Prevalence and Factors Associated with Ocular Morbidity among Prisoners of Luzira Prison (Uganda): Across-Sectional Based Study.

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Abstract

Background: Globally, ocular morbidity has emerged as a major public concern with over 284 million people visually impaired. Prisoners(inmates) tend to have limited access to health care especially eye health and as a result some conditions may go undiagnosed or mismanaged. With the increasing prison population in Uganda and in the face of limited facilities, little is known about the prevalence and factors associated with ocular morbidity amongst prisoners(inmates) of Luzira prison.

Method: This was a descriptive cross-sectional study conducted on inmates of Luzira prison. The study included both male (334) and female (33) prisoners(inmates) using the Proportionate Stratified Random Sampling. Data on social demographic characteristics, medical, imprisonment factors and ocular assessment was collected using a questionnaire. All complete data was entered using an Epidata version 3.1 entry template. Logistic regression was used to determine associated factors.

Results: Overall, a total of 367 inmates were examined consisting of 334 (91%) males and 33(8.9%) females. The male to female ratio was 10:1. The ages ranged from 18-76 years with mean age of 39 years (SD + 13.4). The overall ocular morbidity was found to be 49 percent. The most common ocular morbidity included; Presbyopia (27.4%), Allergic conjunctivitis (19.6%), Cataracts (11.4%). Other disorders included Refractive errors, Pterygia, Optic atrophy and Vitamin A deficiency. There was a statistically significant relationship between ocular morbidity and Age (OR 11.96, P-value=0.001), Trauma (OR 5.21, P-value 0.009), Non prison food (OR 0.45, P-value=0.006).

Conclusion: The prevalence of ocular morbidity among inmates was found to be high. Ocular morbidity was significantly associated with age, trauma and having meals besides prison food. A fully functional eye unit established within the prison with essential drugs and timely referral of complicated cases would help in offering quality eye services to the inmates.

Background

Eye diseases have emerged as a major public health concern yet eye care still tends to have a low priority rating in most developing countries general healthcare. WHO statistics show that about 284 million people are visually impaired worldwide, 39 million are blind and 246 million have low vision and most importantly 80% of all visual impairment can be treated, prevented or cured.

Ocular morbidity is a widespread term that describes any eye disease including both visually impairing and non-visually impairing conditions experienced by a population. Ocular morbidity is significant either to the individual (the individual is concerned enough to seek medical care) or to the professionals (the professional determines the individual would benefit from advice, review or treatment). The visually impairing ocular morbidity is a major public health problem. [1, 2] Cataracts, Refractive errors and Glaucoma are major causes of blindness throughout the world and need early detection and timely referral for management. Many non-visually impairing conditions for example allergic conjunctivitis, presbyopia, dry eye syndrome while not blinding can cause distress and result in demand for health

services. [3] One study showed that presbyopia and refractive errors have significant impact on the performance of near vision tasks and also distant in rural Tanzania. [4]

Prisons are places where people are confined for a period determined by law for purposes of retribution, deterrence, rehabilitation and protection of public and state. [5] A prisoner is a person incarcerated in a prison for a crime committed or an individual who is confined against ones will by force of the law either for a crime he is convicted of or pending investigation and trial for a crime one is accused of.[6] Prisoners have restricted access to health care particularly eye healthcare, hence eye disorders tend to be high in such communities.[7] In some studies that were done in Nigerian prisons, they showed a high prevalence of ocular morbidity among the inmates. Olesa prison and Benin city, 69.7% and 66.5% respectively. [7, 8] Another study was done on health status of inmates in Italy and eye diseases were some of the most frequently reported problems. [9]

Several factors strongly influence the occurrence, burden and pattern of ocular disease in a certain population. Such factors include; age, socioeconomic, occupational profile, environmental conditions. Healthcare system related factors like; access, quality, financing also strongly influence impart of these morbidities. [10] Findings from a study conducted by Human Rights Watch in Ugandan prisons reported that poor conditions (overcrowding, malnutrition, trauma), infectious diseases and inadequate medical care threaten the lives and health of the inmates. [11]

The prison population in Uganda is growing at an alarming rate of 10% annually straining the poor prison facilities. It is also estimated that the inmate population will increase from the current 42,000 to the projected 60,000 in the next five years if the government does not strengthen crime prevention. [12] Luzira prison is a maximum security prison for both male and female and currently Upper Prison Luzira has 3,190 inmates yet its holding capacity is 756. [13]

Lack of proper awareness among prisoners, [14] delay in seeking care and not so readily available quality eye care services pose a major risk for ocular morbidity. This may result in delayed diagnosis and management of the eye conditions which can result into blindness. In the face of limited resources, it's important to determine the prevalent eye disorders so that there is effective planning for eye care programs for Ugandan prisoners. There has been no published study done on the ocular health of the inmates in Ugandan prisons. The aim of this study was to provide initial data on prevalent eye disorders and factors associated with ocular morbidity among the inmates. This should be of help in improving eye health care and prevention of blindness among prisoners.

Methods

This was a descriptive cross-sectional study employing quantitative methods of data collection on inmates of Luzira prison. Approval was granted by the Makerere school of medicine research and ethics committee and the commissioner General of prisons, Uganda Prison Services. Written informed consent was provided by each inmate. All data collected on paper questionnaires was anonymized. This study was carried out according to the principles of the Declaration of Helsinki.

Quantitative Methodology

Study location and population

This study was carried out at Luzira maximum security prison. It is a maximum security prison for both male and female in Uganda. Luzira is located in Nakawa division in south eastern Kampala. It is a maximum prison for both male and female that are convicted, sentenced and those awaiting trial. The prison was designed to house 1700 inmates but currently has close to 8000 with over 500 on death row. It has various sections depending on the level of cases namely; Luzira upper prison (maximum security), Murchison Bay prison, Remand prison and Luzira women's prison. By the time of concept and proposal development Luzira maximum security prison had 7632 adult male and 700 adult female inmates. Luzira maximum security prison has a referral hospital for all prisons with a dedicated Ophthalmic Clinical Officer among other health workers though the ophthalmic clinic lacks the basic diagnostic tools and currently boasting of a Snellen chart and a torch. The inclusion criteria was adult male and female inmates of Luzira prison who consented during the study period.

Sample size and strategy

The sample size was calculated using the Kish and Leslie's formula and an adequate sample size of 361 inmates was reached. Proportionate stratified random sampling was done using male and female inmates as strata. Based on the proportionate contribution to the overall prison population of 91% for male and 8.9% for females, the corresponding sample of 334 males and 33 females was enrolled. Dependent variable was ocular morbidity while the independent variables were (social demographic factors, imprisonment factors, social economic associated systemic diseases and trauma).

Data collection

A structured pre-tested questionnaire was administered by a trained research assistant under direct supervision of the Investigator. The respondents that met the inclusion criteria were voluntarily recruited and informed consent obtained before the interview. The questionnaire was used to collect demographic data, duration of incarceration, past and present ocular history, history of associated systemic diseases, occupation, trauma and drug abuse was obtained. The inmates medical card was used to obtain HIV status and measurements for blood pressure and random blood sugar measurements were taken for all participants on site. A detailed ocular examination was done by the principle investigator and two ophthalmic clinical officers starting with the right eye then left eye. The visual acuity of the inmates was measured using Snellen's chart or illiterate 'E' chart placed 6 meters away from the seated inmate in open daylight by a trained ophthalmic nurse. Each eye was tested separately and unaided. A pinhole was used if V/A was 6/9 and below. Any eye that improved with pinhole by two or more lines was assessed to be a case of refractive error and considered for refraction. In prisoners whose refractive errors predated their incarceration, they were tested with their glasses on. Near vision acuity was assessed using a Jaeger chart at 33 cm and refraction done on all inmates with impaired vision. The gross visual field assessment

was assessed using the confrontation method compared with the examiner (the examiner had normal visual fields confirmed by perimetry). Extra ocular muscle activity was assessed, cover-uncover test was done to assess for phorias. Examination of the lids, conjunctiva, cornea, anterior chamber, pupil, and iris was assessed using a pen touch, loupe and a portable slit lamp. Amsler grid was done in all subjects to assess macular function. Tonometry was done using a Perkin's applanation tonometer after instilling anesthetic drop, for intraocular pressure measurements. Direct ophthalmoscopy was used for assessing the fundus. Any anomaly detected during the patient assessment was documented and managed where possible or the patient was referred to Mulago eye clinic for further management.

Data analysis

Data was cleaned and exported to Stata 14.0. Continuous variables were summarized using means, standard deviations, medians, and ranges. Categorical variables were summarized using frequencies, proportions and percentages. The proportion of prisoners with ocular morbidity was determined. The association between each of the independent factors and ocular disorders was assessed using logistic regression. The strength of the association was assessed using the odds ratios and 95% confidence intervals of the odds ratio. Variables with a P value of < 0.2 at bivariate analysis were considered for multivariate model. The variables were entered into a stepwise logistic model. Interaction between the variables which remain in the model were assessed using the chunk test. This was followed by assessing for confounding using a difference of $> 10\%$ between the crude and adjusted measure of effect (OR) for the variables that would have gone out at each step. Significance was set at P value of 0.05 or less.

Results

A total of 367 inmates participated in the study of which were male 334(91%). The age of the inmates ranged from 18–76 years with a mean age of 39.1(SD + 13.4). More than half of the inmates 193(52.6%) reported to have ever taken alcohol with 45(23.3%) still taking. The majority of the inmates had attained only primary education 181(49.3%) Table 1. All inmates had access to clean water (99.5%) with the majority (94%) staying more than 16 persons per cell Table 2. Almost half complained of itchy eyes and reduced vision while only nineteen of them had a history of trauma and only eight having visual effects from the trauma Table 3. Eighty-eight percent of the inmates had VA of 6/6–6/18 **Table 4**. For the purposes of this study, Presbyopia was included in the definition of ocular morbidity. Presbyopia was a significant cause of ocular morbidity (27%). Other morbidities included: Allergic conjunctivitis (19.6%) Cataracts (10.5%), Refractive errors (8.7%) and Vitamin A deficiency (4.6%) as summarised in Table 5.

One hundred and eighty inmates (49%) had an ocular morbidity in atleast one eye and 187 inmates were normal Fig. 1 while seven of the inmates were totally blind as shown in Fig. 2. At multivariate analysis, Age of inmate, having food besides prison foods and history of trauma were found to be statistically significant at 95% confidence interval. Inmates that were 50 years and above were twelve times more likely to have an ocular morbidity (OR = 11.96, P-value 0.001) than inmates 18–30 years. Inmates eating foods besides prison meals were 0.45 times less likely to have an ocular morbidity than those having

only prison meals (OR = 0.45, P-value 0.006). Those with a history of trauma were five times more likely to have an ocular morbidity compared to those with no history of trauma (OR = 5.21, P-value = 0.009) as summarized in Table 6, 7.

Table 1
Sociodemographic characteristics of the inmates.

Variable	n (percentages)
Sex	
Male	334(91)
Female	33(8.9)
Occupation	
Business	129(35.2)
Farming	78(21.3)
Office related occupation	26(7)
Others	132(36)
Drugs and alcohol use	
Reported to have taken alcohol	193(52.6)
Currently take alcohol (n = 193)	45 (23.3)
Type of alcohol consumed	
Spirits	86(44.6)
Beers	124(64.3)
Local brews	94(48.7)
Amount consumed (Bottles Per Week)	
1–5	8(41.5)
5–10	57(29.3)
> 10	41(21.2)
Not stated	15(7.8)
Recreational drugs	118(32.2)
Cigarette	92(78)
Raw tobacco	28(23.7)
Marijuana	41(34.8)
Cocaine	19(16.1)
Others	3 (2.5)

Variable	n (percentages)
Duration of drug use	
Days	3(2.5)
Months	1(0.9)
Years	113(95.8)
Not stated	1(0.9)
Education level	
Informal	39(10.6)
Primary	181(49.3)
Secondary	94(25.6)
Tertiary	51(13.9)

Table 2
Prison life of the inmates.

Variable	n (percentages)
Ate other foods other than prison meal in the last 2 weeks	114(31.6)
Type of foods (n = 114)	
Vitamin A rich foods	86(75.4)
Energy foods	106(93)
Body building foods	79(69.3)
Others	7(6.1)
Has access to clean water	365(99.5)
Number of prisoners per cell	
1 to 5	8(2.2)
5 to 15	14(3.8)
> 16	343(94.0)
Duration of incarceration	
0–3 months	57(15.5)
4–12 months	54(14.7)
1–5 years	114(31.1)
> 5 years	141(38.7)
Participant had responsibilities in prison	72(19.6)
Type of responsibilities (n = 72)	
Kitchen staff	7(9.7)
Warder leader	22(30.6)
Clinic staff	14(19.4)
Others	38 (52.8)

Table 3
Medical and ocular history of the inmates.

Variable	n (percentage)
Ocular history	
Wear spectacles	50(13.6)
Participants reported eye complaints	201(54.8)
Eye complaints reported (n = 201)	
Itchiness	94(46.8)
Eye pain	29(14.4)
Tearing	73(36.3)
Discharge	7(3.5)
Reduced distant vision	63(31.3)
Reduced near vision	91(45.3)
Foreign body sensation	42(20.9)
Others	27(13.4)
History of eye evaluation prior to incarceration	31(8.5)
History of eye trauma	19(5.2)
Duration of trauma (n = 19)	
Days	4(21.1)
Months	2(10.5)
Years	12(63.2)
Visual effects from any trauma	8(42.1)
History of surgical operation	3(0.8)
Medical history (N = 367)	
Has diabetes	4(1.1)
Hypertensive	43(11.7)
Hypertensive on medication	11(25.6)
Chronic diseases (n = 73)	73(19.9)
HIV	69 (94.5)
Chronic medications (n = 73)	68(91.9)

Variable	n (percentage)
HIV status	
Positive	72(19.6)
Negative	293(79.8)
Unknown status	2(0.5)

Table 4 : Visual acuity of all inmates

Visual acuity in better eye	Category of vision	Frequency(%)
6/6- 6/18	Normal or mild	326(88.8)
Worse than 6/18-6/60	Moderate visual impairment	32(8.7)
Worse than 6/60-3/60	Severe visual impairment	2(0.5)
Worse 3/60	Blindness	7(1.9)

Table 5
Pattern of ocular morbidity among inmates.

Diagnosis	Frequency	Percentage
Presbyopia	60	27.4
Allergic conjunctivitis	43	19.6
Cataract	23	10.5
Refractive error	19	8.7
Vitamin A deficiency	10	4.6
Pterygium	9	4.1
Optic atrophy	8	3.7
Central corneal scar	3	1.4
Glaucoma	2	0.9
Bacterial conjunctivitis	2	0.9
Pseudophakia	2	0.9
Uveitis	2	0.9
others	36	17.3

others include anterior staphyloma, anophthalmos, dry eye, infected lid laceration, lacrimal gland tumour, lid melanoma, old retinal detachment, pinguecula, macular scars, molluscum contagiosum, maculopathy, retinitis.

Table 6
Table showing bivariate analysis of the factors assessed (N = 367).

Variable	Normal	Morbidity	OR (95% CI)	P Value
Age				
18–30 years	85(45.5)	34(18.9)	1	0.011
31–49 years	89(47.6)	69(38.3)	1.94(1.17–3.22)	0.001
50 years and above	13(7.0)	77(42.8)	14.80(7.28–30.11)	
Sex				
Male	170 (90.9)	164 (91.1)	1	
Female	17 (9.1)	16 (8.9)	0.98 (0.48–2.00)	0.946
Occupation				
Business	74 (39.6)	55 (30.6)	1	
Farming	33 (17.7)	45 (25.0)	1.83 (1.04–3.24)	0.037
Office related occupation	8 (4.3)	18 (10.0)	3.02 (1.23–7.47)	0.016
Others	71 (38.0)	61 (33.9)	1.16 (0.71–1.88)	0.561
Alcohol				
No history of taking alcohol	88 (47.1)	86 (47.8)		
Has ever taken alcohol	99 (52.9)	94 (52.2)	0.97 (0.64–1.46)	0.890
Education level				
Informal	14 (7.5)	25 (13.9)	1	
Primary	89 (47.6)	92 (51.1)	0.58 (0.28–1.18)	0.135
Secondary	57 (30.5)	37 (20.6)	0.36 (0.17–0.79)	0.010
Tertiary	25 (13.4)	26 (14.4)	0.58 (0.25–1.37)	0.215
Recreational drugs				
Doesn't use drugs	129 (69.0)	120 (66.7)	1	
Uses recreational drugs	58 (31.0)	60 (33.3)	1.11 (0.72–1.72)	0.635
Food besides prison meals				
No meal beside prison food	120 (64.2)	133 (73.9)	1	
Ate food beside prison food	67 (35.8)	47 (26.1)	0.63 (0.40–0.99)	0.045

Variable	Normal	Morbidity	OR (95% CI)	P Value
Number of prisoners per cell				
1 to 4 prisoners	4 (2.1)	4 (2.2)	1	
5 to10 prisoners	11 (5.9)	3 (1.7)	0.27 (0.04–1.79)	0.177
More than 10 prisoners	170 (90.9)	173 (96.1)	1.01 (0.25–4.13)	0.980
Position of responsibility in prison				
No position of responsibility	157 (84.0)	138 (76.7)	1	
Has position of responsibility	30 (16.0)	42 (23.3)	1.59 (0.95–2.68)	0.080
Variable	Normal	Morbidity	OR (95% CI)	P Value
Eye trauma				
No history of eye trauma	183 (97.9)	165 (91.7)	1	
Has history of eye trauma	4 (2.1)	15 (8.3)	4.16 (1.35–12.78)	0.013
Diabetes Mellitus				
No diabetes	180 (98.4)	173 (99.4)	1	
Has diabetes mellitus	3 (1.6)	1 (0.6)	0.35 (0.04–3.37)	0.361
Hypertension				
No hypertension	176 (94.1)	153 (85.0)	1	
Hypertension	11 (5.9)	27 (15.0)	2.82 (1.36–5.88)	0.006
HIV				
Negative	155 (82.89)	140 (77.78)	1	
Positive	32 (17.1)	40 (22.22)	0.73(0.44 – 1.22)	0.232

Table 7

Multivariate logistic model for the factors associated with ocular disorders among inmates.

Variable	Normal	Morbidity	OR (95% CI)	P Value
Age	85(45.5)	34(18.9)	1	0.140
18–30 years	89(47.6)	69(38.9)	1.54(0.87–2.74)	0.001
31–49 years	13(7.0)	77(42.8)	11.96(5.31–26.94)	
50 years and above				
Occupation				
Business	74 (39.6)	55 (30.6)	1	
Farming	33 (17.7)	45 (25.0)	0.77 (0.38–1.57)	0.478
Office related occupation	8 (4.3)	18 (10.0)	1.44 (0.49–4.27)	0.510
Others	71 (38.0)	61 (33.9)	0.99 (0.56–1.75)	0.969
Food besides prison meals				
No meal beside prison food	120 (64.2)	133 (73.9)	1	
Ate food beside prison food	67 (35.8)	47 (26.1)	0.45 (0.26–0.79)	0.006
Number of prisoners per cell				
1 to 4 prisoners	4 (2.1)	4 (2.2)	1	
5 to10 prisoners	11 (5.9)	3 (1.7)	1.05 (0.10–10.74)	0.967
More than 10 prisoners	170 (90.9)	173 (96.1)	2.43 (0.45–13.15)	0.302
Position of responsibility in prison				
No position of responsibility	157 (84.0)	138 (76.7)	1	
Has position of responsibility	30 (16.0)	42 (23.3)	1.38 (0.73–2.62)	0.319
Eye trauma				
No history of eye trauma	183 (97.9)	165 (91.7)	1	
Has history of eye trauma	4 (2.1)	15 (8.3)	5.21 (1.52–17.87)	0.009
Diabetes Mellitus				
No diabetes	180 (98.4)	173 (99.4)	1	
Has diabetes mellitus	3 (1.6)	1 (0.6)	0.87 (0.06–11.71)	0.915
Hypertension				
No hypertension	176 (94.1)	153 (85.0)	1	

Variable	Normal	Morbidity	OR (95% CI)	P Value
Hypertension	11 (5.9)	27 (15.0)	1.12 (0.48–2.62)	0.793
Goodness of fit of the final model: Chi square = 245.51, p value 0.515				

Discussion

Prevalence of ocular morbidity among inmates.

In this study, the prevalence of ocular morbidity was 49% among inmates which was high compared to previously reported studies of inmates in Nigeria (26.8%). [15] The difference could have been due to age differences with Nigeria study reporting a mean age of 27.2 years. The tendency of ocular morbidity to occur increases at around 40 years of age and further shows a steep increase after the age of 60 years. [16] It was also noted that inmates from other prisons would be referred to Luzira prison for various reasons some being medical, overcrowding in other prisons or completion of their sentences. This could also probably account for the high ocular morbidity in our study. In a similar study done in Ilesa prison Osun state, mean age of inmates was 32 years and prevalence was 69.7%. [8] This was high in comparison to this study. This could be due to difference in environmental factors. Osun state is situated in a tropical rain forest zone and experiences winter and summer. In comparison to non-incarcerated populations, inmates are known to have elevated rates of morbidities. [17]

In a population-based study done on rural adults in southwest Uganda, the prevalence of ocular conditions was found to be 9%. [18] This was low in comparison to this study. These findings would be due to the fact that the study noted only nonvisual impairing conditions and left out the blinding conditions. There are no similar studies like this one among the general population in Uganda.

Similarly, to other studies [7, 15, 19], Presbyopia, Allergic conjunctivitis, Refractive errors, Cataracts and Vitamin A deficiency were among the most common ocular morbidities. Presbyopia was found in 27.4% of the inmates. This prevalence is comparable though higher than a similar study in inmates which found presbyopia in 21.5%. [15] In Ilesa prison Nigeria had a lower prevalence of 10.9% [8] in comparison to our study. This could be because most of the inmates in Ilesa were in 21-30-year age group. Presbyopia is a physiological change associated with ageing. The expected age of onset is 40 years with incidence increasing with age [4] which explains the higher prevalence in this study where more than 50% were aged 40 and above. Identification of such inmates with presbyopia and providing them with reading glasses will be useful in rehabilitating them and also help them in performing near tasks.

Allergic conjunctivitis was the second commonest morbidity with a prevalence of 19.6% and was comparable to studies done elsewhere [7, 8, 15, 18]. Prisons tend to have similar conditions overcrowding and dusty. Ilesa prison is reported to be smoky. Allergic conjunctivitis is associated with a lot of discomfort.

Cataracts were found in 23 inmates accounting for 10.9% prevalence which is high in comparison to studies done among Nigerian inmates where prevalence was 5.7% [15] and 4.9%. [8] However the inmates in Nigeria had a mean age of 27.6 and 32 years respectively and cataract incidence increases with age. In our study we also found a higher number in trauma cases which could also explain increase of the cataracts(traumatic). Cataracts are some of the leading causes of treatable blindness.

The global initiative for elimination of avoidable blindness (VISION 2020) has recognized refractive errors as a major cause of visual disability. The prevalence of refractive errors was 8.7% and this was comparable to a study done in south western Uganda, [19] where 12.3% of the refractive errors inmates had refractive errors. Provision of eye glasses will go a long way in alleviating symptoms.

In comparison to earlier studies done in both southwestern Uganda (35%) and Kenya (23.6%) [19, 20], prevalence of Vitamin A deficiency was low (4.6%). This could be due to the fact that inmates in Luzira prison were routinely given vitamin A supplements and also perhaps due to additional meals that some inmates have.

The prevalence of glaucoma among inmates was 0.9% and this was comparable to the prevalence of a study done in Mbarara prison. 0.4%. [19] Studies done on prevalence of glaucoma at Mulago National Referral hospital and Ruharo Eye hospital were found to be high, 26.1% and 64.2% respectively [21]. These prevalences are much higher than in our study probably due to the fact that Mulago and Ruharo were hospital based studies with possible referral bias. In this study 2 of the inmates had advanced glaucoma. However, they had never had anti-glaucoma treatment. This creates a great danger as there is irreversible visual field loss when glaucoma remains untreated. [22]

Optic atrophy, Corneal scars, dry eye syndrome, uveitis, macular scars, were documented in these inmates. Any of the above conditions may be associated with marked visual impairment especially when there are poor ophthalmic facilities.

Factors associated with ocular morbidity

In this study, the factors that were significantly associated with ocular morbidity among the inmates included: age, trauma and eating non prison food.

From this study, the older inmates (> 50 years) were about 12 times more likely to have an ocular morbidity. (OR = 11.96, P-value = 0.001) than those aged 18–30 years. This correlates with findings in the study on pattern of ocular morbidity in an elderly population. The study showed a relationship between increasing age and ocular morbidity. This could be due to the physiological changes that happen with aging. Incidence of disease like presbyopia, cataracts, dry eye syndrome increases with age. [1]

Inmates with a history of trauma were five times more likely to have an ocular morbidity (OR = 5.21, P-value = 0.009). A study was done on ocular injuries in patients with major trauma and it was reported that the risk of an eye injury with a facial fracture was 6.7 times as that for a patient with no facial fracture.

[23] Inmates are likely to incur trauma when out in the fields, fights with fellow inmates or possibly when being given a punishment or even in the process of arrest or mob justice. Untimely and improper management can lead to visual impairing complications. In a study done in USA, 16% of the inmates experienced ocular trauma ($p < 0.001$) and 1.2% had open globe injury ($p = 0.06$), requiring surgical intervention. [24]

Inmates who had other foods besides prison food were less likely to have an ocular morbidity. (OR = 0.45, P-value = 0.006) This could be because they were having foods rich in vitamin A, energy foods, body building foods that help in normal bodily functioning. A study done in Haiti among inmates noted that those who did not receive additional food from visitors, were at increased risk of poor nutritional status and physical health. [17]

In this study, HIV was not statistically significant. In a study done by Pathai et al showed that a low CD4 count (< 100 cells/ul and WHO clinical stages 3 and 4 were associated with increased odds of having an ocular morbidity. [25] This low CD4 count predisposes them to many opportunistic infections. However, in Luzira all inmates on arrival are screened, counseled and started on anti-retroviral if found positive. This has reduced the incidence of some of the opportunistic infections.

Study limitations:

- Selection bias as some inmates were in solitary confinement and could not be assessed for the study.
- Information bias as some inmates were scared to give information for example in cases of torture or assault.
- Being a cross sectional study, the ocular disorders found during this season may not be the ones found in other climatic conditions.

Conclusion

- The prevalence of ocular morbidity among the inmates was high (49%). One in every two inmates had an ocular morbidity.
- The most common ocular morbidities among the inmates were; presbyopia, allergic conjunctivitis, cataracts, refractive errors, vitamin A deficiency.
- Age, history of trauma and not eating food besides the prison foods were significantly associated with ocular morbidities among inmates.

Abbreviations

VA

Visual acuity

HIV

Human immunodeficiency virus.

Declarations

Ethics approval and consent to participate

Ethical approval to carry out the study was obtained from the school of Medicine Research and Ethical Committee and Uganda National Science and Research Technology. The study was conducted in accordance with the Declaration of Helsinki. Permission to carry out the study was also sought from the commissioner general of Prisons. Written informed consent was obtained from the participants before enrolment in the study. Strict confidentiality was observed during data collection, entry, storage and analysis.

Consent for publication:

Not applicable

Availability of data and materials.

Data described in the manuscript will be made available by the corresponding author upon request.

Competing interests:

The researchers declare no competing interest.

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Author's Contributions:

CZ: designed the study, coordinated recruitment of the participants, collected data, analysed and led the writing of the manuscript. PA: co-ordinated recruitment of participants, collected data and participated in writing of the manuscript. DE: collected data, participated in writing of the manuscript. PM: designed the study, participated in data collection and data analysis. MM: participated in study design, participated in data analysis and reviewed all drafts of the manuscript. AM: data analysis and reviewed all the drafts for the manuscript. All authors read and approved the final manuscript.

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Figures

Figure 1

Figure 2

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