CrossMark

AMERICAN ACADEMY® OF OPHTHALMOLOGY
The Eye M.D. Association

Health Service Use and Mortality of the Elderly Blind

Julie M. Crewe, PGSci,[1] Katrina Spilsbury, PhD,[1] Nigel Morlet, FRANZCO,[1] William H. Morgan, PhD, FRANZCO,[2] Aqif Mukhtar, MSc,[1] Antony Clark, PhD,[1] James B. Semmens, PhD[1]

Purpose: To determine whether blindness in older people is associated with increased health service use and mortality.

Design: Retrospective matched cohort study from July 1, 1999, through June 30, 2010.

Participants: A blind cohort 65 years of age and older from a volunteer blind register and a cohort of age- and gender-matched controls selected randomly from the Western Australian electoral roll.

Methods: Person-level linked hospital, emergency department (ED), mental health, and death records for the blind and control cohorts were used. Generalized estimating equations assuming a negative binomial distribution were used to estimate relative rates of hospital admissions, lengths of stay, and mortality after adjusting for sociodemographic variables and comorbidity. Emergency department and mental health service visits also were quantified.

Main Outcome Measures: Relative rates of hospital admissions, lengths of stay, and mortality, as well as crude proportions of ED and mental health service visits.

Results: The blind cohort comprised 1726 individuals alongside 1726 matched controls; 39% were men, and the mean age was 83 years. Combined, the cohorts accumulated a total of 34 130 hospital admissions amounting to 201 867 bed-days. After adjusting for the principal reason for hospital admission and comorbidity, the blind cohort was admitted to the hospital 11% (95% confidence interval [CI], 6%−17%) more often than the control cohort. The blind cohort also stayed in the hospital longer than the controls, but this effect varied by age. Blind participants 65 to 69 years of age spent 88% more days (95% CI, 27%−178%) in the hospital compared with age-matched controls, whereas there was no difference in length of stay between the cohorts by 80 years of age (rate ratio, 1.10; 95% CI, 0.97−1.25). A larger proportion of the blind cohort visited a hospital ED and accessed mental health services compared with the control cohort.

Conclusions: Health service use is increased for the elderly blind compared with age-matched controls after accounting for comorbidity. The elderly blind have more hospital admissions, ED visits, and mental health-related visits. The younger elderly blind stay longer in hospital. However, there was no evidence of worse mortality outcomes after adjusting for comorbidity. *Ophthalmology 2015;122:2344-2350 © 2015 by the American Academy of Ophthalmology.*

Supplemental material is available at www.aaojournal.org.

Blindness is principally a disease of aging in developed countries. In Western Australia (WA), the prevalence of blindness in persons 50 years of age and older is estimated at 0.4%[1] and is expected to increase with an aging population. It has been well established that visual impairment in the elderly is associated with reduced independence, physical mobility, social connectivity, and activities of daily living.[1,2] An increased prevalence of both physical and mental comorbidities, particularly anxiety and depression, also have been reported in the elderly with vision loss.[3−5]

Despite well-documented data on the incidence, prevalence, and causes of vision loss and blindness[1,6,7] and the associated comorbidities, little information exists on how vision impairment impacts health service use in the elderly blind. Several studies have reported poor vision in the elderly as a risk factor for single and recurrent falls[8] and for hospital admissions for falls.[9,10] Integrated mental health interventions in an outpatient setting have shown improvements in depressive symptoms.[11] However, the extent of hospital admissions, length of hospital stays, emergency department (ED) presentations, mental health outpatient contacts, and mortality outcomes in the elderly blind relative to their sighted contemporaries has not been quantified.

Herein we report the findings from a retrospective cohort study that used linked population-based administrative data sets to compare health service use and mortality outcomes in individuals who were registered legally blind at 65 years of age and older with an age-matched sighted cohort. The Western Australia Data Linkage System is a validated process that creates links that allows records from multiple health-related data sets to be brought together for all individuals living in WA.[12] Western Australia is the largest

Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.ophtha.2015.07.001
ISSN 0161-6420/15

state of Australia with a population of 2.5 million, with most of the population living in the southwest corner that includes the only major metropolitan city, Perth.

Methods

Individuals 65 years of age or older at the time they were first registered as legally blind were identified from the voluntary register of the Association for the Blind of Western Australia from January 1, 2003, through December 31, 2009, and formed the blind cohort. The terms *blind* and *blindness* used throughout refer to legal blindness in Australia which is defined as having a best-corrected visual acuity of more than 1 logarithm of the minimum angle of resolution or a visual field of less than 10° in diameter, or a combination of both reduced visual acuity and field restriction, resulting in an equivalent level of vision loss in the better eye. We previously validated the accuracy of the clinical ophthalmic information on the register and established that approximately 50% of the eligible blind in WA were registered.[1,13]

A 1:1 age-matched (±2 years) and gender-matched control cohort was selected randomly from the state electoral roll. Because voting is compulsory in Australia, the electoral roll is considered representative of the adult population. The control selection and de-identified extraction of all hospital morbidity, ED, mental health outpatient, and death registration records for both cohorts from July 1, 1999, through June 30, 2010, were performed by the Data Linkage Branch, Department of Health of Western Australia.[14]

Each blind participant was assigned an index date that corresponded to the date of confirmed blindness from the blind registry. The corresponding age- and gender-matched control was assigned the same index date after confirming they were still alive at the index date. The hospital morbidity data were manipulated so that multiple episodes of care within the same hospital admission were combined into a single hospital stay record. Episodes of care followed by a transfer to another hospital also were combined into a single admission record. The length of stay for each admission was defined as the latest discharge date minus the earliest date of admission plus 1. The exposure time that an individual was at risk of a hospital stay was defined as time from July 1, 1999, through June 30, 2010, or until date of death if earlier.

The principal reasons for each hospital admission were categorized into 218 Clinical Classification Systems groups using published International Classification of Diseases, 10th Edition, Clinical Classification Systems translation codes.[15] Comorbidity associated with each hospital admission was identified from up to 21 codiagnosis fields in the hospital record and was classified as the presence or absence of the 30 different Elixhauser comorbidity conditions associated with increased risk of in-hospital death.[16] The proportion of participants with hospital admissions via the ED, any record of spending time in an inpatient psychiatric unit, and death during the study period also were determined.

The Accessibility and Remoteness Index of Australia was used to describe geographical accessibility to health services.[17] This index uses information about populations based on their access, by road, to service centers (towns) of various sizes, and ranges from major cities to the very remote. The Index of Relative Socio-economic Disadvantage was based on the most recent residential postcode.[18] This index combines census collected data on income, education, and unemployment of people and families, as well as dwellings within an area, and ranks these areas on a scale of relative disadvantage.

Age was classified into 10-year age groups to demonstrate overall trends. Being recorded as married or in a de facto relationship at the time of the 3 most recent hospital admissions was classified as partnered. Identification with being aboriginal or of Torres Strait Islander ethnicity on any hospital record was classified as being indigenous. Limited demographic information was available for participants who were not admitted to a hospital at all during the follow-up period and were classified as unknown where necessary.

Statistical Analysis

Bivariate associations of the various demographic factors and blind status were tested using Pearson's chi-square test for proportions, *t* tests for normally distributed continuous variables, and the Wilcoxon rank-sum test for medians. Because of multiple testing (218 identified diagnostic groups, 30 comorbidity groups), Bonferroni-adjusted critical *P* values were used when appropriate. Bivariate tests of associations with count variables were performed using negative binomial regression models with a single independent variable. All hospital admissions (including renal dialysis) were included in all regression analyses.

The association of being blind with hospital use was investigated using regression modeling adjusted for potential confounders, in particular comorbidity, because of the known association of blindness with increased morbidity. There were several steps involved in the modelling process. First, the records of each participant were collapsed such that the total number of hospital admissions, combined total length of stay (number of bed-days), and the presence or absence of all principal diagnostic and comorbidity groups at any time during follow-up were summarized onto a single record per participant. The length of follow-up (exposure time) for each participant also was recorded. Second, each of the large number of possible principal diagnostic and comorbidity combinations were reduced further into 2 empirically derived variables for each of the 2 main outcome measures: total number of admissions and the total number of bed-days. To create these empirically derived variables, each outcome was modeled using negative binomial regression models that included either all 218 identified principal diagnostic groups or all 30 comorbidity groups and accounted for exposure time. Based on these 4 models, the predicted total number of admissions and predicted total length of stay per person were estimated for each covariate pattern represented by the different possible combinations of either the principal diagnoses or comorbidity variables.

Finally, the effect of blindness on the 2 main outcome measures was estimated in 2 further models that included the newly created empirically derived variables containing the predicted outcome based on principal diagnosis and comorbidity. Other variables included in the final modeling process were age, gender, marital status, accessibility to services, and whether the participant underwent renal dialysis or chemotherapy or died during the follow-up period. To account for any similarity (lack of independence) between blind participants and their matched control, generalized estimating equations assuming a negative binomial distribution were used to estimate rate ratios after accounting for exposure time.

Mortality rates were age standardized using the 2009 WA population. Poisson regression was used to model mortality rates. Analysis was carried out using IBM PASW software version 18 (IBM Corporation, Armonk, NY) and Stata software version 13 (StataCorp LP, College Station, TX). This study was approved by the Human Research Ethics Committees of Curtin University and the Western Australia Department of Health.

Results

The blind cohort consisted of 1726 people confirmed as being legally blind and older than 65 years with 1726 age- and gender-matched persons in the control cohort. The mean age was