 | 35 (1773) |
| Income >=$75,000 | 15 (772) |
| Private insurance | 89 (4446) |
| Medicaid insurance | 1 (33) |
| Medicare insurance | 4 (188) |
| Other insurance | 6 (291) |
| No Insurance | 1 (63) |
| Seasonal allergies | 38 (1889) |
| Arthritis/rheumatism | 30 (1514) |
| Chronic allergies or sinus trouble | 28 (1392) |
| Hypertension | 25 (1238) |
| Migraines | 14 (717) |
| Cataracts | 9 (448) |
| Diabetes | 6 (293) |
| Angina | 5 (241) |
| Myocardial infarction | 3 (169) |
| Congestive heart failure | 2 (118) |
| Glaucoma | 2 (119) |
| Macular degeneration | 2 (125) |
| Epilepsy/other seizure | 1 (47) |
| Cataract and glaucoma[++] | 1 (63) |
| Cataract and macular degeneration | 1 (55) |
| Glaucoma and macular degeneration | 1 (24) |
| Sciatica/chronic back problems | 22 (1122) |
| Stomach trouble | 19 (938) |
| Limited use of arm or leg | 10 (500) |
| Dermatitis/chronic skin rash | 10 (484) |
| Prostate problems | 6 (305) |
| Kidney problems | 3 (175) |
| Abnormal vaginal bleeding | 3 (174) |
| Liver trouble | 2 (109) |
| Blurred vision | 8 (414) |
| Deafness/trouble hearing | 14 (716) |
| Trouble seeing | 13 (654) |
| Deafness and trouble seeing[++] | 4 (178) |
| Deafness and blurred vision | 2 (125) |
| Cataracts and trouble seeing | 3 (150) |
| Cataracts and blurred vision | 2 (116) |
| Macular degeneration and trouble seeing | 1 (65) |
| Glaucoma and blurred vision | 1 (49) |
| Macular degeneration and blurred vision | 1 (45) |
| Glaucoma and trouble seeing | 1 (30) |

[+]The respondents in the age ranges of 60–64 and 65 and older were 6% and 22%, respectively.

[++]The percentages for individual condition include those having multiple conditions.

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## TABLE 2

Number of Self-reported Eye Diseases by the Presence of Visual Symptoms

| | Number of Eye Diseases* | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| No Blurred Vision | 91% | 8% | 1% | 0.2% |
| Blurred Vision Present | 66% | 24% | 8% | 2% |
| No Trouble Seeing | 91% | 7% | 1% | 0.2% |
| Trouble Seeing Present | 71% | 21% | 7% | 2% |

* Eye diseases are cataract, glaucoma, and age-related macular degeneration

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## TABLE 3

SF-36® v.1 Physical and Mental Health Summary Scores (PCS and MCS) Regressed on Self-Reported Conditions, Symptoms, and Demographic Variables (n = 5021)

| Independent variable | PCS (Adjusted $R^2$ = 0.45) | MCS (Adjusted $R^2$ = 0.14) |
|---|---|---|
| Age 50–59 | −0.86 | 3.29 |
| Age 60–69 | −2.22 | 6.23 |
| Age 70+ | −4.10 | 6.30 |
| Male | 0.98 | |
| <=$9,999 | −3.06 | −3.04 |
| $10,000–19,999 | −2.61 | −2.12 |
| $20,000–39,999 | −1.05 | |
| $40,000–74,999 | −0.90 | |
| Medicaid | | −4.66 |
| Hypertension | −1.46 | −0.97 |
| CHF | −2.61 | |
| Diabetes | −1.36 | |
| Angina | −2.55 | |
| Migraines | −0.81 | −1.54 |
| Chronic allergies or sinus trouble | −0.74 | −0.69 |
| Arthritis or rheumatism | −3.71 | |
| Sciatica or back problems | −4.49 | −1.29 |
| Trouble seeing | −1.07 | −2.69 |
| Chronic lung disease | −4.52 | |
| Liver trouble | −3.07 | |
| Stomach trouble | −1.39 | −3.68 |
| Kidney problems | −2.67 | |
| Limitations in use of arm or leg | −9.32 | |
| Blurred vision | | −2.71 |
| Vaginal bleeding | | −3.82 |

* Variable included in the models that were not statistically significant for either dependent variable included age 18–29, age 40–49, black race, Hispanic, asian race, other race, high school or less, some college or vocational school, Medicare, other insurance, no insurance, MI, cancer, cataracts, glaucoma, macular degeneration, seasonal allergies, dermatitis, deafness or other trouble hearing, epilepsy, thyroid problems, and problems with prostrate.

Numbers are unstandardized beta coefficients and represent adjusted deviations from reference group (30–39 year old, white, female, private health insurance, college graduate, income >=$75,000 or more, without medical conditions or symptoms) in T-score metric (standard deviation = 10).

All numbers present are statistically significant at the $P \leq 0.05$ level. Blanks signify that no statistically significant association was found.