

Disability and its Predictors among Glaucoma Patients in a Nigeria City

¹O.O. Oyewole, ²O.T. Bodunde, ³K.S. Oritogun, ²H.A. Ajibode, ²O.O. Onabolu, ²O.T.Otulana

1. Department of Physiotherapy, Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria.
2. Department of Ophthalmology, Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria.
3. Department of Community Medicine and Primary Care, Olabisi Onabanjo University, Sagamu, Nigeria.

Abstract

This study estimates disability and its predictors among adult Nigerians with glaucoma. Cross-sectional design, recruiting consecutive glaucoma patients attending a glaucoma clinic. Disability was assessed using WHO Disability Assessment Schedule. Poisson regression was used to assess predicting factors. 123 (male 70, 56.9%) glaucoma patients with mean age 62.8±15.1 years participated in the study. Mild to moderate disability was reported (108, 87.8%) with overall level of 18 and 56% reported moderate/severe degree of their disability. This was high in mobility and life activities domains such as walking outside home and community participation. Sex, marital status, religion, age, left intraocular pressure and diastolic blood pressure significantly predicted disability. Male participants compared with females and participants who professed belief in Christianity/Islam compared with traditional belief were 14% and 50% respectively less likely to report disability. The singles were 4 times more likely to report disability compared with widow/widower. Participants with less than tertiary education were more likely to be 34% disabled. With increase in age, the participants were more likely to be 0.02% disabled and with a decrease in diastolic blood pressure, there is 0.6% decrease in disability. In conclusion, moderate disability was reported especially in mobility and participation domains with 56% expressing moderate/severe degree of it. Older age impact upon disability and is a good predictor of it whereas being religious is less so.

Keywords: Glaucoma, Disability, Prevalence, Predictor, Nigeria

Introduction

Glaucoma is one of the diseases causing visual impairment leading to significant functional/mobility disability.¹⁻⁴ It is a public health problem in Sub-Saharan Africa (SSA) with prevalence of 4.5% and the second leading cause of blindness.⁵ Poor awareness and low knowledge about glaucoma among people affected by the condition compound the health problem of the sufferer in SSA.⁵ In Nigeria about 5% of the population are reported to be suffering from glaucoma blindness⁶ partly because of lack of awareness, inadequate uptake of services and non-adherence to treatment.⁷

The impact of glaucoma on the sufferer is multi-dimensional. A significant social impact caused by glaucomatous visual field loss has been reported to include: social isolation, higher rates of institutional living and increased burden on friends and family members.^{3,4} Glaucoma is associated with functional/mobility disability such as driving limitation or cessation, slower walking, difficulties in stair climbing and reading.^{3,4,8} Coupled with fear of falling, this may result in more home-bound and less travel away from home among individuals with glaucoma, particularly those with greater visual field loss than individuals with normal vision and may result into physical inactivity.⁹⁻¹¹ Glaucoma is associated with disability in instrumental activities of daily living while significant visual field loss is associated with falls and fractures.¹² Thus, people with glaucoma are prone to these consequences including: difficulties related to extremes of lightning such as glare, bumping into objects, and difficulties in performing household chores, problem of face recognition/social relations and balance impairment.³ It has been suggested that patients severely impaired from glaucoma are more likely to develop depression.³ Therefore, estimating post glaucoma disability will not only provide magnitude of the problem but can help in defining guidelines to increase patients' safety (i.e. avoid crashes in drivers), identify subjects who might benefit from rehabilitative interventions, and test the efficacy of rehabilitative interventions.³

Results of a focus group study from Nigeria suggested that emotional well-being, social issues, economic issues, impact on family and relationships and resilience were the major issues/problems faced among people with glaucoma.⁷ In another study,

Correspondence to:

O.O. Oyewole

Department of Physiotherapy,
Olabisi Onabanjo University Teaching Hospital,
PMB 2001, Sagamu, Nigeria.
+2348033970714,
oyewoleye@yahoo.co.uk, oyewoleye@gmail.com

activity participation, moving around environment, ability to uphold personal responsibilities and commitments, importance of lighting, and emotional and psychological impact were functioning perceived to be affected among people with glaucoma.¹³ Therefore, estimating these impacts of glaucoma among the sufferer will further help in identifying the health need of people with glaucoma.

In a review study, factors such as the age of onset of glaucoma and the natural history, access to services, the quality of care provided and adherence to treatment and follow-up and intraocular pressure greater than 31 mmHg were reported to influence disability severity.⁵ Socio-demographic factors such as place of residence and gender may affect the accessibility of health services and thereby worsen the disability.²

Studies that estimate disability among people with glaucoma in Nigeria are scarce for referencing. Assessing disability in glaucoma patients will help identify health needs of people with glaucoma and thus, emphasis can then be placed on developing interventions to target specific functional deficits.¹ Therefore, the aim of this study was to estimate disability and its predictors among glaucoma patients attending a glaucoma clinic in Nigeria.

Methods

This study was approved by Health Research Ethic Committee of Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria (OOUTH) and adhered to the tenets of the Declaration of Helsinki. All the participants provided written informed consent. The study procedure was completed between June, 2016 and July, 2017.

Study participants

A hospital-based cross-sectional study was carried out and recruited consecutively. 123 glaucoma patients attending glaucoma clinic of Olabisi Onabanjo University Teaching Hospital, Sagamu were eligible if diagnosed by an Ophthalmologist as having glaucoma and able to grant interview.

Assessment of disability

Short form of WHO Disability Assessment Schedule (WHODAS 2.0) was used to assess disability among the participants. It is a generic tool for assessing disability in population and ill-health conditions. We chose WHODAS 2.0 in order to make our results comparable with other studies which assessed disability in ill-health conditions. Short form WHODAS 2.0 is a 12-item instrument and five-point ordinal scale ranging from 1 (none) to 5 (extreme/cannot do it), the greater the score the worse the disability. Its validity, psychometric properties, development and scoring has been discussed in detail

in other studies.¹⁴⁻¹⁷ For summary score and simple sum analysis, we re-coded each item as 0 (none) to 4 (extreme/cannot do it). Each item was dichotomised for item-based analysis as 0 (no disability) and 1 to 4 (presence of disability). Summary score of 45 was the cut-off point for overall disability.¹⁸ Simple sum norm values of 1-4, 5-9, and 10-48 were used to classify survivors as having mild, moderate, and severe disability respectively.¹⁴

Evaluation of demographics and health information

A structured questionnaire was used to collect information on socio-demographic data. Self reported information on duration of glaucoma was also obtained. Standard methods were used to assess participants' blood pressure and body mass index.

Assessment of vision

Visual acuity was assessed with Snellen's chart, adapted the meter system to record near visual acuity and this was converted to Logarithm Minimum Angle of Resolution (LogMAR). The most recent intraocular pressure was extracted from the patients' record.

Statistical Analysis

All data were analysed using the statistical package for social sciences (SPSS 16.0.) and R software package version 3.2.1 (1999-2015 R, Core Team). Descriptive statistics of mean, standard deviation, median and inter quartile range were used to assess continuous variables while frequency, percentage and charts were used to assess categorical variables. Chi-square (χ^2) test was used to assess gender differences of disability items. Independent variables reduction was performed using cluster analysis by grouping the independent variables into five clusters and two variables with highest squared loading (R^2) values were selected from each cluster. Poisson regression was used to assess predicting factors of disability. *P*-value was considered significant at 0.05.

Results

One hundred and twenty-three (male 70, 56.9%) glaucoma patients with mean age 62.8±15.1 years participated in the study. The majority were married and had formal education. Their health and vision variables are as shown in table 1.

The overall level of disability was 18.4±15.6 which suggests mild disability based on ICF severity. When stratified by items, the disability was mild (11.4% to 20.3%) in 4 items, moderate (25.2% to 48.8%) in 6 items and high (52.8% to 69.1%) in 2 items (table 2). Mobility domain especially walking outside home and participation domain i.e. emotional restriction to participate in community activity were the severely affected domains. Life activity such as

Table 1: Characteristics of the participants

Demographics	Mean±SD/ median(IQR)	n (%)
Age in year, Mean±SD	62.8±15.1	
Male, n(%)		70(56.9)
<i>Marital status</i>		
Single		7(5.7)
Married		91(74.0)
Widow/widower		25(20.3)
<i>Education</i>		
No formal education		17(13.8)
Formal education		106(86.2)
<i>Occupation</i>		
Working/employed		66(53.7)
Unemployed/retired		57(46.3)
<i>Religion</i>		
Christian		89(72.4)
Islam		32(26.0)
Tradition		2(1.6)
Health		
Systolic blood pressure in mmHg, Mean±SD	130.6±20.5	
Diastolic blood pressure in mmHg, Mean±SD	79.9±12.2	
Body mass index in kg/m, Mean±SD	23.89±4.28	
%disability(IRT), median(IQR)	13.89(5.56, 27.78)	
Vision		
<i>Intraocular pressure in mmHg, Mean±SD</i>		
Right eye	16.3±8.4	
Left eye	16.7±7.3	
<i>VA in Log MAR, median(IQR)</i>		
Right eye	0.6(0.3, 1.8)	
Left eye	0.6(0.3, 1.8)	
Glaucoma duration in month, median(IQR)	40(12, 93)	

household responsibilities and cognition such as learning a new task were moderately affected. However, when summary cut-off score (45) was used only 9.0% reported overall disability. There was no gender association with disability (table 2). Only 19.5% of the participants reported disability in more than 6 items while 26.8% reported disability in one or two items (figure 1). Figure 2 shows severity/degree of disability. About 56% of the participants have moderate/severe disability while 32% have mild disability. About 12% (17% in males and 6% in females) of the participants reported no disability (figure 2). When stratified by sex, the pattern remains the same as there was no sex difference except in the mild disability group (27% mild disability in males as

against 38% in females).

Table 3 shows regression analysis of disability and associated factors. Sex, marital status, religion, education, age, left intraocular pressure and diastolic blood pressure were significantly associated with disability among the participants. Male participants compared with females and those who professed belief in Christianity/Islam compared with traditional belief were 15% and 52% respectively less disabled. The singles were 3 times more disabled compared with married. Participants with less than tertiary education were more likely to be disabled (37% - 52%). With increase in age, they were 2.1% disabled and with a decrease in diastolic blood pressure, there is 0.5% decrease in disability.

Table 2: Prevalence of disability by items and its association with gender

Items		All sample	Male	Female	χ^2 -value	P-values
		n (%)	n (%)	n (%)		
1. How much difficulty did you have in standing for long periods such as 30 min?	Disability	41(33.3)	22(31.4)	19(35.8)	0.265	0.61
	No disability	82(66.7)	48(68.6)	34(64.2)		
2. How much difficulty did you have in taking care of your household responsibilities?	Disability	50(40.7)	29(41.1)	21(39.6)	0.041	0.84
	No disability	73(59.3)	41(58.6)	32(60.4)		
3. How much difficulty did you have in learning a new task, for example, learning how to get to a new place?	Disability	53(43.1)	27(38.6)	26(49.1)	1.352	0.25
	No disability	70(56.9)	43(61.4)	27(50.9)		
4. How much of a problem did you have joining in community activities?	Disability	60(48.8)	34(48.6)	26(49.1)	0.003	0.96
	No disability	63(51.2)	36(51.4)	27(50.9)		
5. How much have you been emotionally affected by your health problems?	Disability	85(69.1)	44(62.9)	41(77.4)	2.971	0.09
	No disability	38(30.9)	26(37.1)	12(22.6)		
6. How much difficulty did you have in concentrating on doing something for 10 min?	Disability	24(19.5)	12(17.1)	12(22.6)	0.581	0.45
	No disability	99(80.5)	58(82.9)	41(77.4)		
7. How much difficulty did you have in walking a long distance such as a kilometer [or equivalent]?	Disability	65(52.8)	35(50.0)	30(56.6)	0.528	0.47
	No disability	58(47.2)	35(50.0)	23(43.4)		
8. How much difficulty did you have in washing your whole body?	Disability	18(14.6)	11(15.7)	7(13.2)	0.152	0.70
	No disability	105(85.4)	59(84.3)	46(86.8)		
9. How much difficulty did you have in getting dressed?	Disability	14(11.4)	7(10.0)	7(13.2)	0.308	0.56
	No disability	109(88.6)	63(90.0)	46(86.8)		
10. How much difficulty did you have in dealing with people you do not know?	Disability	25(20.3)	12(17.1)	13(24.5)	1.016	0.31
	No disability	98(79.7)	58(82.9)	40(75.5)		
11. How much difficulty did you have in maintaining a friendship?	Disability	31(25.2)	17(24.3)	14(26.4)	0.073	0.79
	No disability	92(74.8)	53(75.7)	39(73.6)		
12. How much difficulty did you have in your day-to-day work?	Disability	42(34.1)	26(37.1)	16(30.2)	0.649	0.42
	No disability	81(65.9)	44(62.9)	37(69.8)		
All items (summary score)	Disability	11(8.9)	5(7.1)	6(11.3)	0.647	0.42
	No disability	112(91.1)	65(92.9)	47(88.7)		

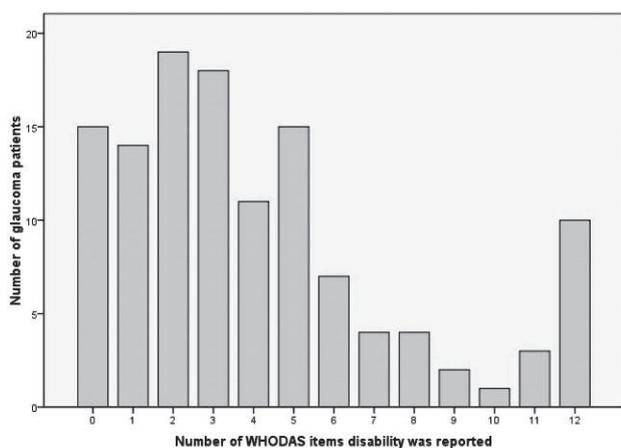


Figure 1: Frequency distribution of number of WHODAS items disability was reported

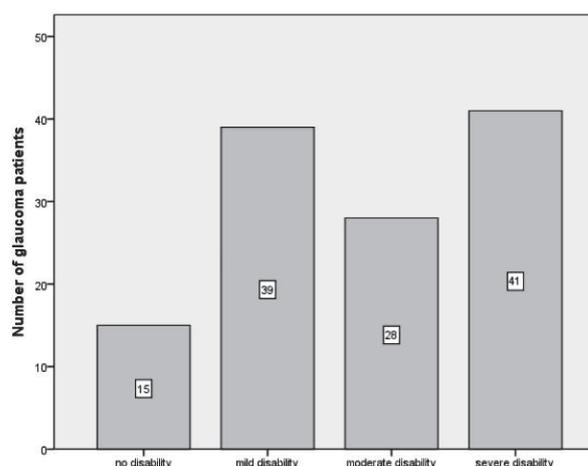


Figure 2: Severity/degree of disability

Table 3: Poisson regression of disability and associating factors

Variables	B	SEB	IRR	95%CI(IRR)	P
Intercept	2.118	.2480	8.311	5.112 13.512	0.0001
Sex					
Female (ref)					
Male	0.163	0.0475	0.850	0.774 0.933	0.001
Marital status					
Married (ref)					
Single	1.168	0.1302	3.214	2.490 4.149	0.0001
Widow/widower	-0.253	0.0594	0.777	0.691 - 0.873	0.0001
Religion					
Traditional (ref)					
Christian	-0.737	0.1323	0.479	0.369 - 0.620	0.0001
Islam	-0.779	0.1348	0.459	0.352 - 0.598	0.0001
Education					
Tertiary (ref)					
Illiterate/primary	0.421	0.0570	1.524	1.363 - 1.704	0.0001
Secondary/proficiency cert	0.317	0.0574	1.373	1.226 - 1.536	0.0001
Age	0.021	0.002	1.021	1.016- 1.026	0.0001
Glaucoma duration	0.000	0.000	1.000	1.000- 1.001	0.322
Right IOP	0.006	0.003	1.006	0.999- 1.012	0.089
Left IOP	0.011	0.003	1.011	1.005 - 1.018	0.001
Systolic blood pressure	0.001	0.002	1.001	0.998 – 1.004	0.631
Diastolic blood pressure	-0.005	0.003	0.995	0.990 – 1.000	0.041

IOP: Intraocular pressure

Discussion

Our study found mild to moderate disability among adult Nigerians with glaucoma and many reported moderate/severe degrees of their disability. This was high in mobility and life activities domains. Worse glaucoma disability was determined by being single, lower education, being female and older age. However, lower diastolic blood pressure and expressing belief in Christianity/Islam reduced the disability in people with glaucoma.

Our report is in agreement with previous studies which reported mobility disability among visually impaired (glaucoma inclusive) adults.^{1,3,19} The mobility disability by visual impairment status has been reported to be largely accounted for by slower performance speeds among the visually impaired such as glaucoma.¹⁹ Majority of our study participants were elderly and it has been observed that speed declined with aging, and the visually impaired had significantly slower speeds than the non-visually impaired.²⁰ Thus, improving mobility performance especially walking outside home among people with glaucoma may reduce glaucoma disability. This is important as impaired mobility has been suggested to be a primary pathway leading to instrumental activities of daily living

disability in patients with Glaucoma.¹ Thus, travelling outside of the home and grocery shopping, in particular, which require a means of transportation and the ability to walk in an out-of-home environment with varied terrain may be affected and thereby limit physical activity.¹⁹ Therefore, effort during rehabilitation should be directed at improving mobility performance such as walking in order to reduce the perception of disability among older people with glaucoma. This may also improve community participation which was observed to be severely affected among participants in this study.

The level of disability in this study was 18 which suggest mild disability based on ICF severity. This was lower than 44 reported among Nigeria stroke survivors¹⁸ though, the samples from both studies were from the same setting in Nigeria. The differences in disability reported among people with glaucoma and stroke survivors could be explained due to more affectation of motor and cognition in stroke survivors compared with glaucoma patients.²¹ It has been observed that neurological chronic disorders contributed more to disability than visual impairments.²² However, the level of disability reported was similar to 22 reported among Nigerian with diabetes.²³ Therefore, attention should be focused on

people with glaucoma once the diagnosis has been made so as to limit the post glaucoma disability. This is essential as glaucoma has been linked to contribute to disability significantly.²²

Comparing the proportion of disability reported by people with glaucoma in our study that used generic measure of disability with other studies that used glaucoma specific disability measures or visual function questionnaires indicated that the value of disability reported is lower in the present study compared to other studies. Generally, it seems glaucoma specific disability measures or visual function questionnaires captured more disability among people with glaucoma than generic scale. For instance in Ethiopia, Africa, the proportion of disability measured by Glaucoma Quality of Life-15 questionnaire (GQL-15) showed that the mean GQL-15 score in the glaucoma cases was substantially higher (46.3) indicating high disability and poorer quality of life than the apparently healthy controls (18.6).²⁴ Whereas in Norway only 54% of patients with glaucoma reported visual disability or difficulties.²⁵ When disability was assessed by the 12-item ocular surface disease index (OSDI) questionnaire, scores on OSDI questionnaires indicated that 62.7% of patients who had glaucoma or ocular hypertension and who were using one intraocular pressure lowering medication had mild to severe disability.²⁶ Even the prevalence of end-of-life visual impairment (26%) is considerable in patients with glaucoma.²⁷ In a study that measured disability in a large data set using WHODAS 2.0, it suggested that the scale capture disability more among Physical impairment (stroke and spinal cord injury) and mental impairment (schizophrenia, dementia, depression, bipolar affective disorder, mental retardation, and autism) compared with sensory impairment (visual and hearing diseases).²⁸ Generally, patients with glaucoma often have challenge in outdoor mobility, glare and lighting, household tasks, and personal care which most of visual function questionnaires addressed in their questions in assessing disability.^{3,4,8}

However, WHODAS 2.0 has been shown to capture disability in physical disorders including visual impairments.¹⁴ Therefore, we chose it to assess disability among patients with glaucoma in order to compare our study results to other ill-health disorders and general population in which the scale has shown to have good psychometric properties.¹⁴⁻¹⁷ More so, our goal of chosen WHODAS satisfied the two major criteria of Washington group. It was relevant to our population and feasible to collect the data with short form generic scale. The scale was developed to assess difficulties due to health conditions including diseases, illnesses, or injuries, mental or emotional problems, and problems with alcohol or drugs.¹⁴

Factors that influence the report of glaucoma

disability are multi-factorial. The present study suggests that sex, marital status, religion, education, age, left intraocular pressure and diastolic blood pressure were significantly associated with disability among people with glaucoma. Though, disability reported stratified by items was similar in both genders, the regression analysis revealed that men with glaucoma were 15% less than women reported disability. Globally, women have reported more visual impairments than men and thus have participation restriction and activity loss.^{2,29} Therefore, women should be more targeted during rehabilitation for disability reduction.

The present study indicated that with an increase in age, the participants were more likely to be disabled. This is expected as function declined with aging.^{30,31} Advance age is associated with glaucoma.³² Coupled with chronic conditions such as glaucoma, the disability reported among aged may be worsening as shown by our data. Another finding of this study is that the singles were 3 times more likely to have disability compared with married. As shown by the present data, majority are emotionally affected by their health conditions. It is likely that singles are more emotionally affected and thus worsening the disability. It has been observed that emotional adaptation decreased in the visually impaired over time.³³ Evidence has shown that functional inability impacted 'positive affect' and that functional ability is a key competence for successful emotional aging in sensory impaired individuals.³⁴ The results of this study also revealed that participants who professed belief in Christianity/Islam were 52% less disabled. Participating in public and private religious activity has been shown to have between 2 and 4 more total and disability-free years at age 55 compared to their counterparts that reported never participating.³⁵ Also, higher religious attendance predicts lower levels of functional disability.³⁶

Other findings of this study showed the influence of socioeconomic statuses on the report of glaucoma disability. Participants with less than tertiary education were more disabled. Generally, studies have indicated poor health outcome among low educated people.³⁷⁻⁴⁰ Low-education predicted either presence or severity of disability.⁴⁰

The clinical variables such as intraocular pressure and diastolic blood pressure predicted glaucoma disability in the present study. With increase in left intraocular pressure (IOP), there was 0.1% more disability reported. Elevated IOP has been associated with glaucoma progression.⁴¹ The subjects in the present study were undergoing glaucoma treatment which includes IOP reduction medication. Effort should be directed more to compliance with medication to facilitate optimal reduction of IOP as non-adherence to treatment has been reported among Nigerians with glaucoma.⁷ Therefore, reduction of IOP may prevent or

delay visual field loss in patients with glaucoma and hence reduce post glaucoma disability.⁴¹ Generally, increased visual field loss is associated with disability severity.^{42,43} Our data suggest participants with elevated IOP reported severe disability and since elevated IOP have been associated with increased visual field loss,⁴⁴ it is likely that some of our participants may have substantial visual field loss. This may account for 56% of them reported moderate/severe degree of their disability. Therefore, effort directed at addressing visual field loss and elevated IOP may reduce significantly the disability experienced by glaucoma patients.

Limitation

The results of the present study should be interpreted with caution. The participants are undergoing glaucoma treatment and thus the magnitude of glaucoma disability might have been attenuated and thus may report lesser disability than generality of people with glaucoma that are not aware of their condition or adhere to treatment. Therefore, the results of this study may not be generalised to the population. Also, the disability reported in this study might be more than the value reported if glaucoma specific disability measure was used as it has been shown that disease-specific measure captured more disability. As in many cross-sectional study, causal effect relationship may not be drawn. This might undermine the results of regression analysis.

Conclusion

Moderate disability was reported among glaucoma patients especially in mobility participation, cognition and life activity domains with 56% expressing moderate/severe degree of it. Older age impact upon disability and is a good predictor of it whereas being religious is less so.

References

- Hochberg C, Maul E, Chan ES, Van Landingham S, Ferrucci L, Friedman DS, et al. Association of Vision Loss in Glaucoma and Age-Related Macular Degeneration with IADL Disability. *Invest Ophthalmol Vis Sci*. 2012 May;53(6):3201–6.
- Kıvanç SA, Akova-Budak B, Olcaysü OO, Çevik SG, Kıvanç SA, Akova-Budak B, et al. Sociodemographic status of severely disabled and visually impaired elderly people in Turkey. *Arq Bras Oftalmol*. 2016 Feb;79(1):24–9.
- Ramulu P. Glaucoma and Disability: Which tasks are affected, and at what stage of disease? *Curr Opin Ophthalmol*. 2009 Mar;20(2):92–8.
- Ramulu PY, West SK, Munoz B, Jampel HD, Friedman DS. Driving Cessation and Driving Limitation in Glaucoma: The Salisbury Eye Evaluation Project. *Ophthalmology*. 2009 Oct;116(10):1846–53.
- Kyari F, Abdull MM, Bastawrous A, Gilbert CE, Faal H. Epidemiology of glaucoma in Sub-Saharan Africa: Prevalence, incidence and risk factors. *Middle East Afr J Ophthalmol*. 2013 Apr 1;20(2):111.
- Kyari F, Entekume G, Rabi M, Spry P, Wormald R, Nolan W, et al. A Population-based survey of the prevalence and types of glaucoma in Nigeria: results from the Nigeria National Blindness and Visual Impairment Survey. *BMC Ophthalmol* [Internet]. 2015 Dec 12 [cited 2017 Sep 11];15. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676891/>
- Abdull MM, Chandler C, Gilbert C. Glaucoma, “the silent thief of sight”: patients' perspectives and health seeking behaviour in Bauchi, northern Nigeria. *BMC Ophthalmol* [Internet]. 2016 Apr 21 [cited 2017 Sep 11];16. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4839108/>
- Prado Vega R, van Leeuwen PM, Rendón Vélez E, Lemij HG, de Winter JCF. Obstacle Avoidance, Visual Detection Performance, and Eye-Scanning Behavior of Glaucoma Patients in a Driving Simulator: A Preliminary Study. *PLoS ONE* [Internet]. 2013 Oct 16 [cited 2017 Sep 11];8(10). Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3797776/>
- Nguyen AM, Arora KS, Swenor BK, Friedman DS, Ramulu PY. Physical activity restriction in age-related eye disease: a cross-sectional study exploring fear of falling as a potential mediator. *BMC Geriatr* [Internet]. 2015 Jun 12 [cited 2017 Sep 11];15. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4464712/>
- Ramulu PY, Hochberg C, Maul EA, Chan ES, Ferrucci L, Friedman DS. Glaucomatous Visual Field Loss Associated with Less Travel from Home. *Optom Vis Sci Off Publ Am Acad Optom*. 2014 Feb;91(2):187–93.
- Ramulu PY, Maul E, Hochberg C, Chan ES, Ferrucci L, Friedman DS. Real-World Assessment of Physical Activity in Glaucoma Using an Accelerometer. *Ophthalmology*. 2012 Jun;119(6):1159–66.
- Patino CM, McKean-Cowdin R, Azen SP, Allison JC, Choudhury F, Varma R. Central and Peripheral Visual Impairment and the Risk of Falls and Falls with Injury. *Ophthalmology*. 2010 Feb;117(2):199.

13. Glen FC, Crabb DP. Living with glaucoma: a qualitative study of functional implications and patients' coping behaviours. *BMC Ophthalmol* [Internet]. 2015 Oct 6 [cited 2016 Dec 10];15. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4596492/>
14. Andrews G, Kemp A, Sunderland M, Von Korff M, Ustun TB. Normative Data for the 12 Item WHO Disability Assessment Schedule 2.0. *PLoS ONE* [Internet]. 2009 Dec 17 [cited 2016 Dec 10];4(12). Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2791224/>
15. Galindo-Garre F, Hidalgo MD, Guilera G, Pino O, Rojo JE, Gómez-Benito J. Modeling the World Health Organization Disability Assessment Schedule II using non-parametric item response models. *Int J Methods Psychiatr Res.* 2015 Mar 1;24(1):1–10.
16. TB Üstün, N Kostanjsek, S Chatterji, J Rehm. *Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)* [Internet]. 20 Avenue Appia, 1211 Geneva 27, Switzerland: WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland; 2010. 88 p. Available from: http://apps.who.int/iris/bitstream/10665/43974/1/9789241547598_eng.pdf
17. Üstün TB, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, Epping-Jordan J, et al. Developing the World Health Organization Disability Assessment Schedule 2.0. *Bull World Health Organ.* 2010 Nov 1;88(11):815–23.
18. Oyewole OO, Ogunlana MO, Oritogun KS, Gbiri CA. Post-stroke disability and its predictors among Nigerian stroke survivors. *Disabil Health J.* 2016 Oct;9(4):616–23.
19. Swenor BK, Bandeen-Roche K, Muñoz B, West SK. Does Walking Speed Mediate The Association Between Visual Impairment and Self-Report of Mobility Disability? The Salisbury Eye Evaluation Study. *J Am Geriatr Soc.* 2014 Aug;62(8):1540–5.
20. Swenor BK, Muñoz B, West SK. A Longitudinal Study of the Association Between Visual Impairment and Mobility Performance in Older Adults: The Salisbury Eye Evaluation Study. *Am J Epidemiol.* 2014 Feb 1;179(3):313–22.
21. Oyewole OO, Odusan O, Bodunde OT, Thanni LOA, Osalusi BS, Adebajo AA. Self-acceptance and Attitude towards Disability among People with Disability Attending a Nigerian Tertiary Health Facility. *Br J Med Med Res.* 2017 May 6;21(3):1–10.
22. Palazzo C, Ravaud J-F, Trinquart L, Dalichampt M, Ravaud P, Poiraud S. Respective Contribution of Chronic Conditions to Disability in France: Results from the National Disability-Health Survey. *PLoS ONE* [Internet]. 2012 Sep 14 [cited 2017 Sep 11];7(9). Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3443206/>
23. Oyewole OO, Odusan O, Ale AO. Global disability burden and its predictors among adult Nigerians living with Type-2 diabetes. *Ghana Med J.* 2019 Jun;53(2):135–41.
24. Ayele FA, Zeraye B, Assefa Y, Legesse K, Azale T, Burton MJ. The impact of glaucoma on quality of life in Ethiopia: a case-control study. *BMC Ophthalmol.* 2017 Dec 13;17(1):248.
25. Odberg T, Jakobsen JE, Hultgren SJ, Halseide R. The impact of glaucoma on the quality of life of patients in Norway. I. Results from a self-administered questionnaire. *Acta Ophthalmol Scand.* 2001 Apr;79(2):116–20.
26. Costa VP, Marcon IM, Galvão Filho RP, Malta RFS. The prevalence of ocular surface complaints in Brazilian patients with glaucoma or ocular hypertension. *Arq Bras Oftalmol.* 2013 Aug;76(4):221–5.
27. Ernest PJG, Busch MJWM, Webers CAB, Beckers HJM, Hendrikse F, Prins MH, et al. Prevalence of end-of-life visual impairment in patients followed for glaucoma. *Acta Ophthalmol (Copenh).* 2013 Dec;91(8):738–43.
28. Chi W-C, Chang K-H, Escorpizo R, Yen C-F, Liao H-F, Chang F-H, et al. Measuring Disability and Its Predicting Factors in a Large Database in Taiwan Using the World Health Organization Disability Assessment Schedule 2.0. *Int J Environ Res Public Health.* 2014 Dec;11(12):12148–61.
29. Stevens GA, White RA, Flaxman SR, Price H, Jonas JB, Keeffe J, et al. Global prevalence of vision impairment and blindness: magnitude and temporal trends, 1990-2010. *Ophthalmology.* 2013 Dec;120(12):2377–84.
30. Besen E, Young AE, Pransky G. Exploring the relationship between age and tenure with length of disability. *Am J Ind Med.* 2015 Sep;58(9):974–87.
31. van Houwelingen AH, Cameron ID, Gussekloo J, Putter H, Kurrle S, de Craen AJM, et al. Disability transitions in the oldest old in the general population. The Leiden 85-plus study. *Age.* 2014 Feb;36(1):483–93.
32. Al-Mansouri FA, Kanaan A, Gamra H, Khandekar R, Hashim SP, Al Qahtani O, et al. Prevalence and Determinants of Glaucoma in Citizens

- of Qatar Aged 40 Years or Older: A Community-Based Survey. *Middle East Afr J Ophthalmol*. 2011;18(2):141–9.
33. Wahl HW, Schilling O, Oswald F, Heyl V. Psychosocial consequences of age-related visual impairment: comparison with mobility-impaired older adults and long-term outcome. *J Gerontol B Psychol Sci Soc Sci*. 1999 Sep;54(5):P304-316.
34. Wahl H-W, Drapaniotis PM, Heyl V. Functional ability loss in sensory impaired and sensory unimpaired very old adults: analyzing causal relations with positive affect across four years. *Exp Gerontol*. 2014 Nov;59:65–73.
35. Hidajat M, Zimmer Z, Saito Y, Lin H-S. Religious activity, life expectancy, and disability-free life expectancy in Taiwan. *Eur J Ageing*. 2013 Apr 5;10(3):229–36.
36. Van Ness PH, Kasl SV. Religion and Cognitive Dysfunction in an Elderly Cohort. *J Gerontol B Psychol Sci Soc Sci*. 2003 Jan;58(1):S21–9.
37. Bettger JP, Zhao X, Bushnell C, Zimmer L, Pan W, Williams LS, et al. The association between socioeconomic status and disability after stroke: Findings from the Adherence eValuation After Ischemic stroke Longitudinal (AVAIL) registry. *BMC Public Health*. 2014 Mar 26;14:281.
38. Demakakos P, Nazroo J, Breeze E, Marmot M. Socioeconomic status and health: the role of subjective social status. *Soc Sci Med* 1982. 2008 Jul;67(2):330–40.
39. Edmunds MR, Huntbach JA, Durrani OM. Are Ethnicity, Social Grade, and Social Deprivation Associated With Severity of Thyroid-Associated Ophthalmopathy? *Ophthal Plast Reconstr Surg*. 2014 May;30(3):241–5.
40. Siordia C. Disability Prevalence According to a Class, Race, and Sex (CSR) Hypothesis. *J Racial Ethn Health Disparities*. 2015 Sep 1;2(3):303–10.
41. Nguyen QH. Combination of brinzolamide and brimonidine for glaucoma and ocular hypertension: critical appraisal and patient focus. *Patient Prefer Adherence*. 2014 Jun 12;8:853–64.
42. Yang Y, Trope GE, Buys YM, Badley EM, Gignac MAM, Shen C, et al. Glaucoma Severity and Participation in Diverse Social Roles: Does Visual Field Loss Matter? *J Glaucoma*. 2016;25(7):e697-703.
43. Peters D, Heijl A, Brenner L, Bengtsson B. Visual impairment and vision-related quality of life in the Early Manifest Glaucoma Trial after 20 years of follow-up. *Acta Ophthalmol (Copenh)*. 2015 Dec;93(8):745–52.
44. Shukla AG, De Moraes CG, Cioffi GA, Girkin CA, Weinreb RN, Zangwill LM, et al. The Relationship Between Intraocular Pressure and Rates of Central Versus Peripheral Visual Field Progression. *J Glaucoma*. 2020 Jun;29(6):435–40.