Prevalence and causes of visual impairment in Fundong District, North West Cameroon: Results of a population based survey

Running head: Blindness in Cameroon

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ABSTRACT

Purpose: To estimate the prevalence and causes of visual impairment in Fundong Health District, North West Cameroon.

Methods: Fifty-one clusters of 80 people (all ages) were sampled with probability proportionate to size and compact segment sampling. Visual acuity (VA) was measured with a tumbling "E" chart. An ophthalmic nurse examined people with VA<6/18 in either eye. The presence of hearing and physical impairments were assessed using clinical examination, and self-reported visual problems using the Washington Group Short Set.

Results: In total, 4,080 people were enumerated of whom 3,567 were screened (response rate 87%). The overall prevalence of visual impairment was 2.3% (95% CI=1.8-3.0%) and blindness was 0.6% (0.3-1.0%). The prevalence of both blindness and visual impairment increased rapidly with age, so that the vast majority of cases of visual impairment (84%) and blindness (82%) were in people aged 50+. Posterior segment disease and cataract were the main causes of blindness and visual impairment, with refractive error also an important cause of visual impairment. Cataract surgical coverage (proportion of all cataracts that had received surgery) was relatively high (87% of people at VA<6/60). Post-surgery outcomes were poor, with 31% of operated eyes having VA<6/60. Among the 82 people with visual impairment, 22% had a physical impairment or epilepsy and 30% had a hearing impairment. Self-reported difficulties in vision were relatively closely related to clinical measures of visual impairment.

Conclusions: Ophthalmic programmes in Cameroon need to incorporate control of posterior segment diseases while also working to improve outcomes after cataract surgery.

INTRODUCTION

Globally there are an estimated 191-285 million people living with visual impairment (VI), of whom 32-39 million are blind. [1, 2] Over 80% of cases of VI are either treatable (e.g. cataract) or preventable (e.g. trachoma), and around 85% of people with VI live in low and middle income countries (LMICs).[2] Estimates of the prevalence of VI in people aged 50 years and above are relatively robust, due to the widespread use of the Rapid Assessment of Avoidable Blindness (RAAB), as RAAB focuses on this age group,[3] and to date at least 266 RAABs have been conducted globally.[4] However, fewer surveys are available that include younger people, and consequently much less is known about the prevalence and causes of VI across all age groups.

There are also other knowledge gaps with respect to surveys of visual loss. Older people are vulnerable to VI, but also to other types of impairment (e.g. hearing, physical).[5] However, few surveys consider multiple types of impairment and so have not assessed how these conditions overlap. This is an important gap, as the presence of other impairments may make it more difficult for people to access vision-related services and also for clinicians to communicate effectively with people about their eye care needs. Consequently, a focus on inclusive eye health services may be needed, as is already promoted by some organizations.[6]

Furthermore, self-reported data on difficulties with vision are widely available because they are relatively easy to collect and form a core component of disability measures. As an example, the Washington Group Short Set questionnaire, which are promoted by the UN and other groups for the collection of disability statistics, ask

about whether the person surveyed experiences difficulties in seeing.[7] Routine collection of this information therefore potentially provides a large pool of data on the prevalence of sight difficulties. However, few studies have assessed the validity of these self-reported measures compared to clinical tools for visual impairment assessment.[8, 9]

In response to these evidence gaps, we conducted an all-age population-based survey of VI in Fundong Health District, North West Cameroon. The purpose of the study was three-fold: (i) to estimate the prevalence and causes of VI (all ages); (ii) to estimate the prevalence of other types of functional difficulties in people affected by VI; and iii) to measure sensitivity and specificity of visual screening using the Washington Group Short Set tool compared to clinical visual acuity assessment.

MATERIALS AND METHODS

Study design

A population-based cross sectional survey was conducted during August-October 2013 in Fundong Health District, North West Cameroon. This district is predominantly rural. All selected participants underwent clinical examination and completed an interviewer-administered questionnaire. A detailed description of the study design has been published. [10, 11]

Sampling

The expected prevalence of VI was conservatively estimated at 4%.[2] The required sample was therefore 4,056, assuming precision of 20% around the estimate, 95% confidence, a design effect of 1.5 and 20% non-response.

Fifty-one clusters of 80 people were selected using probably proportionate to size sampling with the 2005 census data as the sampling frame. Within clusters, households were selected using compact segment sampling.[12] For this sampling method, maps of the cluster were divided into segments of approximately 80 people and one segment was randomly selected. The enumerators visited all households door-to-door in that segment until 80 people (all ages) were enumerated.

Household members were informed about the survey and invited to attend an examination clinic at a central location over the next two days. If an enumerated resident did not attend the clinic the enumerators visited their household at least

twice to encourage attendance. The survey team visited all participants at home who were unable to travel to the clinic.

Screening for visual impairment

All participants attending the clinic were screened for VI. For participants aged >5 years, visual acuity (VA) was assessed using a tumbling 'E' chart with 6/18 size optotype on one side and 6/60 on the other. Pinhole vision was assessed if vision was VA <6/18 in either eye. Vision was categorised according to the presenting vision in the better eye as:

- Blind: VA<3/60
- Severely visually impaired: VA<6/60 but >=3/60
- Moderately visually impaired: VA<6/18 but >=6/60
- Normal vision: VA>=6/18
- VI: VA<6/18

For children aged under 2 years, vision was assessed by ophthalmic nurses using the fix and follow method. For children aged 2-4 years counting fingers was used whereby the child was asked to count or copy the number of fingers held up by the nurse/assistant standing at 6 meters. Children who failed these tests were counted as having a VI (VA<6/18), but severity was not assessed.

All people with presenting VA<6/18 had their eyes examined by an ophthalmic nurse using a direct ophthalmoscope to determine the likely cause of vision loss.

These participants were also asked about whether they had undergone cataract surgery and reasons for not attending cataract surgery, where relevant.

Screening for other impairments

Participants were also assessed for the presence of other impairments at the examination camp.

Hearing: All participants were screened through an otoacoustic emissions (OAE) hearing test (validated as a tool for screening for hearing loss) [13]. Participants who failed this test in both ears or for whom a reading could not be taken underwent Pure Tone Audiometry screening to assess the level of hearing impairment. Hearing in each ear was measured at 1KHz, 2 KHz, 4 KHz, 0.5KHz and again at 1KHz to ensure consistency of response and the average reading for each ear across the 4 frequencies was recorded. Children <4 years underwent OAE testing only. People were classified as having a “Moderate or greater” hearing impairment if they had an average hearing level of >41db (adults aged >18 years) or >35db (children 4-18 years). The level of hearing impairment was not classified in children below the age of 4.

Physical impairment and epilepsy: Participants were asked six screening questions to assess the presence of: a) difficulty using the musculoskeletal system b) use of mobility aid c) whether the participant considers any body part to be misshapen and d) whether they have experienced seizures.[14] Any participant answering “yes” to at least one question was examined by a physiotherapist or orthopaedic clinical officer

to determine the presence of a moderate/severe physical impairment and/or epilepsy.

Measuring self-reported difficulties

Self-reported difficulties in vision were assessed using the question from the Washington Group on “Do you have difficulty seeing, even if wearing glasses? ”, with possible answers given as “no difficulty”, “some difficulty”, “a lot of difficulty” and “cannot do at all”.[7] In addition, people were asked if they had difficulty in hearing, walking/climbing steps, remembering/concentrating, washing/dressing or communicating. People were classified as having a disability if they reported “a lot of difficulty” or more in at least one domain.

Fieldworker training

Three survey teams each consisting of 1 ophthalmic nurse, 1 ear nose and throat (ENT) nurse, 1 physiotherapist or orthopaedic clinical officer, 2 enumerators, 3 field assistants and 2 interviewers received 10 days training. The inter-observer variation for the measurement of vision, hearing and physical impairment level and diagnosis of cause was assessed against a gold standard (ophthalmologist, ENT surgeon and orthopaedic surgeon, respectively) to ensure it was of an acceptable standard (i.e. Kappa ≥0.6). The survey protocol was pilot tested for suitability.

Data analysis

Data were analysed using STATA version 14. Prevalence estimates and 95% confidence intervals were generated for vision impairment, disaggregated by severity, age and gender. The svy command was used to derive prevalence estimates accounting for the cluster sampling design. Sensitivity, specificity, predictive values positive and negative were estimated comparing clinical measures to self-reported difficulties with seeing. First, using a broader definition of vision loss (i.e. “some” or more difficulty seeing reported) and then using a more restrictive definition of vision loss (i.e. “a lot” or more difficulty seeing).

Ethics

Ethical Approval for the study was obtained from: the London School of Hygiene & Tropical Medicine (UK), the National Ethics Committee for Research in Human Health (Cameroon) and the Cameroon Baptist Convention Health Board Institutional Review Board (Cameroon). We adhered to the guidelines of the Declaration of Helsinki during the conduct of the study. All participants who attended the screening gave written/finger print informed consent. For people aged <21 years a caregiver was required to provide consent and remain present throughout the screening. All participants with unmet health needs were referred to relevant services.

RESULTS

In total, 4,080 people (51 clusters of 80 people) were enumerated for the survey, of whom 3,567 were screened (response rate 87%). The age distribution of the study participants was generally similar to the census estimates, although females were overrepresented in the sample (Table 1). Among the non-responders, only 0.5% (n=17) refused to participate, whilst the remaining 12.7% (n=521) were unavailable at the time of the study. Mean age was higher amongst non-attenders (28.5 95% CI 26.8-30.1 years) than those examined (24.4 years 95% CI 23.6-25.1). Gender distribution was similar between those examined (59% female) and non-attenders (56%), but refusers were more likely to be female (65%).

The overall prevalence of VI (VA<6/18) was 2.3% (95% CI=1.8-3.0%) and the prevalence of blindness (VA<3/60) was 0.6 (0.3-1.0%) (Table 2). The prevalence of both blindness and VI increased rapidly with age, so that the vast majority of cases of VI (84%) and blindness (82%) were in people aged 50+. The prevalence of VI was similar in males (2.5%, 1.7-3.8%) and females (2.2%, 1.6-3.0%), while blindness was more common in males (0.9%, 0.5-1.8%) than females (0.3%, 0.2-0.9%).

The main cause of blindness and VI were both posterior segment disease followed by cataract (Table 3). Posterior segment disease included diabetic retinopathy, glaucoma, ARMD, in the absence of cataract, refractive error or other anterior segment causes. Refractive error was a leading cause of visual impairment, but not of blindness. Only 0.3% of people in the survey wore glasses for refractive error correction. Among the 8 children (age<18) with VI, the leading cause was posterior

segment disease (75%) followed by refractive error (25%). Posterior segment disease was also the most common cause of VI for adults aged 18-50 years (67%) followed by cataract (33%). Among the 66 adults aged >50 with VI, 35% was due to cataract, 33% to posterior segment disease, and 22% to refractive error. In terms of blindness in this age group, 60% was due to posterior segment disease, while cataract was responsible for 27%. Causes of blindness and VI were therefore similar among people aged >50 years to in the total population.

Fifty-two eyes had been operated for cataract, among people identified in the survey, and the mean time since operation was 6.6 years (SD=6.9).The cataract surgical coverage (CSC – i.e. proportion of all cataract patients or eyes that have received cataract surgery) was relatively high (87% of people and 61% of eyes at VA<6/60). CSC for people was lower in males (83%) than females (91%). Nearly a third of eyes (31%) had a poor outcome after surgery (VA<6/60), which improved slightly after correction for refractive error (27%). Cause of poor/borderline outcome was available for 23 out of 29 eyes with VA<6/18 after cataract surgery. Ocular co-morbidity (35%) and refractive error (35%) were the leading causes of poor/borderline outcome. Long-term complications (i.e. where there was initially a good outcome, with subsequent vision loss apparently due to postoperative capsule opacification or retinal detachment) was responsible for 26% of poor/borderline outcomes, while operative complications were rarely the cause (4%). Almost all people (97%) had undergone surgery at Mission hospitals. The most common reported barriers to cataract surgery among those with VI<6/18 due to cataract, were inability to afford surgery (59%), lack of perceived need for surgery (33%) and lack of awareness that treatment was possible (30%).

Among the 82 people with VI, 22% (95% CI: 14-32%) had a physical impairment or epilepsy and 30% (22-41%) had a hearing impairment. Among the 17 people who were blind 18% (6-41%) had a physical impairment or epilepsy and 41%(22-64%) had a hearing impairment. Furthermore, almost half (49%, 95% CI: 38-59%) of people with VI had “a lot” or more difficulties in at least one domain other than vision, as assessed by the Washington Group Short Set. People with other functional difficulties (excluding those due to vision problems) had lower CSC than those without functional difficulties (83% vs 92%), although this difference was not statistically significant (p=0.09).

Self-reported difficulties in vision were closely related to clinical measures of VI (Table 4). Of the 82 people with VI, 65 reported “some” or more difficulties with seeing (sensitivity=79%) and 25 reported “a lot of difficulty” or more with seeing (sensitivity = 30%). Of the 3229 people who had no VI (VA>=6/18), 2582 reported no problem with seeing (specificity = 80%). Of the 2599 who reported that they had no problem with seeing, 2582 also had no VI (negative predictive value of 99%). Among 712 people who said that they had “some” or more problem with vision, 65 had VI (positive predictive value of 9%). However, if this was restricted to the group reporting “a lot of difficulty” or more then the positive predictive value increased to 46%.

DISCUSSION

This study conducted in Fundong district in North-West Cameroon had a number of findings that are important from both the programmatic and methodological perspective in order to address the needs of people affected by VI in Fundong district and other similar contexts.

The all age prevalence of blindness in this study (0.6%) was similar to the estimates for Africa from the WHO global review (0.7%), while the prevalence of VI (2.3%) was lower than in the review (3.3%).[2] Two previous surveys were conducted in Cameroon, both among people aged 40+ years. When restricting our estimates to people aged 40+, the prevalence of blindness (2.0%, 1.2-3.3%) and vision impairment (8.4%, 6.3-10.9%) reported in this study were similar to those from the rural area (1.6% and 10.2%)[15] but higher than in the urban area (1.1% and 4.4%).[16] As expected from the global review,[2] the prevalence of VI and blindness increased rapidly with age, with the majority of VI cases found in people aged 50 years+, even though this group only constituted 18% of the survey sample. Furthermore, the causes of VI in this age group were reflective of the causes across the whole population. These findings provide strong rationale for the continued use of RAAB which focuses on people aged 50+, as the prevalence of VI is highest in this age group so that a smaller sample size is required for surveys, yet the causes of VI reflect those of the population of all ages, allowing planning of public health strategies. These results therefore tally with those previously made using data from the Gambia, which also supported the use of surveys in people aged 50+ for assessing visual impairment prevalence in populations,[17] as well as for settings with

higher prevalence of refractive error such us Shanxi Province China (76% of visual impairment among people of all ages was in people aged 50+) [18] and Hebei Province China (82% of visual impairment among people aged 7+ was in people aged 50+). [19]

Posterior segment disease was the leading cause of blindness, responsible for 65% of cases. This group of disorders included diabetic retinopathy, glaucoma, ARMD, but attempts was not made to define the exact cause, given that ophthalmic nurses with limited ophthalmic equipment made diagnoses in the field available. The results were similar to the study in the urban area in Cameroon, where posterior segment disease was responsible for 67% of blindness.[16] The high CSC achieved through outreach services and subsidised cataract surgeries supported by mission hospitals was a likely explanation for the relatively low prevalence of cataract blindness and proportionately higher contribution of posterior segment disease in both settings. This pattern of causes is in contrast with hospital based studies and population–based surveys conducted in rural parts of Cameroon, where CSC was relatively low and cataract was the leading cause of blindness.[15, 20] Another possible explanation of the dominance of posterior segment disease as a cause of blindness and VI in this study was that this area of Cameroon had been hyperendemic for onchocerciasis in the past.[21] The dominance of posterior segment disease as a cause of VI in this setting will require further investigation to elucidate the types of posterior segment disease that predominate and therefore define prevention and treatment strategies. It is likely that glaucoma is the leading cause of posterior segment disease here, as it was within the national survey of blindness in Nigeria,[22] which would necessitate a scale up of appropriate services in order to diagnose the condition and provide long-term sustained treatment.

Poor outcome after surgery is an important concern highlighted by the survey, as 31% of eyes had VA<6/60 against the recommended level of no more than 5%.[23] Similar findings were reported in the earlier surveys in Cameroon,[15, 16] as well as elsewhere in West Africa.[24] Urgent attention is therefore needed to further investigate the causes of poor outcomes after cataract surgery and develop strategies for improvement. These strategies may vary by setting, but are likely to include better monitoring of outcomes, better management of eye departments, improved provision of refractive correction after surgery, and more widespread use of biometry.[25, 26]

The prevalence of hearing impairments (30%) and the prevalence of physical impairments (22%) was high among people with VI, as was reported functional difficulties not related to vision. This finding is unsurprising, since these impairments are more common in older people, and are therefore likely to cluster. However, there are few previous similar studies investigating the overlap of VI with other impairments. This evidence emphasises the need to ensure that eye health services are inclusive of people with disabilities. This is important to ensure the fulfilment of the rights of people with disabilities to health care, as stipulated by the United Nations Convention on the Rights of Persons with Disabilities. In addition, since people with disabilities may face difficulties in accessing health care services, it is unlikely that Universal Health Coverage will be achieved, or the Sustainable Development Goal of “Good Health and Wellbeing”, without making efforts to ensure that all health services are inclusive of people with disabilities. There are many

changes that can be made to provide inclusive eye health services, although the effectiveness of these has not been formally evaluated. These approaches include providing accessible buildings, training staff on the needs and rights of people with disabilities, and ensuring that information is available in different formats. [6] Incorporating the Short Set Washington Questions within the RAAB survey protocol may be helpful to highlight the high correlation of VI with other functional difficulties, and therefore help to advocate and plan for inclusive eye health services (e.g. accessible facilities and transport).

Self-reported difficulties in vision were closely related to clinically measured VI, with relatively high sensitivity and specificity. A strong positive relationship between visual acuity and self-rated vision has been noted in previous studies. [8, 9] However, these studies also showed that self-rated vision is related to other aspects of visual function besides VA, including contrast sensitivity, stereoacuity and visual fields. These features were not measured in this study, and may explain some of the discrepancies between self-reported and clinically measured visual problems. The poor positive predictive value shows that self-reported vision is inadequate for assessing the prevalence of VI, and clinical measures are still needed in order to determine eye health service needs.

There were a number of limitations to the study. The prevalence of VI was lower than expected, so the precision of the prevalence estimates was less than anticipated, but is accurately reflected by the 95% confidence intervals reported . Diagnoses were made by an ophthalmic nurse in the field with limited equipment available, making

determination of causes of posterior segment disease difficult as well as assessment of visual acuity in young children. Furthermore, there was the potential for selection bias with under-estimation of men of working age and over-sampling of the older population, which may have over-estimated the prevalence of visual impairment. There were also important strengths. The study was population-based and included people of all ages, in contrast to RAAB studies which focus on people aged >50 years. Complementary data were collected on other impairments, including hearing and physical impairment, as well as on self-reported difficulties with seeing.

In conclusion, ophthalmic programmes in Cameroon will need to incorporate control of posterior segment diseases while also working to improve outcomes after cataract surgery. It is also important to ensure that eye health services are designed to be inclusive of people with disabilities, since other impairments are common among people with vision impairment.

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