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Impact of vision loss on health-related quality of life in Trinidad and Tobago

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Conflict of interest

Henry Bailey is a member of the EuroQol research group. The work included in this article formed part of Tasanee Braithwaite's thesis, submitted for the degree of Doctor of Medicine to the University of Oxford. The authors report no conflicts of interest.

Keywords

Utility, blindness, vision impairment, presbyopia, health-related quality of life, Trinidad and Tobago

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This article contains additional online-only material. The following should appear online only: eComponent Supplementary Table 1

eComponent Supplementary Table 2

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Abstract

Purpose: To determine whether distance vision impairment (VI) (Logarithm of the Minimum Angle of Resolution (LogMAR) >0.30), or near VI (NVI) (LogMAR 0.32 to 1.30 at 40cm with ≤0.30 at 3m) independently predict health-related quality of life (HRQoL), and to estimate societal impact.

Design: The National Eye Survey of Trinidad and Tobago was a population-based, cross-sectional eye survey using multi-stage, cluster random sampling with probability-proportionate-to-size methods.

Participants: Adults aged ≥ 40 years.

Methods: Responders rated general health level in the five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) of the EQ-5D 5-level instrument. Multivariable regression analysis with robust standard error estimation explored the relationship between utility score and presenting vision.

Main Outcome Measures: Utility value and Quality Adjusted Life Year (QALY) loss by vision category.

Results: 62.4% (2658/4263) adults completed the EQ-5D-5L. Mean age was 58.4 (SD 11.8, range 40 to 103) years and 56.3% were female. Blindness had the largest independent effect on utility coefficient, at -0.140 (95% CI -0.092 to -0.192), with mean utility value 0.727 (95% CI 0.671-0.784) and mean EQ-VAS score 69.9 (95% CI 62.0-77.8). Near VI was also independently associated with utility loss of -0.012 (95% CI -

0.004 to -0.021). Independent predictors of utility<1.000 included female sex, older age, being uninsured, lower educational attainment, ethnicity, and multiple medical co-morbidities. A hypothetical person, experiencing onset of a stable vision state at 40 years, would be expected to accrue lifetime loss of 0.45 QALYs for near VI, 0.72 QALYs for mild VI, 1.64 QALYs for moderate VI, 3.30 QALYs for severe VI and 5.13 QALYs for blindness. VI caused 762.3 QALYs lost per 100,000 population per year, of which 36.5% were attributed to near VI, exceeding the equivalent QALY loss from stroke (307 QALYs), depression (284 QALYs), and arthritis (522 QALYs). 91% (694.9/762.3) of the VI-related QALY loss was potentially avoidable.

Conclusions: This is the first population-based survey to identify that both distance and near VI independently reduce HRQoL. The estimated QALY loss highlights the societal importance of efforts to address all degrees of avoidable VI.

Estimating quality adjusted life years (QALYs) lost to vision impairment (VI), and the cost-effectiveness of alternative interventions, requires reliable measurement of health-related quality of life (HRQoL). Whether VI impacts HRQoL is uncertain,[1] but recent population-based surveys, in Singapore, and South Korea, established independent association between severe distance VI and utility loss. Here we report novel independent association between less severe categories of distance and near VI (NVI), in adult participants aged ≥40 years in the National Eye Survey of Trinidad and Tobago (NESTT).

The NESTT (2013-2014) is the most comprehensive Caribbean eye survey undertaken in recent decades. Details are provided elsewhere.[2] Briefly, we sampled 9913 eligible people aged ≥5 years, including 4263 aged ≥40 years, residing in 3556 households (95.9% coverage) in 120 clusters, using multi-stage, random cluster sampling with probability-proportional-to-size methods. We measured presenting distance and near visual acuity outside households, using Logarithm of the Minimum Angle of Resolution (LogMAR) charts at 3m and 40cm, respectively, and standardized protocols (Stage 1). We defined mild VI (LogMAR 0.32 to 0.48), moderate VI (LogMAR 0.50 to 1.00), severe VI (LogMAR 1.02 to 1.30), and blindness (LogMAR ≥1.32) in the better-seeing eye, and binocular NVI (LogMAR 0.32 to 1.30 at 40cm with ≤0.30 at 3m). Avoidable VI included uncorrected refractive error, cataract, diabetic retinopathy and glaucoma.

All participants ≥40 years were invited for clinic-based assessment (Stage 2), including EQ-5D-5L.[3] EQ-5D-5L contains five questions, on mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, scored 1 to 5, resulting in 3125 (5^5) possible health states. We transformed these into utility values using a Trinidad and Tobago value set and scoring algorithm for EQ-5D-3L, by "cross-walking".[4] In addition,

participants selected one number on the visual analogue scale (EQ-VAS), ranging from 0 to 100 (worst to best imaginable heath state).

The University of the West Indies (Trinidad), Anglia Ruskin University (UK), and Ministry of Health (Trinidad and Tobago) provided ethics committee approvals. The study adhered to the tenets of the Declaration of Helsinki.

Using standard statistical software (StataCorp. 2013. Release 13.1), we adjusted crude data for multilevel sampling (island, cluster), and weighted for selection probability and cluster response rate. Post-stratification adjustment used Census data (15 municipalities, gender and 5-year age categories). We applied finite population corrections to first and second sampling stages. We applied VI prevalence to the 2014 mid-year population to estimate cases.

We estimated utility coefficients and EQ-VAS scores using ordinary least squares (OLS) regression analysis, with robust standard error estimation (RSE).[5] We explored odds of less than full health (utility <1.000), and experiencing difficulty (raw score $\geq$2) in each domain, by vision category, using multi-level mixed effects logistic regression analysis. Full models contained 25 variables, including age, sex and ethnicity as potential confounders. We took a backward approach to select the most parsimonious model. Following logistic regression we assessed nested model fit using the classical likelihood ratio test to obtain p values, and the smaller value of Akaike's and Schwarz's Bayesian information criterion. Following linear regression we used Wald p values. We set significance at 5%.

We estimated prevalent QALY loss by multiplying cases of VI by utility coefficients. To illustrate individual lifetime QALY loss, we assumed VI states persisted from age 40 years to death 36.1 years later, applying no discount.

In sensitivity analysis we explored the effect of alternative statistical analysis approaches (adjusting for age and sex), a UK EQ-5D-5L value set, and binocular vision category definitions.

3589 of 4263 (84.2%) eligible adults completed Stage 1 and 62.4% completed Stage 2. Mean age was 58.4 years (SD11.7, range 40-103), 56.3%(1496) were women, and the majority were African (45.4%,1177) or South Asian (41.4%,1074) ethnicity. After adjustment, full health (utility value 1.000) was reported by 52.7%(95%CI 50.6-54.9), mean utility was 0.920(95%CI 0.916-0.925), and EQ-VAS was 80.2(95%CI 79.6-80.8); both reduced with severity of VI (Table 1, available at http://aaojournal.org).

Blindness had the largest independent effect on EQ-VAS and utility value (Figure 1). Utility coefficients ranged from -0.140(95%CI -0.092 to -0.192) for blindness, -0.091(95%CI -0.031 to -0.151) for severe VI, -0.045 (95%CI -0.024 to -0.067) for moderate VI, and -0.020(95%CI -0.004 to 0.013) for mild VI, to -0.012(95%CI -0.004 to -0.021) for NVI. EQ-VAS score coefficients similarly ranged from -7.8(95%CI -0.2 to -15.3) for blindness, to -2.5(95%CI 0.7 to -5.7) for mild VI, and -1.6 (95%CI -0.2 to -3.0) for NVI.

Reporting less than full health was ten times more likely if blind (OR 9.58, 95%CI 1.18-78.16), and 1.3 times more likely with NVI (OR 1.31, 95%CI 1.03-1.66)(p=0.009), than normal vision. Table 2 details independent predictors (available at http://aaojournal.org).

NVI significantly increased reporting some difficulty with mobility (OR 1.84, 95%CI 1.35-2.50, p<0.001), self-care (OR 2.24, 95%CI 1.33 to 3.76, p=0.002), and usual activities (OR 1.89, 95%CI 1.29-2.77, p=0.001), and distance VI significantly impacted all five domains.

A 40-year-old would experience a lifetime loss of 0.45 QALYs for NVI, 0.72 QALYs for mild VI, 1.64 QALYs for moderate VI, 3.30 QALYs for severe VI and 5.13 QALYs for blindness. VI was associated with 4,131 lost QALYs in 2014, equivalent to 762.3 QALYs per 100,000 people per year, 694.9 of which were potentially avoidable.[2] This exceeded the equivalent rate of QALYs lost from stroke (307), depression (284) and arthritis (522). One fifth of adults ≥ 40 years (120,842 people) had NVI, accounting for 36.4% (1502) of total QALYs lost.

Blindness disutility coefficients were similar for OLS with RSE estimation (0.138), Tobit (0.135), and CLAD (0.090) analyses, and closely agreed with the UK value set (-0.159, 95%CI -0.098 to -0.220). Uniocular blindness utility loss ranged from -0.019(95%CI -0.002 to 0.037, p=0.029) to -0.101(95%CI -0.060 to 0.138, p<0.001), depending on the other eye having normal vision, or moderate/severe VI, respectively. Uncertainty in the 95% CI around VI cases and utility coefficients resulted in ranges of 3504 to 4743 and 1655 to 6608 lost QALYs, respectively.

This national survey is the first to report that both distance VI and NVI independently predict HRQoL loss. This highlights the societal impact and importance of continued investment to address all degrees of avoidable VI.

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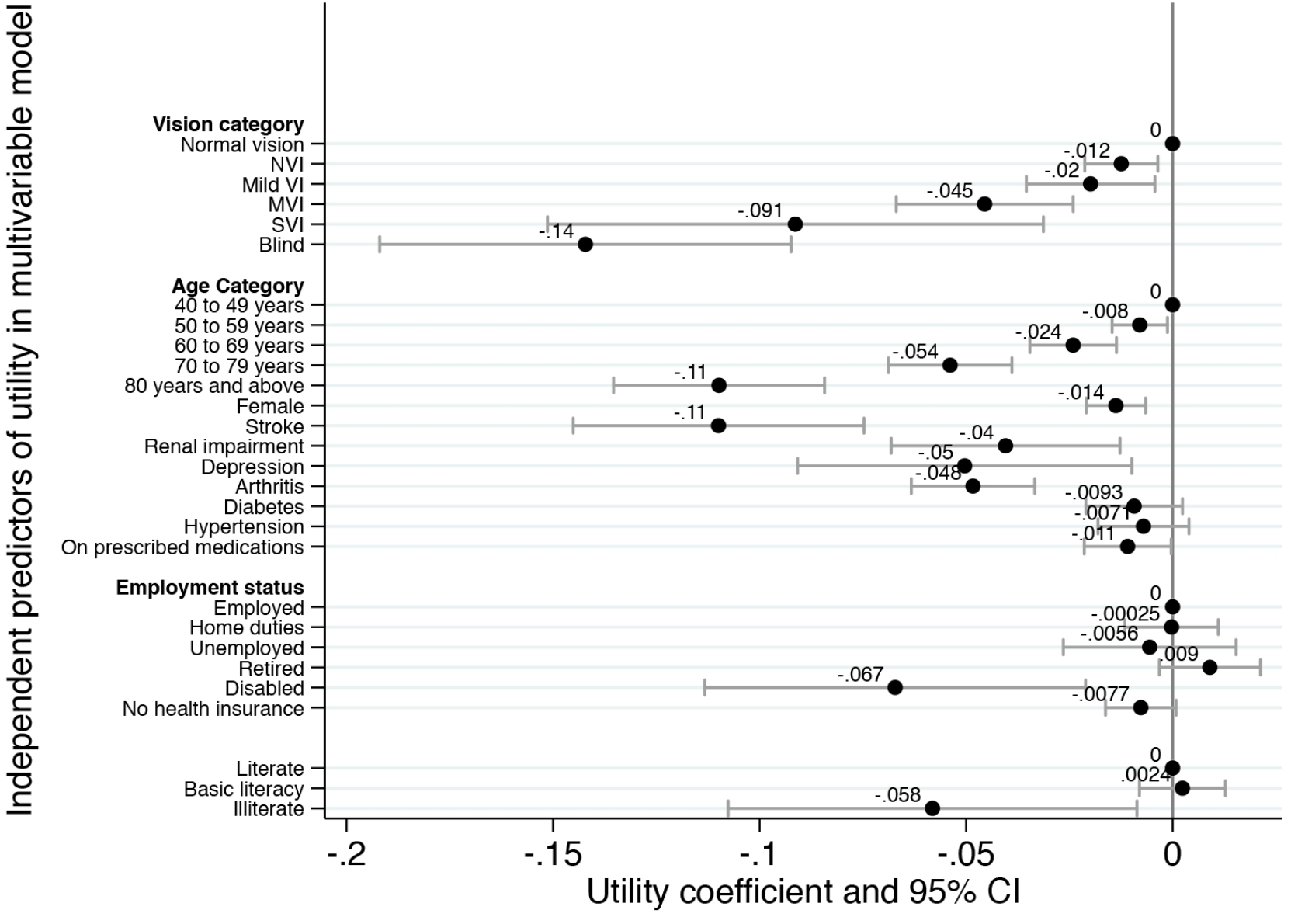
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Figure legends

Figure 1: Utility coefficients (with 95% confidence intervals) from the multilevel multivariable model showing the independent effect of vision impairment category


Independent predictors of utility in multivariable model
Vision category
Normal vision
NVI
Mild VI
MVI
SVI
Blind
Age Category
40 to 49 years
50 to 59 years
60 to 69 years
70 to 79 years
80 years and above
Female
Stroke
Renal impairment
Depression
Arthritis
Diabetes
Hypertension
On prescribed medications
Employment status
Employed
Home duties
Unemployed
Retired
Disabled
No health insurance
Literate
Basic literacy
Illiterate
0
-.012
-.02
-.045
-.091
-.14
0
-.008
-.024
-.054
-.11
-.014
-.11
-.04
-.05
-.048
-.0093
-.0071
-.011
0
-.00025
-.0056
.009
-.067
-.0077
0
.0024
-.058
-.2
-.15
-.1
-.05
0
Utility coefficient and 95% CI